valspar

SOLVENT MANAGEMENT PLAN – 2019
DEESIDE PACKAGING COATINGS

Document REFERENCE: 34312R2

REPORT PREPARED BY: The VALSPAR CORPORATION (UK) LTD

DATE: 31st January 2020

REPORT ISSUE

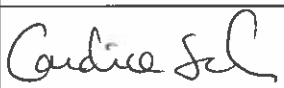
Issue/revision	Issue 1	Revision 2	Revision 3
Remarks	-		
Date	31st January 2020		
Prepared by	Candice Sankoomar		
Signature			
Position	EHS Manager		
Verified by	Neil Booth		
Signature			
Position	Site Manager		

TABLE OF CONTENTS

Contents

REPORT ISSUE 2
TABLE OF CONTENTS 3
1.0 INTRODUCTION 4
2.0 METHODOLOGY 4
3.0 SOLVENT EMISSIONS CALCULATIONS 5
4.0 SUMMARY REPORT 11

1.0 INTRODUCTION

1.1 Background

This annual solvent emissions report for 2019 has been written to address the relevant annual compliance requirements of Environmental Permit reference BU7545IM.

The calculation of solvent emissions has been undertaken in accordance with the methodology outlined in 'The BCF VOC Workbook', as requested by the Natural Resources Wales (NRW) in EPR Compliance Assessment Report reference BU7545IM/0221994. The relevant inputs and calculations are detailed within this report.

2.0 METHODOLOGY

2.1 Scope

As required by the Environmental Permit for the installation, the solvent emissions calculations only consider releases from the Coatings Plant. However, it should be noted that all materials manufactured in the Resin Plant are used in the Coatings Plant and therefore the Volatile Organic Compound (VOC) input to the process can be considered as all solvents used on site.

2.2 Assessment Criteria

There are two solvent emission limit Options outlined in the BCF VOC Workbook. These are summarised in Table 1.

Table 1 VOC Emission Limits for Coatings Manufacture

Solvent Consumption (tonnes per annum)		Option 1	Option 2	
		Total Emissions	Fugitive Emissions	Waste Gas Emissions
Band 0	< 100	Not in scope	Not in scope	
Band 1	100 - 1,000	< 5% of solvent inputs	< 5% of solvent inputs	< 150mg carbon/m^3
Band 2	> 1,000	< 3% of solvent inputs	< 3% of solvent inputs	< 150mg carbon/m^3

The Deeside Packaging Coatings facility consumes in excess of 1,000-tonnes of solvent per annum and is therefore classified as a Band 2 installation. Stack monitoring has shown carbon concentrations greater than 150mg/m^3 in the exhaust gases. As such, the emission limit provided in Option 1 has been selected for use in this assessment.

2.3 Emission Calculation

As stated in the BCF VOC Workbook:

Total emission = waste gases emissions + fugitive emissions
= final discharge from a stack + any other emissions to air, soil or water, excluding solvent in product
= Solvent emissions in waste gases (O1) + (uncaptured emissions (O4) + solvents lost in water (O2) + solvent contamination or residues in products (O3) + solvent released in other ways (O9)).

It should be noted that O3 is not applicable to coatings manufacturing processes as solvents in products are deliberately present.

The installation is shown to conform to the emission limit if:

(O1 + O2 + O4 +O9) ≤ 3 (Purchases of solvents (I1) + solvent recovered and reused in the installation (I2)) / 100

3.0 SOLVENT EMISSIONS CALCULATIONS

3.1 I1 - Purchase of Solvents

Solvent usage at the facility was obtained from delivery and usage records. The results are summarised in Table 2.

Table 2 Solvent Usage

	Usage (kg)
Diacetone aol AF Type	24883
n-Butanol	334947
IPA	40667
isobutanol	7526
IMS99	16080
Propylene glycol	173702
1° amyl aol	0
Tridecanol	21925
ISOAMYL ALCOHOL	7268
Glycol ether DE-LG	1556957
Butyl di glycol acetate	10273
Glycol ether EB	718475
Butyl acetate	20630
Diethylene glycol butyl	25428
Dowanol PM	5086
Buyl cellosolve acetate type	47158
Glycol ether EP	95743
PM acdetate	33336
Methyl carbitol	200
Dibasic ester solvent	13702
MIBK	15976
cyclo Hexanone	23222
MEK	196289
Mineral spirits	6195
Solvent 60	5184
Xylene	175890
CDA 99%	194
Aromatic 100	743905
Aromatic 150	209654
TOTAL	**4,530, 495**

As shown in Table 2, **4,530, 495** kg of solvent was used in 2019.

The majority of the resins used in the Coatings Plant are manufactured on site. However, other bought in resins containing solvents were used in 2019. Table 3 details calculated solvent based on suppliers SDS data.

Table 3 Solvent in bought in resins usage

Resin	Usage (kg)	% Solvent content	Calculated solvent usage (kg)
RB0008B	246642	2	4932.84
AK1118A	2604062	39.70	1033812.61
SB0018B	250911	36.20	90829.78
SB0069B	2634	100	2634.00
SB0071B	56294	24.75	13932.77
SQ0567P	0	50	0
SQ0700E	197916	48.62	96226.76
SQ0839E	61391	41.50	25477.27
TOTAL	3,419, 850		**1,267,846**

As such, **I1.2 (solvent in bought-in resins) = 1,267,846 kg.**

No other solvents in addition to those shown in Table 2 are used on site. As such, I1.3 (Solvent in other bought-in materials) = **0**kg. Based on the above values, **I1 =5,798,341 kg**.

3.2 I2 - Solvent Recovered and Reused in the Installation

There are no recovered solvents bought in to the facility. As such, I2.1 (bought-in recovered solvent) = **0**kg.

There are no solvents recovered on site. As such, I2.2 (on-site recovered solvent) = **0**kg. Based

on the above values, **I2 = 0kg.**

3.3 O1 - Solvent Emissions in Waste Gases:

The amount of solvent emissions in waste gases has been calculated for the relevant routes in the following Sections.

3.3.1 O1.1 - Powered Vents:

The emission points associated with the Coatings Plant:

3.3.1 Emission point A5 and A37 - Coatings plant vessels; and,
3.3.2 Coatings plant fugitive emissions local exhaust ventilation system (LEV).

Emissions from these points are calculated below.

Emission Points A5 and A37:

Quarterly monitoring of VOC emissions from A5 and A37 was undertaken for each quarter of 2019 to show compliance with the relevant condition included within the site's Environmental Permit. A summary of 2019 monitoring results is provided in Table 4.

Table 4 Monitoring Results - VOC Concentrations

Emission Point	Total VOC (kg/hr)				
	Q1	Q2	Q3	Q4	Mean
A5	0.0005	0.0404	0.0865	0.0878	0.0538
A37	0.0305	0.0077	0.00181	0.057	0.024

The calculation requires the monitored VOC concentration as carbon to be converted to mass of VOC. This requires speciation of the emission. However, this was not undertaken during 2014. As such, reference was made to the Speciation Monitoring included in the Environmental Permit Application for the site. This indicated the following species were present in the exhaust gases:

- n-Butanol
- 2-Butoxyethanol
- 2-Ethoxyethanol
- Ethyl benzene
- Formaldehyde
- Toluene
- Trimethylbenzenes
- Xylene
- Other hydrocarbons

The BCF VOC Workbook states that for the simplified approach it should be assumed that all of the emission consists of the species with the lowest proportion of carbon. As such, butanol was selected for the purpose of the assessment at it consists of 41% carbon.

The Coatings Plant operates 24-hours per day, 362-days per year. The annual mass emission from A5 and A37 was therefore calculated as follows:

0.0778/41*100 x 24 x 362 = **1649** kg VOC/year

Local Exhaust Ventilation System (Fugitive Emissions)

Annual workplace exposure monitoring of various VOCs is undertaken within the Coatings Plant. The results have been normalized to mg/m3 and are summarised in Table 5. These were utilised to represent solvent concentrations within the Coatings Plant in lieu of direct monitoring of the LEV system.

Table 5 Ambient VOC Concentrations

Species	Average molecular mass (g/mole)	Monitored Conc (ppm)	Monitored Conc (mg/m^3)
n-Butanol	74.12	0.31	0.94
2-Butoxyethanol	118.17	0.02	0.09666
2-Ethoxyethanol	90.12	0.024	0.44
Ethyl benzene	106.16	0.19	0.61
Formaldehyde	30.026	0.026	0.04974
Toluene	92.14	0.018	0.21

Trimethylbenzenes	120.195	0.46	0.84
Xylene	106.16	0.67	0.09426
Other hydrocarbons			2.5
Total			**5.78066**

It should be noted that the workplace exposure monitoring recorded VOC concentrations whilst workers undertook specific activities with a high risk of solvent release. As such, the results are considered to provide a worst-case representation of VOC concentrations from fugitive emissions within the Coatings Plant.

The flow rate within the LEV system has been measured by an external consultant and when combined with the volume of the Coatings Plant the total volume discharged by the LEV system is as follows. 2018 data was used for this calculation:

10,571 x 2.06 = 21,776.26 m^3/hr.

This was converted into the airflow per year by multiplying by the number of operational hours:

21,776.26 x 24 x 362 = 189,192,146.9 m^3/year.

This was multiplied by the monitored VOC concentration to determine the annual mass release:

(189,192,146.9 x 0.78071) / 1,000,000 = 1093.65 kg VOC/year

Total Powered Vent Losses

Based on the above calculations, **O1.1 = 2742.65 kg**

3.3.2 O1.2 - Non-Powered Process Vessel Vents

Any releases through non-powered process vessel vents are collected by the LEV system as fugitive emissions to the building and have been accounted for in O1.1. As such, O1.2 (non-powered process vessel vents (e.g. breather vents) = 0kg.

3.3.3 O1.3 - General Extraction and Building Ventilation Systems

Ventilation is provided by the LEV system outlined in Section 3.3.1. As such, O1.3 (general extraction and building ventilation systems) = 0kg.

3.3.4 O1.4 - Bulk Storage Vessel Breather Vents

Tank solvent losses occur through either:

3.3.3 Vapour displacement on filling (F); or,
3.3.4 Vapour breathing losses (B) due to the volume changes as a result of the daily rise and fall in temperature.

F - Filling Losses

Filling losses have been calculated using the equation provided in the BCF VOC Workbook. The results are summarised in Table 6.

Table 6 Filling Losses

Release Point	Species	Annual Usage (kg)	Specific Gravity	Annual Usage (m^3)	Mol. Weight	Vapour Press @20C (kPa)	Filling Losses (kg per year)
Tank 1 & 2	Ethyl Diglycol TE0001A	1556957	0.989	1574.3	134.1	0.024	2.14
Tank 3	Solvesso 100/Naptha	743905	0.878	847.3	127	0.194	8.82
Tank 4	Xylene TR0004A	175890	0.87	202.2	106	0.74	6.70
Tank 5	Epikote 828 RE0276B	1485060	1.16	1280.2	374	0.00	0
Tank 6	Dowanol PM TE0036A	5086	0.921	5.5	90.1	1.33	0.28
Tank 7 & 13	MEK TK0012A	196289	0.806	243.5	72.1	9.459	70.16
Tank 8	Dowanol PMA TE0055A	33336	0.966	34.5	132.2	0.337	0.65
Tank 9	Normal Butanol TC0003A	334947	0.81	413.5	74.1	0.566	7.33
Tank 10	Butyl Glycol Ether TE0003A	718475	0.902	796.5	118.2	0.118	4.70
Tank 18	Methacrylic Acid MQ0025A	87212	1.01	86.3	86.09	0.13	0.41
Tank 12	DMEA CM0564A	111568	1.01	110.5	86.09	0.13	0.52
Tank 14	Wash Solvent	994135	0.82784	1200.9	83.983	3.585	152.73
Tank 16	Butyl DiGlycol TE0027A	25428	0.887	28.7	89.1	0.56	0.60
Tank 17	BCA - TE0047A	47158	0.972	48.5	160.21	0.03	0.10
ST 8	Ethyl Acrylate MQ0037A	271755	0.923	294.4	100	3.9	48.51
						TOTAL	**303.65**

As shown in Table 6, F =**303.65** kg.

It should be noted that the vapour pressures have been used at 20°C as a worst-case, as described in the BCF VOC Workbook.

B - Breathing Losses

As stated in the BCF VOC Workbook, the calculation of breathing losses is complex and laborious. As such, they can be approximated by adopting the value determined for F. Evaluation of data shows these to be similar in magnitude and if the worst case is used for filling losses (as utilised in this

assessment), this compensates for any reduction in breathing losses.

As such, B = **303.65** kg.

Total Bulk Storage Losses

Based on the above calculations, **O1.4 = 607.3 kg.**

3.3.5 O1.5 - Abatement Plant Discharges

The Coatings Plant does not include any solvent abatement equipment. As such, O1.5 (abatement plant discharges) = 0kg.

3.4 O2 - Solvents Lost in Water

The Coatings Plant does not have any associated effluent releases. As such, O2 (solvents lost in water) = 0kg.

3.5 O4 - Uncaptured Emissions

3.5.1 O4.1 - Natural Ventilation of Buildings

Ventilation is provided by the LEV system outlined in Section 3.3.1. As such, O4.1 (natural ventilation of buildings) = 0kg.

3.5.2 O4. 2 - Outside Emptied Drum Storage

All solvents are delivered directly to the tank farm. Resins are delivered in sealed IBCs and returned to the supplier in a closed state. Given the very high solids content of the resin used on site it is considered the amount of residual VOCs in the IBCs is likely to be negligible. Therefore, O4.2 (outside emptied drum storage) = 0kg.

3.5.3 O4.3 - Outside Container Crushing Plant

The facility does not include a container crushing plant. As such, O4.3 (outside container crushing plant) = 0kg.

3.6 O9 - Solvent Released in Other Ways

It is confirmed that there were no exceptional solvent releases in 2019. As such, O9 (solvent released in other ways) = 0kg.

4.0 SUMMARY REPORT

A summary of solvent emissions is provided in Table 7.

Table 7 Summary Report

I/O Code	Activity	Solvent Input (tonnes)	VOC Emission (tonnes)	VOC Emission (% input)
I1.1	Bought-in 'new' solvents	4530.495	-	-
I1.2	Solvent in bought-in resins	1267.846	-	-
I1.3	Solvent in other bought in materials	0.00	-	-
I2.1	Bought-in recovered solvent	0.00	-	-
I2.2	On-site recovered solvent	0.00	-	-
Total Inputs		**5798.341**		
O1.1	Powered vents	-	2.743	0.0473
O1.2	Non-powered process vessel vents	-	0.00	0.00
O1.3	General extraction and building ventilation systems	-	0.00	0.00
O1.4	Bulk storage vessel breather vents	-	0.6074	0.0105
O1.5	Abatement plant discharges	-	0.00	0.00
O2.1	Solvents in final discharges to sewers and drains	-	0.00	0.00
O4.1	Natural ventilation of buildings	-	0.00	0.00
O4.2	Outside open emptied drum storage	-	0.00	0.00
O4.3	Outside container crushing plant	-	0.00	0.00
O9.1	Releases in other ways	-	0.00	0.00
Total Emissions			**3.35**	**0.058**

As shown in Table 7:

O1 + O2 + O4 +O9 = **3.35** t

And:

3 x (I1 + I2) / 100 = **173.95t**

As such, solvent emissions are less than 3% of the input and the facility is compliant with the relevant emission limit and there is no requirement to formally plan further solvent emission reductions.