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17 October 2022

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[EAQ Project Reference: 22024]

Technical Report – Air Quality Impact Assessment of Rotomould Facility (Cardup)

Dear Mike,

Environmental and Air Quality Consulting Pty Ltd (EAQ) provides this technical report that presents the measured concentrations of airborne pollutants for the Cardup Smartstream Technology Rotomould Facility (the Site), and subsequent dispersion modelling of those measured concentrations to determine the ground level concentrations (GLCs) of individual pollutant species (the Assessment) at key sensitive receptor locations within the Cardup locale.

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Tables

Figures

1 Background to Assessment

The Shire of Serpentine-Jarrahdale (SSJ) has requested an updated air emissions report for the Site *"in accordance with the draft guideline on air emissions from the Department of Water and Environmental Regulation* (DWER). *The Air Emission assessment should consider concentrations of air pollutants at source (stack) and/or ground concentrations to compare with the relevant air quality criteria – for example criteria pollutants, principle toxic substances and individual toxic substances".*

The Assessment aims to demonstrate to the SSJ that the Site's operations do not impact upon the ambient air quality afforded to the Cardup locality.

The pollutants targeted are those that are most likely to be emitted from the Rotomoulding activities (plastic products) and include those key toxic pollutants prescribed within the current DWER draft guideline on air emissions.

The pollutant sampling and testing was undertaken by Ektimo. The laboratory results are presented in Appendix A.

The dispersion modelling Assessment of the measured pollutants was undertaken using Calpuff and its supporting suite of processors. The local meteorological characteristics for the complete Calendar Years of 2020-2021 were derived using the CSIRO's The Air Pollution Model (TAPM) v4.0.4 prognostic model. Appendix B presents a summary of the meteorology and modelling setups.

The DWER guideline for air emissions prescribes that for worst-case dispersion modelling assessments, the GLCs should be reported at the 100th percentile and using 1-hr averaging times.

2 Targeted Airborne Pollutants

Table 2-1 lists the airborne pollutants targeted in the Assessment and their ground level exposure limits at the nearest sensitive receptor (urban).

Table 2-1: Targeted Airborne Pollutants

Pollutant	DWER Exposure Criteria µg/m3 @ 250C (100th %ile and 1-hr)
Odour	2.5 @ 99.5th %ile 8.0 @ 99.9th %ile (previous DWER guidance) **1.0 is used in this Assessment (odour threshold)**
Oxides of Nitrogen (NOx)	226
Sulphur dioxide (SO2)	524
Carbon monoxide (CO)	30,000
Total Volatile Organic Compounds C5-C20	n/a
Formaldehyde	20
Acetaldehyde	1,830 (24-hr); 48,500 (Ceiling/Threshold Value)
Propionaldehyde	n/a (*1,830)
n-Butyraldehyde	n/a (1,830)
Valeraldehyde	n/a (1,830)
Acetone	22,000
Acrolein	0.42
Methyl ethyl ketone (2-butanone)	890,000 (Source: Safe Work Aust - Short-Term Exposure)
Hexanal	n/a (Nil Sources)

***** where individual aldehyde species have no exposure criteria, the criteria for Acetaldehyde has been adopted.

3 Results of Airborne Pollutant Sampling and Testing

Table 3-1 lists the emissions parameters measured from the Site's Rotomoulding process.

Table 3-1: Sampling Plane Details

Parameter	Unit	Value
Stack diameter	Metres (m)	0.3
Stack area	Square metres (m^2)	0.0707
Moisture content	% volume/volume	2.1
Temperature	Degrees Celsius (^{0}C)	225 (498.15 Kelvin)
Velocity	Metres per second (m/s)	12
Volumetric flow rate, actual	Cubic metres per minute (m^3/min)	51
Volumetric flow rate, wet		28

- The measured emission temperature of 225^{0}C in **Table 3-1** is high and will greatly improve vertical buoyancy of the emission plume and subsequent dispersion of the pollutants.

Table 3-2 lists the measured concentrations of targeted pollutants.

Table 3-2: Concentration Results of Measured Pollutants

Analyte (Chemical Species)	Value (ou.m^3)	Emission Rate (ou.m^3/s)
Odour	1,100	**935**
Analyte (Chemical Species)	**Value (mg/m^3)**	**Emission Rate (g/s)**
Nitrogen oxides (NOx)	13	**0.0061**
Sulphur dioxide (SO_2)	[A] < 6	**0.0028**
Carbon monoxide (CO)	41	**0.0191**
Total Volatile Organic Compounds	< 0.3	**< detection limits**
Formaldehyde	2.9	**0.0014**
Acetaldehyde	0.22	**0.0001**
Propionaldehyde	≤ 0.025	**< detection limits**
Valeraldehyde	< 0.007	
Acrolein	< 0.007	
Methyl ethyl ketone (2-butanone)	< 0.007	
n-Butyraldehyde	0.065	**0.00003**
Acetone	2.5	**0.00117**
Hexanal	0.021	**0.00001**

[A] " < " refers to a concentration less than the analytical detection limit.

- The concentrations (g/s) listed in **Table 3-2** show that the mass emission rates for all chemical species are very low;
- The mass emission rate for measured odour, of 935 ou.m^3/s, is also a reasonable low emission rate when considering the size of the emission void (stack) and the operational temperature of those emissions; and
- The emission rates listed in **Table 3-2** were modelled to produce GLCs at key receptor locations surrounding the Site.

Given the small mass emission rates for chemical species, these analytes were not presented as modelled contours on a map of the Cardup locality as the ground level concentrations are too low to be visually representative.

The chemical species' GLCs predicted from the modelling Assessment are listed in **Table 3-3** and compared to the exposure criterion for each analyte at the nearest sensitive receptor (house).

Formaldehyde had the highest measured chemical species concentration within the emission plume. Those analytes that had concentrations below the laboratory detection limits were not modelled, however; these analytes can be compared to the Formaldehyde GLC as a worst-case. The final column in **Table 3-3** presents a percentage value that compares the GLCs to the exposure criteria.

Table 3-3: Modelled GLCs at the Nearest Sensitive Receptor

Analyte (Chemical Species)	Measured Value (ou.m^3)	Model GLC	Criteria	% of Criteria
Odour	1,100	0.1911	**1**	**19.113%**
Analyte (Chemical Species)	**Measured Value (mg/m^3)**	**Model GLC**	**Criteria**	**% of Criteria**
Nitrogen oxides (NOx)	13	1.2376	**226**	**0.548%**
Sulphur dioxide (SO_2)	< 6 (modelled as 6)	0.5681	**524**	**0.108%**
Carbon monoxide (CO)	41	3.8752	**30,000**	**0.013%**
Total Volatile Organic Compounds	< 0.3	<	n/a	n/a
Formaldehyde	2.9	0.2840	**20**	**1.420%**
Acetaldehyde	0.22	0.0203	**1,830**	**0.001%**
Propionaldehyde	≤ 0.025	<	n/a	n/a
Valeraldehyde	< 0.007	<	n/a	n/a
Acrolein	< 0.007	<	0.42	n/a
Methyl ethyl ketone (2-butanone)	< 0.007	<	890,000	n/a
n-Butyraldehyde	0.065	[B] 0.2840	**1,830**	**0.016%**
Acetone	2.5	[B] 0.2840	**22,000**	**0.001%**
Hexanal	0.021	[B] 0.2840	n/a	n/a

[B] Analyte Modelled against Formaldehyde Concentration.

- It can be seen from **Table 3-3** that the predicted modelling GLCs at the nearest sensitive receptor (house) are considerably low compared to their respective exposure criteria. As a result there is no risk of harmful impacts from the Site's Rotomoulding activities; and
- The measured odour concentration, odour emission rate and subsequent prediction of ground level concentration of odour at the nearest receptor (house) shows a GLC that is < 20% of the theoretical odour threshold. This GLC was predicted at the 100th percentile i.e., worst-case impact.

The odour threshold is defined as 1 odour unit per cubic metre of air (ou.m^3) that can be detected by 50% of the observing population. At an odour threshold of 1 ou.m^3, the risk of an observer characterising the odour is largely negligible. For context, the previous DWER odour guidance for "exposure" was 2.5 ou.m^3 for the 99.5th percentile of the modelling period i.e., worst 44 hours annually. On this basis there is a negligible risk of odour causing nuisance at any offsite sensitive receptor in the Cardup locale. The odour contour is presented in **Figure 3-1** below.

◯ = Sensitive Receptor Locations	• Contours are predicted Odour Concentrations (ou.m^3) @ 100th Percentile & 1-hr Averaging Times

Figure 3-1: Modelling Predicted Odour Ground Level Concentrations

4 Discussion of Assessment Results

The site-specific sampling and testing of airborne pollutants by Ektimo has provided emission parameters and analtye concentrations for criteria, principal and individual toxic substances, and for measured odour concentration, from the Rotomould emission stack. Importantly, the measured emission temperature is high (225^{0}C) which will provide large thermal buoyancy of the plume and thus aid in dispersion of the plume before the plume touches back to ground level.

The measured chemical species all had low concentrations with some analytes having negligible concentrations which were not detectable at, or above the laboratory lower detection limit.

The measured odour concentration of 1,100 ou.m^3, although higher than previous odour assessments of the stack, is still of a very low concentration given the small emission void and the emission temperature. Key chemical species of Formaldehyde and Acetaldehyde have been targeted in previous assessment years and have also continued to return low concentration values.

Figure 4-1 compares the measured values for odour, Formaldehyde and Acetaldehyde since 2018 when the work was originally requested. In comparing these key pollutants, it is evident that Formaldehyde concentrations increase with increasing odour strength. Acetaldehyde continues to remain largely unchanged.

Variability in measured odour strength is of little concern given that the odour strength in the emission plume is considerably low when predicting its dispersed odour strength at ground level. Additionally, changes in sampling personnel, sampling techniques and the laboratory analysis source, will all contribute to variability in the measured odour strength.

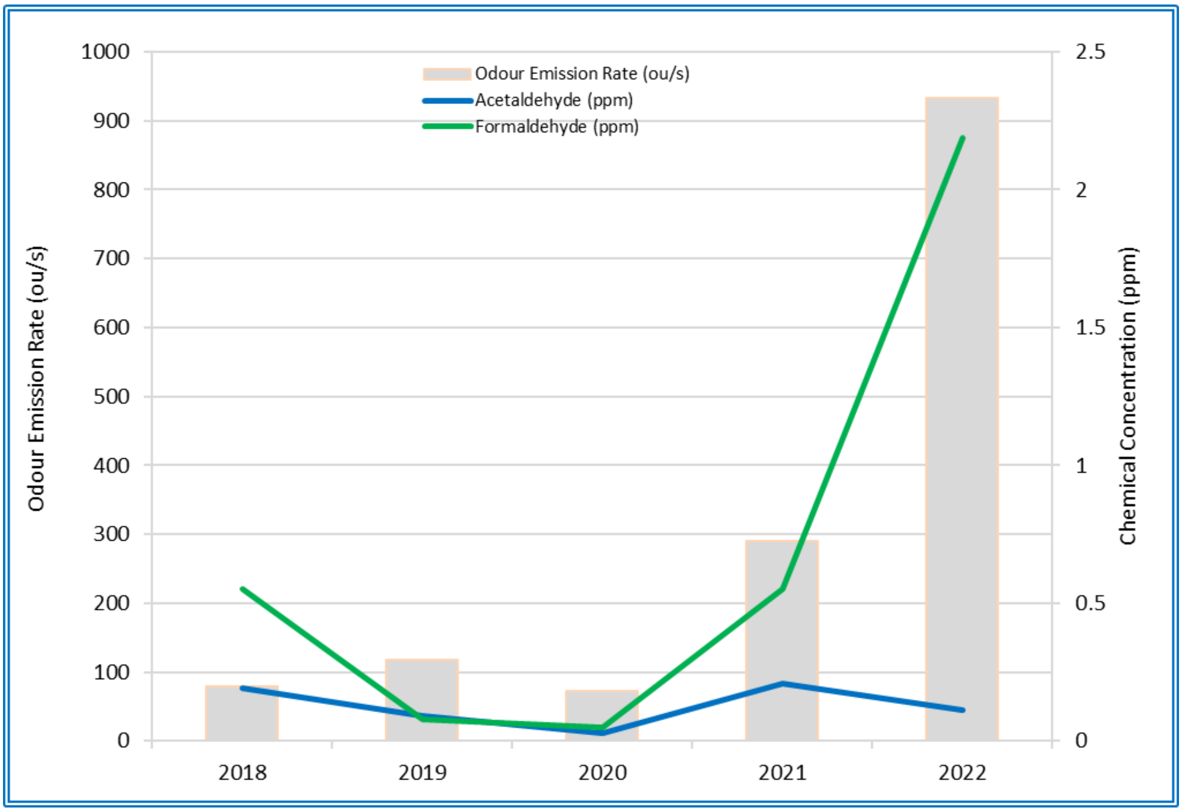

Figure 4-1: Comparison of key Pollutants

5 Conclusion and Closing

The Assessment of Smartstream's Rotomoulding process at their Cardup Site, by site-specific odour and chemical sampling and testing of the stack emission stream, has shown that the measured concentrations of airborne pollutants from the Rotomoulding process are very low and hence the risk of an adverse impact at the nearest sensitive receptor is also low.

Figure 3-1 shows that the plotted odour concentrations at ground level are below the odour threshold for any given odorant and to this end are considered to be negligible at ground level where any adverse or unreasonable odour impact is not evident.

The ground level concentrations were predicted using the Calpuff dispersion model. The meteorological characteristics that are representative of the Cardup locale and accounting for the complex terrain and subsequent complex wind fields effected by the proximity of the Darling Escarpment, were produced using the CSIRO prognostic model known as TAPM. These modelling and meteorological approaches are supported by the current State and Federal assessment guidelines and are entirely appropriate for the Cardup locality.

Based on the Assessment findings, the emission plume from Smartstream's Rotomoulding process poses a negligible risk for causing adverse odour and chemical species impacts at the nearest sensitive receptor.

Closing

Should you have any queries on the Assessment detail and technical points please don't hesitate to contact EAQ as required.

Yours sincerely,

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EAQ Consulting

APPENDIX A – EKTIMO LABORATORY RESULTS

APPENDIX B – EAQ Met & Model Setup Details

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1 CSIRO The Air Pollution Model (TAPM) Setup

The TAPM (v4.0.4) model produced a 3D data tile representative of surface and upper air met characteristics for the Cardup Locale with the following setup:

- 41 grid points (nx, ny);
- Five nests with the outer grid spacing (dx1, dy1) of 30 kms and subsequent nests approximately 1/3rd of the preceding nest (30, 10, 3, 1 and 0.3 kms); and
- 25 vertical grid levels.

Given the Cardup locality is flanked by complex terrain due to the Darling Escarpment, the innermost nest (0.3 km) was extracted as a 3D tile.

The TAPM 3D tile was fed into the Calmet module of the Calpuff modelling suite of processors to derive a hybrid-met file representative of the Keysbrook locality. Hybridising the output dataset was undertaken to allow the Calmet processor to incorporate those sea-breeze and land-breeze effects at the extremes of the modelling domain.

2 Calpuff (v7) Modelling Setup

2.1 Geophysical Configuration

2.1.1 Terrain configuration

Terrain elevations were sourced from 1 Second Shuttle Radar Topography Mission (SRTM) Derived Smoothed Digital Elevation Model (DEM-S). The SRTM data has been treated with several processes including but not limited to removal of stripes, void filling, tree offset removal and adaptive smoothing (Gallant, Dowling, Read, Wilson, Tickle, & Inskeep, 2011). The DEM-S was used as input into TERREL processor to produce a 10 km^2 grid at 0.10 km resolution. Coastline data was sourced from USGS Global Self-consistent Hierarchical High-resolution Shoreline (GSHHS) Database (Paul & Smith, 2015).

2.1.2 Land use configuration

Land use was sourced from the United States Geological Survey (USGS) Global Land Cover Characteristics Data Base for the Australia-Pacific Region (Survey, 1997). The data was used as input into CTGPROC processor to produce a 10 km^2 grid at 0.10 km resolution.

2.1.3 Geophysical configuration

The geophysical data file was created using the MAKEGEO processor. Land use data from CTGPROC and terrain data from TERREL was used as input to produce a 10 km^2 geophysical grid at 0.10 km resolution.

2.2 Calmet Meteorological Model Configuration

Calmet was run as a NO-OBS configuration that uses CSIRO's meteorological data to produce a surface and upper air TAPM 3D data tile. The data was used to initialise the diagnostic functions of the Calmet module to produce the meteorology data, that accounts for locality terrain and land uses, for input into Calpuff. **Table 2-1** shows key variable fields selected.

Table 2-1: Calmet Key Variables (Grid Configuration WGS-84 UTM Zone 50S)

100					NX Cells						
100					NY Cells						
0.10					Cell Size (km)						
402.135			6426.589		SW Corner (km)						
11					Vertical Layers						
ZFACE (m)	0	20	40	80	160	320	640	1000	1500	2000	2500	3000
LAYER	1	2	3	4	5	6	7	8	9	10	11	-
MID-PT (m)	10	30	60	120	240	480	820	1250	1750	2250	2750	-

Critical Wind Field Settings			
Value	Found	Typical	Values
TERRAD	0.7	None	Terrain scale (km) for terrain effects
ICALM	0	0	Do Not extrapolate calm winds
Data Choices			
Value	Found	Typical	Values
NOOBS	2	0,1,2	0=w/Obs; 1=Partial Obs/No-Obs; 2=No-Obs mode
ITPROG	2	0,1,2	0=Obs.; 1=Obs.Sfc/Prog.Upr; 2=Prog. temperatures
ITWPROG	1	0,1,2	0=Obs.; 1=Obs.T_Diff/Prog.Lapse; 2=Prog. Overwater T
IPROG	14	4,14	Use gridded prognostic winds as Initial Guess Field
NM3D	1	None	Number of prognostic data files

2.3 Meteorological Data Analysis

The characteristics of the Calmet derived met dataset for the most recent 2-Calendar Years (2020-2021) are illustrated in the following **Figures** below, showing the annual and seasonal met characteristics, and the hourly met characteristics.

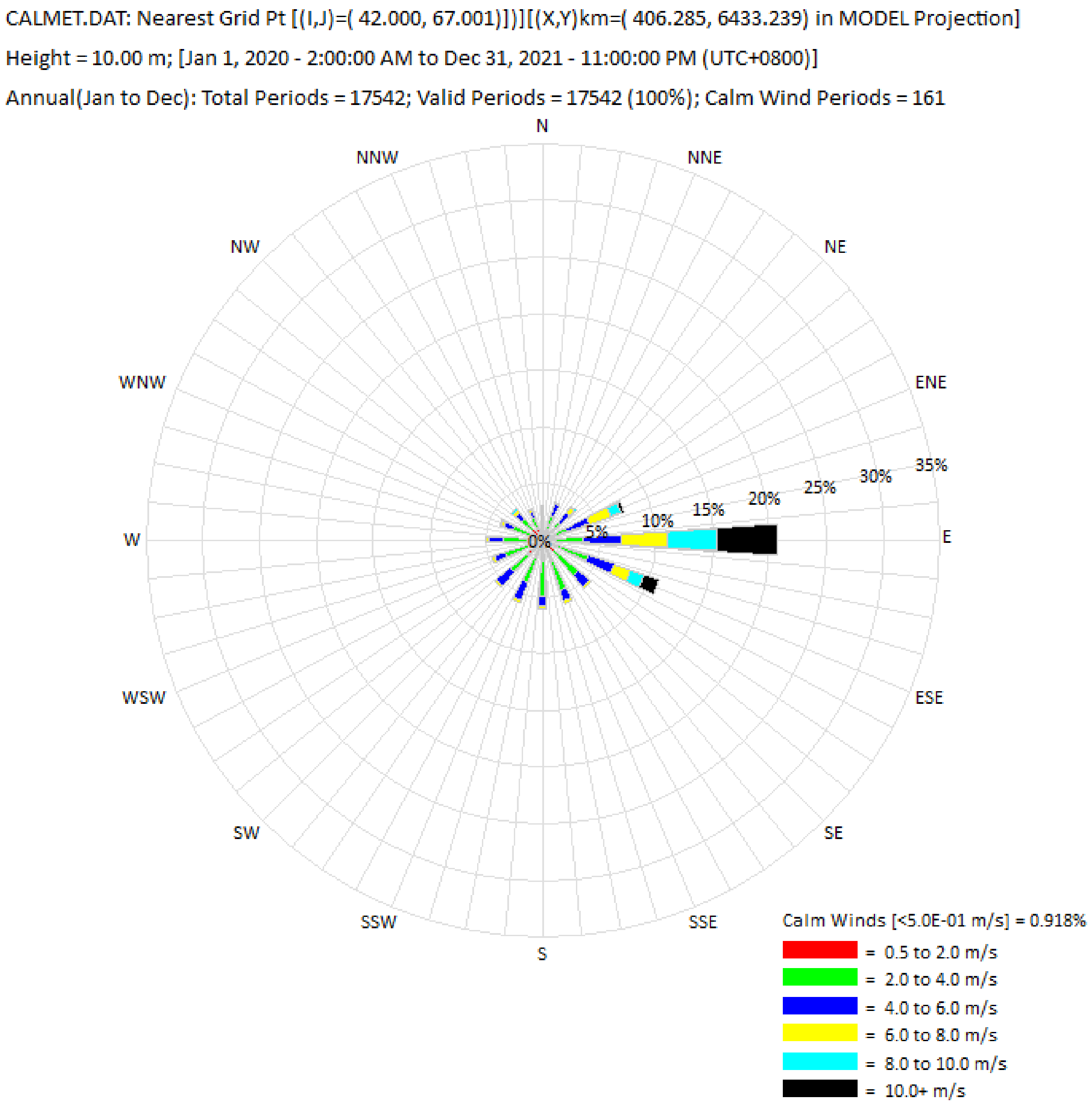

Figure 2-1: Annual Met Characteristics (2020-2021)

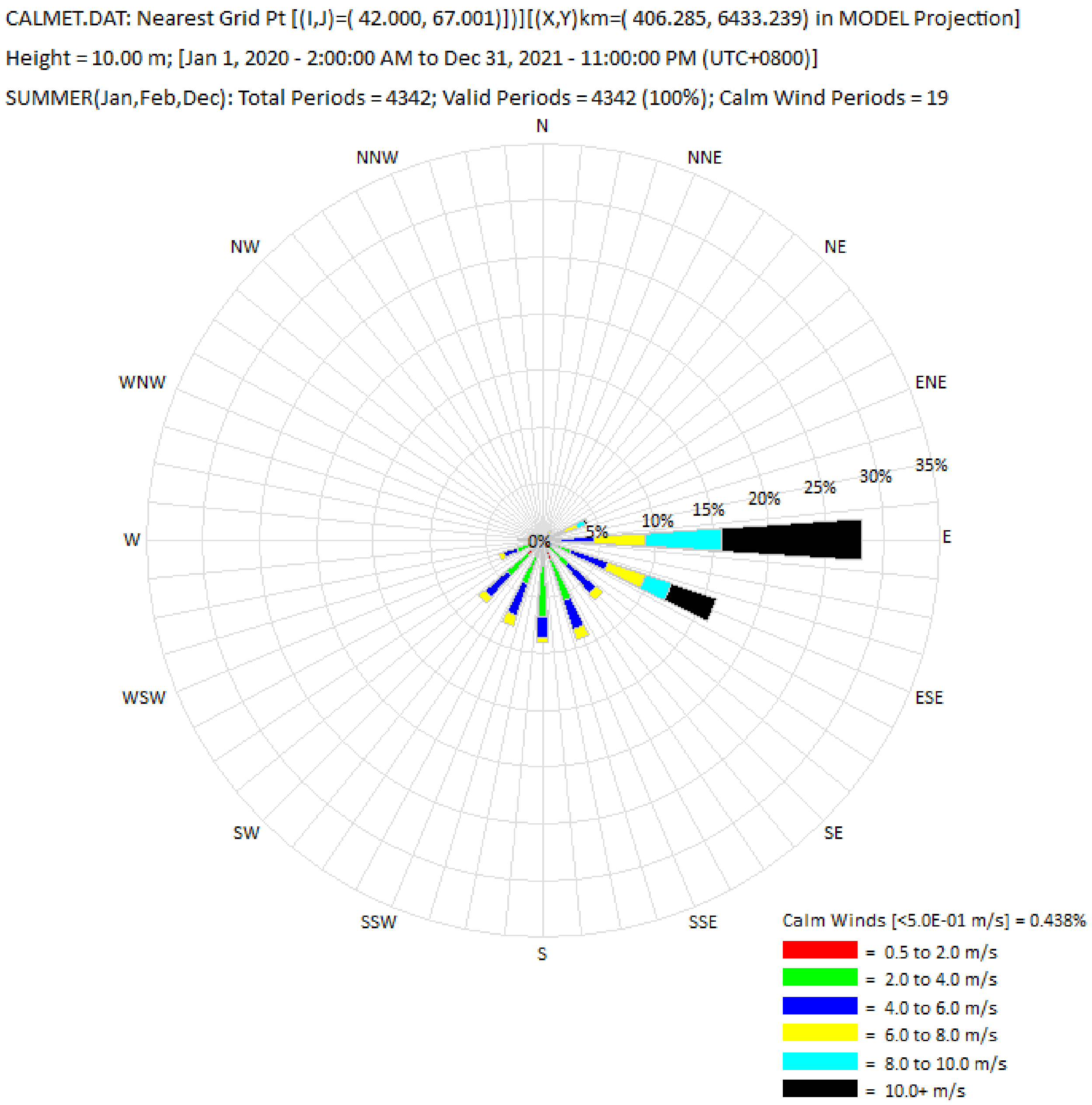

Figure 2-2: Seasonal (Summer) Met Characteristics (2020-2021)

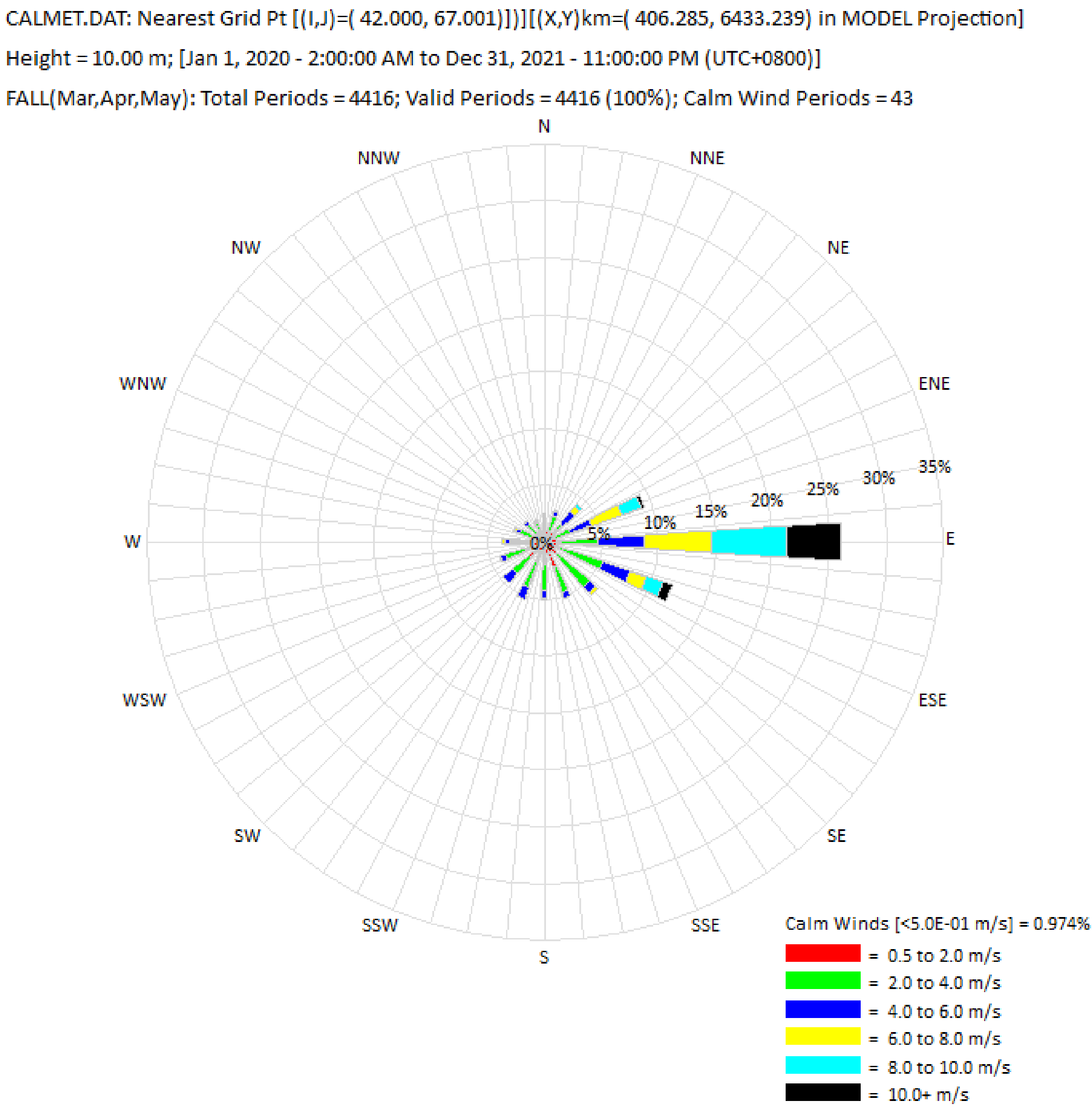

Figure 2-3: Seasonal (Autumn) Met Characteristics (2020-2021)

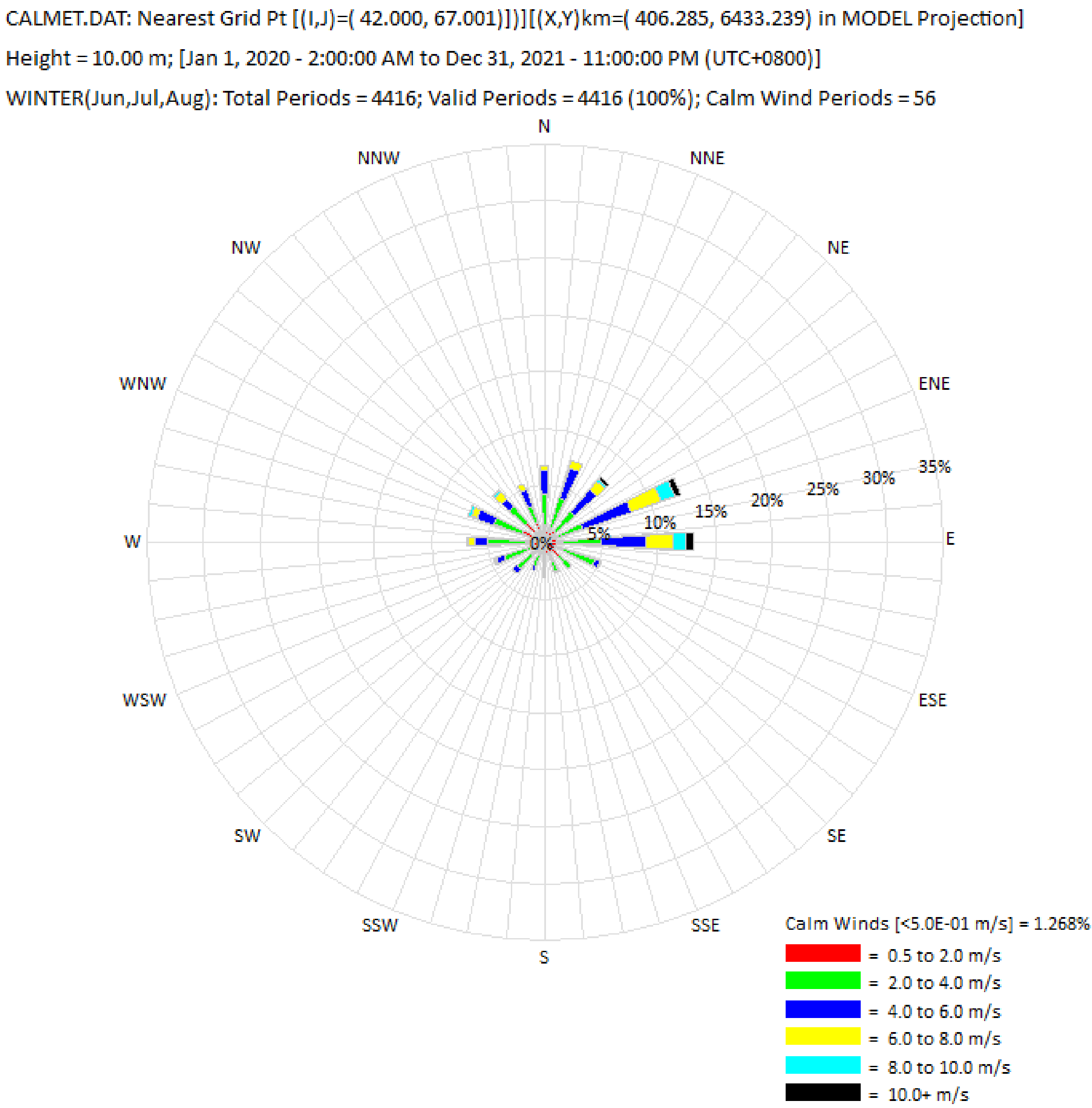

Figure 2-4: Seasonal (Winter) Met Characteristics (2020-2021)

CALMET.DAT: Nearest Grid Pt [(I,J)=(42.000, 67.001)])][(X,Y)km=(406.285, 6433.239) in MODEL Projection]

Height = 10.00 m; [Jan 1, 2020 - 2:00:00 AM to Dec 31, 2021 - 11:00:00 PM (UTC+0800)]

SPRING(Sep,Oct,Nov): Total Periods = 4368; Valid Periods = 4368 (100%); Calm Wind Periods = 43

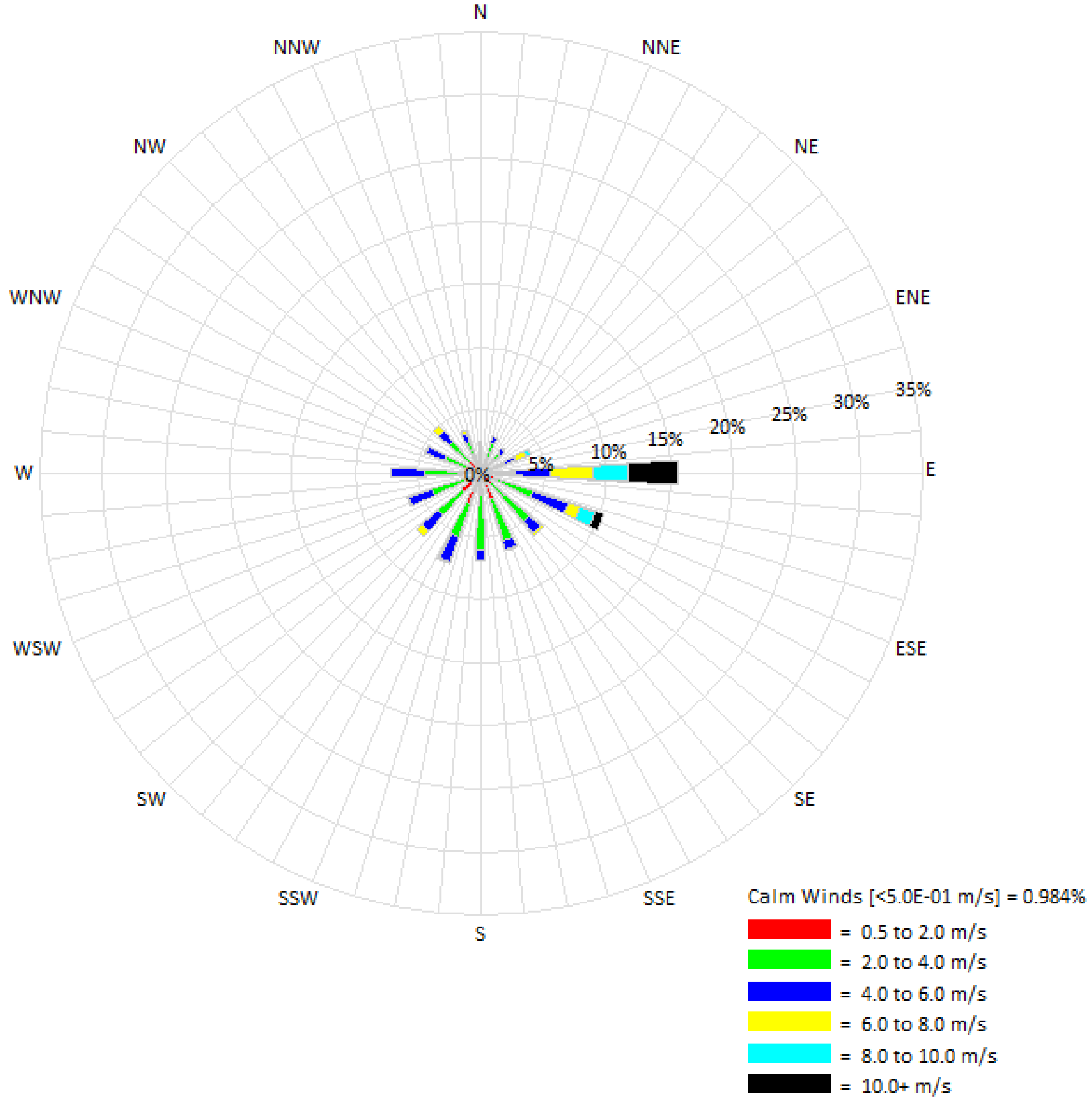

Figure 2-5: Seasonal (Spring) Met Characteristics (2020-2021)

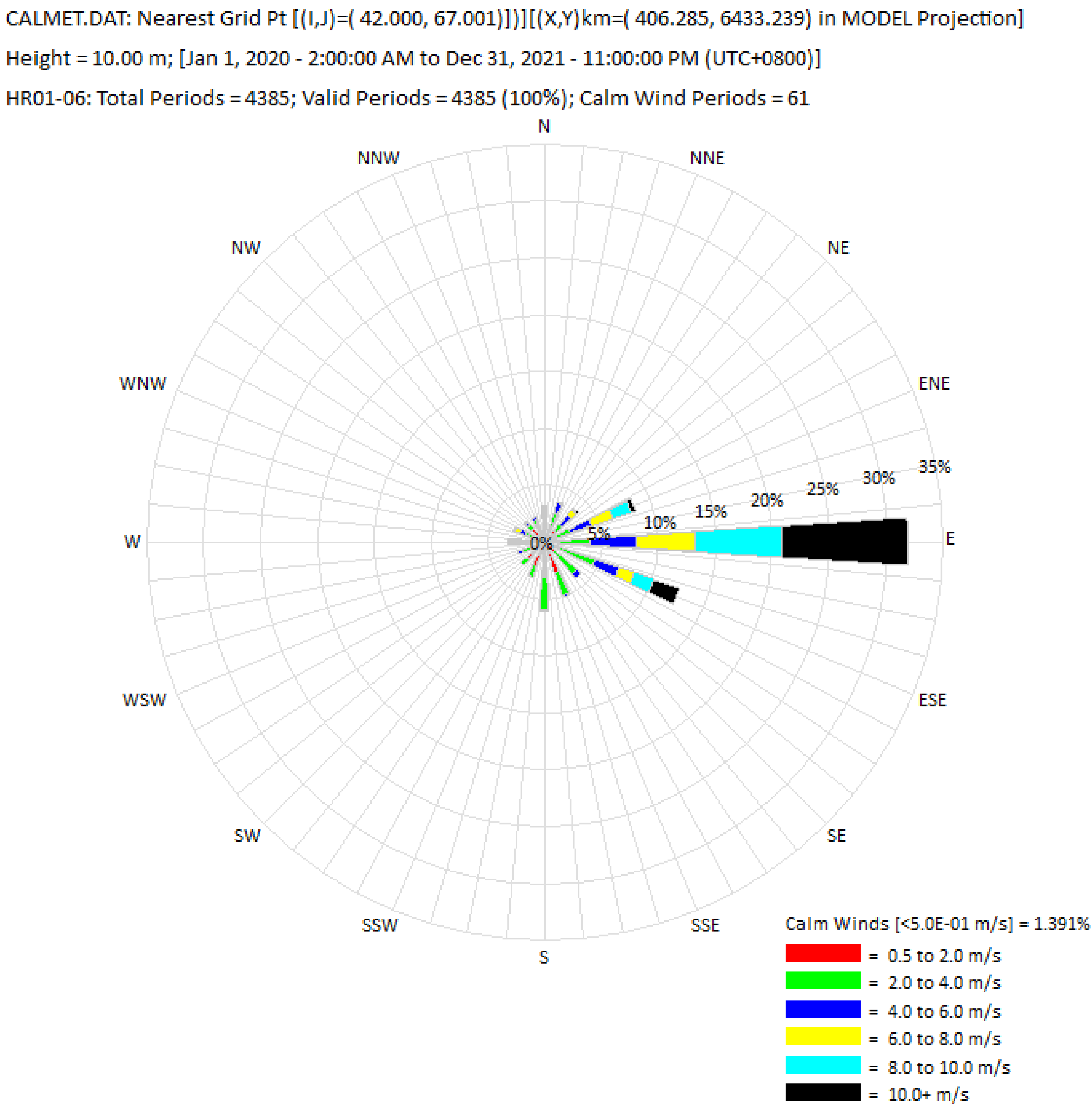

Figure 2-6: Hourly (01-06) Met Characteristics (2020-2021)

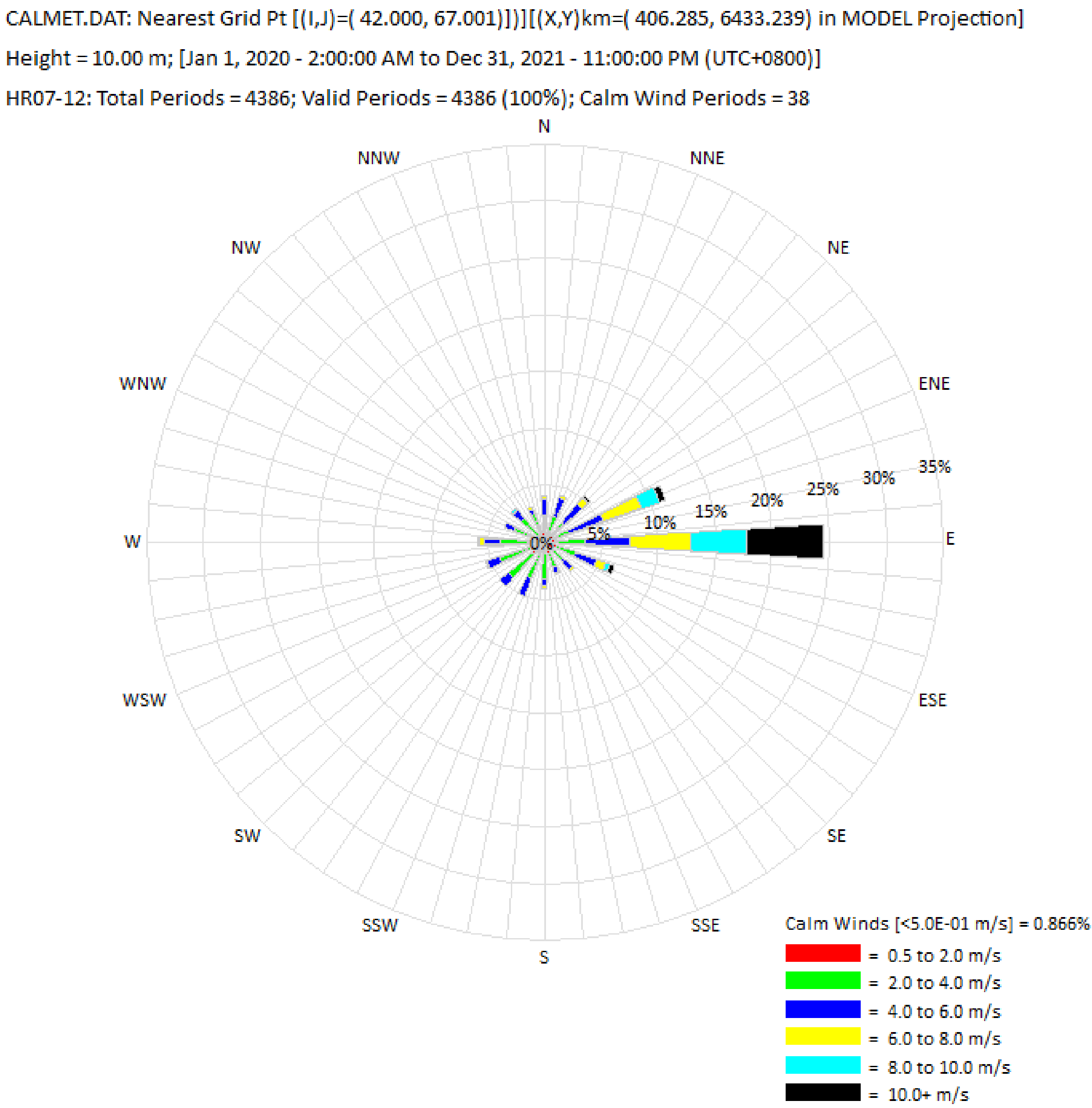

Figure 2-7: Hourly (07-12) Met Characteristics (2020-2021)

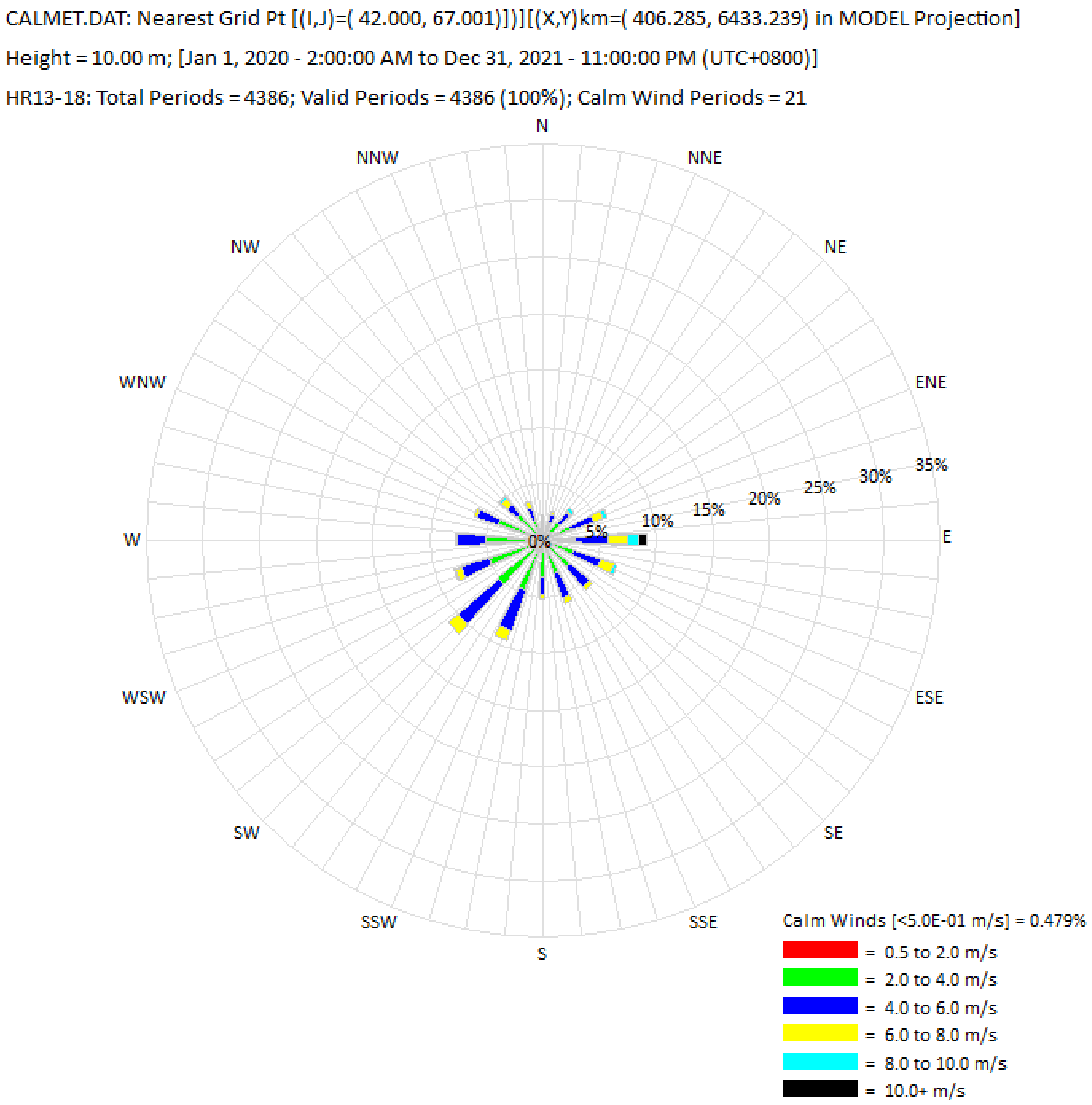

Figure 2-8: Hourly (13-18) Met Characteristics (2020-2021)

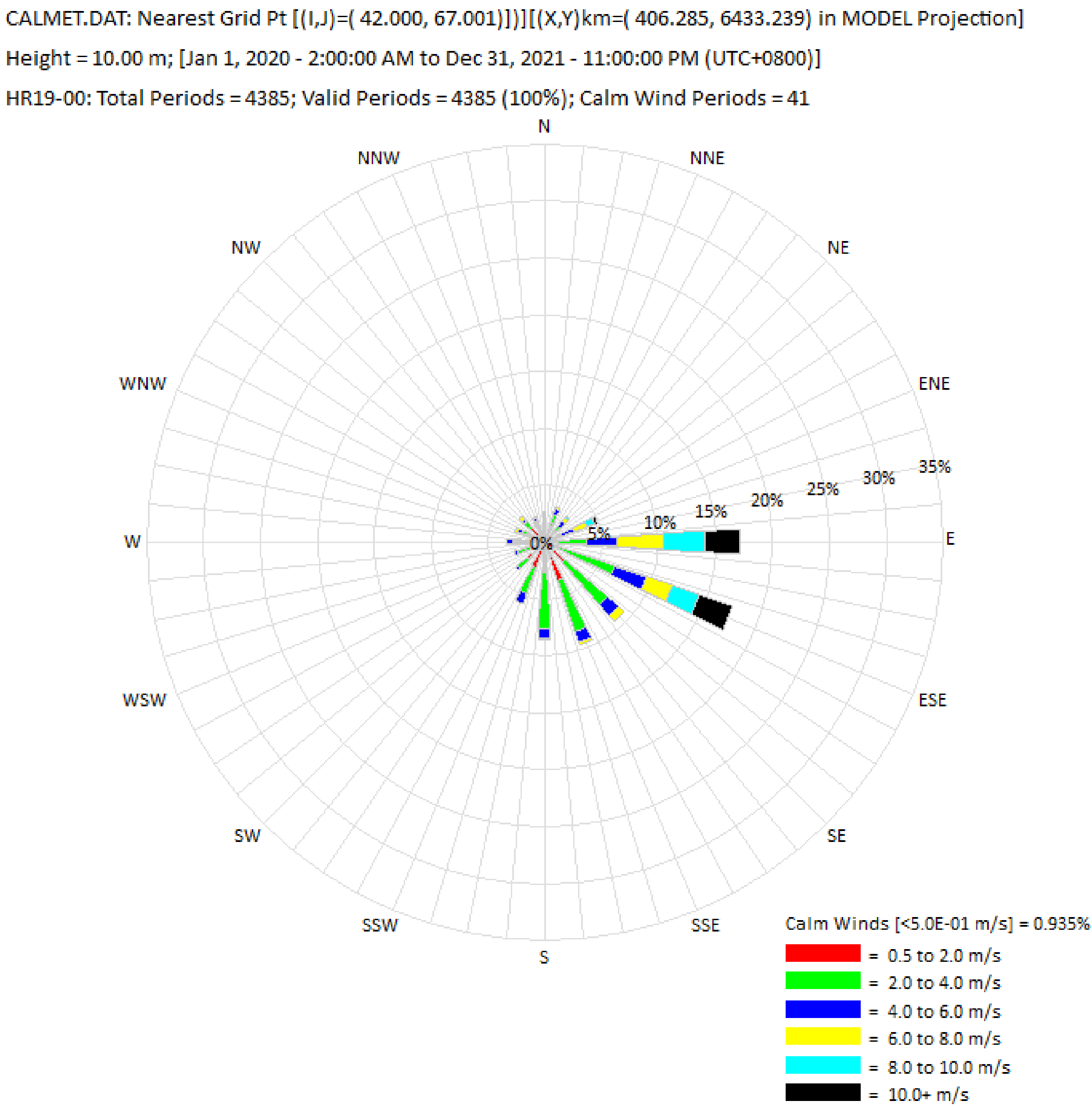

Figure 2-9: Hourly (19-00) Met Characteristics (2020-2021)

3 Calpuff Dispersion Model Configuration

3.1 Computational Domain

The computational domain was set to the same parameters as the meteorological domain.

3.2 Receptor Configuration

Gridded receptors were spaced at 50 m x 50 m (100m; 2 x nesting factor) over a 10 km (easting) x 10 km (northing) domain:

3.3 Building Profile Input Program

Building Profile Input Program (BPIP) was utilised for the dispersion modelling assessment where the Rotomould Emission Stack Height was set to the same height as the factory building to ensure maximum building downwash effects.

3.4 CALPUFF Model Options

Calpuff default model options were set except for the following as recommended in *Table A-4* contained and explained within *Barclay and Scire* (Barclay & Scire, 2011):

- Dispersion coefficients (MDISP) = dispersion coefficients from internally calculated sigma v, sigma w using micrometeorological variables (2); and
- Probability Density Function used for dispersion under convective conditions (MPDF) = Yes (1).

3.5 Source Configuration and Emission Rates

All pollutant concentrations were modelled as constant.

4 Dispersion Modelling Limitations

By definition, air quality models can only approximate atmospheric processes. Many assumptions and simplifications are required to describe real phenomena in mathematical equations. Model uncertainties can result from:

- Simplifications and accuracy limitations related to source data;
- Extrapolation of meteorological data from selected locations to a larger region; and
- Simplifications to model physics to replicate the random nature of atmospheric dispersion processes.

Models are reasonable and reliable in estimating the maximum concentrations occurring on an average basis. That is, the maximum concentration that may occur at a given time somewhere within the model domain, as opposed to the exact concentration at a point at a given time will usually be within the ±10% to ±40% range (US EPA, 2003).

Typically, a model is viewed as replicating dispersion processes if it can predict within a factor of two, and if it can replicate the temporal and meteorological variations associated with monitoring data. Model predictions at a specific site and for a specific hour, however, may correlate poorly with the associated observations due to the above-indicated uncertainties. For example, an uncertainty of 5° to 10° in the measured wind direction can result in concentration errors of 20% to 70% for an individual event (US EPA, 2003).

Ektimo

Smartstream Technology
Stack Emissions Testing 2022
Report Number R013668r

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James Jackson **Air Monitoring Project Manager**	NATA Accredited Laboratory No. 14601	**Tom Manton** **Ektimo Signatory**

Accredited for compliance with ISO/IEC 17025 - Testing. NATA is a signatory to the ILAC mutual recognition arrangement for the mutual recognition of the equivalence of testing, calibration and inspection reports.

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Please note that only numerical results pertaining to measurements conducted directly by Ektimo are covered by Ektimo's terms of NATA accreditation as described in the Test Methods table. This does not include calculations that use data supplied by third-parties, comments, conclusions, or recommendations based upon the results. Refer to 'Test Methods' for full details of testing covered by NATA accreditation.

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1 Executive Summary

1.1 Background

Ektimo was engaged by Smartstream Technology to perform emission testing at their Cardup plant. Monitoring was performed during peak production.

1.2 Project Objective & Overview

The objective of the project was to quantify emissions from one discharge point.

Monitoring was performed as follows:

Location	Test Date	Test Parameters*
Roto Moulding Oven Exhaust Stack	20 September 2022	Volatile organic compounds (VOCs), aldehydes and ketones, odour, nitrogen oxides, sulfur dioxide, carbon monoxide, carbon dioxide & oxygen

* Flow rate, velocity, temperature and moisture were also determined.

All results are reported on a dry basis at STP.

Plant operating conditions have been noted in the report.

2 Results

2.1 Roto Moulding Oven Exhaust Stack

Date	20/09/2022	**Client**	Smartstream Technology
Report	R013668	**Stack ID**	Roto Moulding Oven Stack
Licence No.	-	**Location**	Cardup
Ektimo Staff	Tom Manton & Brock Zimoch	**State**	WA
Process Conditions	Please refer to client records.		220818

Sampling Plane Details	
Sampling plane dimensions	300 mm
Sampling plane area	0.0707 m²
Sampling port size, number & depth	1" BSP (x1), 2 mm
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit >2 D
Upstream disturbance	Centrifugal fan >6 D
No. traverses & points sampled	1 4
Sample plane conformance to AS 4323.1	Non-conforming

Comments
The number of traverses sampled is less than the requirement

The sampling plane is deemed to be non-conforming due to the following reasons:
The stack or duct does not have the required number of access holes (ports)

Stack Parameters		
Moisture content, %v/v	2.1	
Gas molecular weight, g/g mole	28.8 (wet)	29.0 (dry)
Gas density at STP, kg/m³	1.29 (wet)	1.30 (dry)
Gas density at discharge conditions, kg/m³	0.71	
Gas Flow Parameters		
Temperature, °C	225	
Velocity at sampling plane, m/s	12	
Volumetric flow rate, actual, m³/min	51	
Volumetric flow rate (wet STP), m³/min	28	
Volumetric flow rate (dry STP), m³/min	27	
Mass flow rate (wet basis), kg/hour	2200	

Gas Analyser Results	Average	
Sampling time	1224 - 1254	
	Concentration mg/m³	Mass Rate g/min
Combustion Gases		
Nitrogen oxides (as NO_2)	13	0.37
Sulfur dioxide	<6	<0.2
Carbon monoxide	41	1.1
	Concentration %v/v	
Carbon dioxide	0.9	
Oxygen	19.2	

Reference: R013668r
Date: 11/10/2022
Prepared for: Smartstream Technology

Ektimo

Date	20/09/2022	**Client**	Smartstream Technology
Report	R013668	**Stack ID**	Roto Moulding Oven Stack
Licence No.	-	**Location**	Cardup
Ektimo Staff	Tom Manton & Brock Zimoch	**State**	WA
Process Conditions	Please refer to client records.		220818

Aldehydes	Average		Test 1		Test 2	
Sampling time			1115-1145		1158-1228	
	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min
Formaldehyde	2.9	0.079	4.9	0.13	0.84	0.023
Acetaldehyde	0.22	0.0061	0.14	0.0038	0.31	0.0084
Acetone	2.5	0.069	3.3	0.09	1.7	0.047
Acrolein	<0.007	<0.0002	<0.007	<0.0002	<0.007	<0.0002
Propionaldehyde	≤0.025	≤0.00069	<0.007	<0.0002	0.043	0.0012
Methyl ethyl ketone (2-butanone)	<0.007	<0.0002	<0.007	<0.0002	<0.007	<0.0002
n-Butyraldehyde	0.065	0.0018	0.042	0.0012	0.087	0.0024
Valeraldehyde	<0.007	<0.0002	<0.007	<0.0002	<0.007	<0.0002
Hexanal	0.021	0.00059	0.021	0.00058	0.022	0.0006

Odour	Average		Test 1		Test 2	
Sampling time			1250 - 1255		1258 - 1303	
	Concentration ou	Odourant Flow Rate oum³/min	Concentration ou	Odourant Flow Rate oum³/min	Concentration ou	Odourant Flow Rate oum³/min
Results	1100	30000	1000	29000	1100	31000
Lower uncertainty limit	760		640		690	
Upper uncertainty limit	1500		1600		1800	
Analysis date & time			21/09/22, 0900-0930		21/09/22, 0900-0930	
Holding time			20 hours		20 hours	
Dilution factor			1		1	
Bag material			Nalophan		Nalophan	
Butanol threshold (ppb)	40					
Laboratory temp (°C)	22					
Last calibration date	January 2022					

VOC's C5-C20	Average		Test 1		Test 2	
Sampling time			1115-1145		1149-1219	
	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min	Concentration mg/m³	Mass Rate g/min
Detection limit(1)	<0.3	<0.008	<0.3	<0.008	<0.3	<0.008

(1) Unless otherwise reported, the following target compounds were found to be below detection:
Ethanol, Isopropanol, Pentane, 1,1-Dichloroethene, Acrylonitrile, Dichloromethane, trans-1,2-Dichloroethene, Methyl ethyl ketone, n-Hexane, cis-1,2-Dichloroethene, Ethyl acetate, Chloroform, 1,1,1-Trichloroethane, 1,2-Dichloroethane, Cyclohexane, Benzene, Carbon tetrachloride, Butanol, Isopropyl acetate, 2-Methylhexane, 2,3-Dimethylpentane, 1-Methoxy-2-propanol, 3-Methylhexane, Heptane, Ethyl acrylate, Trichloroethylene, Methyl methacrylate, Propyl acetate, Methylcyclohexane, Methyl Isobutyl Ketone, Toluene, 1,1,2-Trichloroethane, 2-Hexanone, Octane, Tetrachloroethene, Butyl acetate, Chlorobenzene, Ethylbenzene, m + p-Xylene, 1-Methoxy-2-propyl acetate, Styrene, o-Xylene, Butyl acrylate, Nonane, 2-Butoxyethanol, Cellosolve acetate, 1,1,2,2-Tetrachloroethane, Isopropylbenzene, alpha-Pinene, Propylbenzene, 1,3,5-Trimethylbenzene, beta-Pinene, tert-Butylbenzene, 1,2,4-Trimethylbenzene, Decane, 3-Carene, 1,2,3-Trimethylbenzene, D-Limonene, Undecane, Dodecane, Tridecane, Tetradecane, Residuals as Toluene

3 Plant Operating Conditions

See Smartstream Technology records for complete process conditions.

4 Test Methods

All sampling and analysis performed by Ektimo unless otherwise specified. Specific details of the methods are available upon request.

Parameter	Sampling method	Analysis method	Uncertainty*	NATA accredited Sampling	NATA accredited Analysis
Sampling points - Selection	AS 4323.1	NA	NA	✓	NA
Flow rate, temperature & velocity	USEPA Method 2	USEPA Method 2	8%, 2%, 7%	NA	✓
Moisture	USEPA Method 4	USEPA Method 4	8%	✓	✓
Carbon dioxide & oxygen	USEPA Method 3A	USEPA Method 3A	13%	✓	✓
Carbon monoxide	USEPA Method 10	USEPA Method 10	12%	✓	✓
Nitrogen oxides	USEPA Method 7E	USEPA Method 7E	12%	✓	✓
Sulfur dioxide	USEPA Method 6C	USEPA Method 6C	12%	✓	✓
Aldehydes & ketones	Ektimo 330	Ektimo 330	16%	✓	✓[†]
Speciated volatile organic compounds (VOCs)	Ektimo 344	Ektimo 344	19%	✓	✓[†]
Odour	AS 4323.3	AS 4323.3	refer to results	✓	✓[¥]

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* Uncertainties cited in this table are estimated using typical values and are calculated at the 95% confidence level (coverage factor = 2).
† Analysis conducted at the Ektimo Mitcham, VIC laboratory, NATA accreditation number 14601. Results were reported on
5 October 2022 in report LV-003407.
6 October 2022 in report LV-003407 VOC.
¥ Odour analysis conducted at the Cockburn Central, WA laboratory by forced choice olfactometry, NATA accreditation number 14601. Results were reported on 21 September 2022 in report WO-00268.

4.1 Deviations to Test Methods

Deviation from analytical method: Due to COVID-19 social distancing requirements, the minimum number of panellists stipulated in AS4323.3 of four (4) cannot be adhered to. Three (3) panellists were used and the number of dilution series for each sample was increased to achieve comparable calculated uncertainty and meet the minimum ITE requirement (8) of the method.

5 Quality Assurance/Quality Control Information

Ektimo is accredited by the National Association of Testing Authorities (NATA) for the sampling and analysis of air pollutants from industrial sources. Unless otherwise stated test methods used are accredited with the National Association of Testing Authorities. For full details, search for Ektimo at NATA's website www.nata.com.au.

Ektimo is accredited by NATA to ISO/IEC 17025 - Testing. ISO/IEC 17025 - Testing requires that a laboratory have adequate equipment to perform the testing, as well as laboratory personnel with the competence to perform the testing. This quality assurance system is administered and maintained by the Quality Director.

NATA is a member of APAC (Asia Pacific Accreditation Co-operation) and of ILAC (International Laboratory Accreditation Co-operation). Through mutual recognition arrangements with these organisations, NATA accreditation is recognised worldwide.

6 Definitions

The following symbols and abbreviations may be used in this test report:

% v/v	Volume to volume ratio, dry or wet basis
~	Approximately
<	Less than
>	Greater than
≥	Greater than or equal to
AS	Australian Standard
D	Duct diameter or equivalent duct diameter for rectangular ducts
Disturbance	A flow obstruction or instability in the direction of the flow which may impede accurate flow determination. This includes centrifugal fans, axial fans, partially closed or closed dampers, louvres, bends, connections, junctions, direction changes or changes in pipe diameter.
DWER	Department of Water and Environmental Regulation (WA)
EPA	Environment Protection Authority
Lower bound	When an analyte is not present above the detection limit, the result is assumed to be equal to zero.
Medium bound	When an analyte is not present above the detection limit, the result is assumed to be equal to half of the detection limit.
NATA	National Association of Testing Authorities
OU	Odour unit. One OU is that concentration of odorant(s) at standard conditions that elicits a physiological response from a panel equivalent to that elicited by one Reference Odour Mass (ROM), evaporated in one cubic metre of neutral gas at standard conditions.
STP	Standard temperature and pressure. Gas volumes and concentrations are expressed on a dry basis at 0 °C, at discharge oxygen concentration and an absolute pressure of 101.325 kPa.
USEPA	United States Environmental Protection Agency
VOC	Volatile organic compound. A carbon-based chemical compound with a vapour pressure of at least 0.010 kPa at 25°C or having a corresponding volatility under the given conditions of use. VOCs may contain oxygen, nitrogen and other elements. VOCs do not include carbon monoxide, carbon dioxide, carbonic acid, metallic carbides and carbonate salts.
Upper bound	When an analyte is not present above the detection limit, the result is assumed to be equal to the detection limit.
95% confidence interval	Range of values that contains the true result with 95% certainty. This means there is a 5% risk that the true result is outside this range.

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