Agilent Environmental Permit Application – Redacted for the Public Register

Air Emissions Risk Assessment

Agilent Technologies LDA UK Limited

Essex Road, Church Stretton, Shropshire. SY6 6AX

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Making Sustainability Happen

Revision Record

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Basis of Report

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1.0 Introduction

SLR Consulting Limited (SLR) has been instructed by Agilent Technologies LDA UK Limited (Agilent) to prepare an application for an Environmental Permit (EP) for their organic polymer manufacturing site located at Essex Road, Church Stretton, Shropshire, SY6 6AX (the site). The EP application will be submitted to the Environment Agency (EA) for determination.

The site manufactures silica and organic polymers for use in laboratory consumables and industrial applications at a rate of less than 5 tonnes per year. This is considered to be a listed activity as per the Environmental Permitting (England and Wales) Regulations (EPR) 2016 (as amended):

- Section 4.1 Part A(1)(a)(viii) activity, i.e., producing organic chemicals such as plastic materials (for example polymers, synthetic fibres and cellulose based fibres).

This Air Quality Risk Assessment (AERA) quantifies potential impacts associated with emission releases from the site's processes upon the environment.

1.1 The Site

The site is located in Church Stretton, Shropshire. The site is accessed via Essex Road and the National Grid Reference (NGR) for the site is centred on SO 45672 93772.

The site is located approximately 300m north of Church Stretton and 17.5 km south of Shrewsbury, and is situated within a mix of commercial, recreational and residential property. The A49 runs in a north-south direction approximately 115m east of the site. Residential properties are in close proximity, with the closest located approximately 20m to the north and 35m to the west of the site respectively. The site location is presented in Figure 1-1.

Figure 1-1: Site Location

1.2 Overview of the Site Operations

The site manufactures silica and organic polymers (mostly in the form of microscopic particles) for use in laboratory and industrial applications in human clinical and diagnostics), liquid chromatography, and solid support synthesis particles. On-site processes include receipt and storage of raw materials; polymerisation of monomers and surface modification; storage, loading and despatch of finished products. A research and development (R&D) laboratory is also located onsite.

The site uses raw materials which include organic solvents, and monomers. Where reactions occur, these take place within temperature-controlled reaction systems and once complete, the product is discharged to a vessel where it is mixed with a solvent, filtered and blended prior to discharge. Products are then transferred to smaller packages as required.

The reaction vessels are heated via electrical heating systems. General heating and other processes are heated via the low temperature hot water system which is powered by several small gas fired boilers (<1MWth rated thermal input).

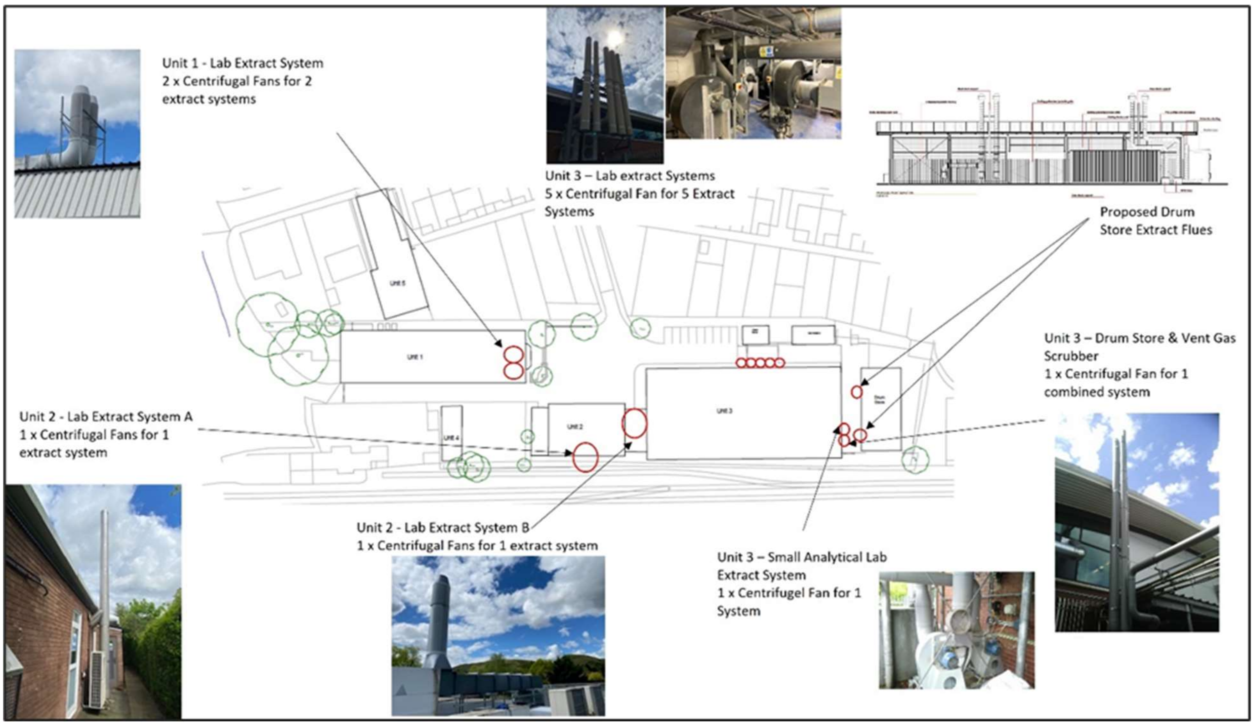
An emergency diesel generator (<1MWth rated thermal input) is also located onsite which backs up critical electrical supplies. These onsite sources are not considered within relevant EA permitting requirements and have therefore been omitted from this assessment.

Reactors and vessels are connected to the wet scrubber to abate volatile organic compound (VOC) emissions to air. Local exhaust ventilation for the fume cupboards (9 No. vents) are also present onsite. These sources are presented in Table 1-1 and illustrated in Figure 1-2.

Table 1-1 Emissions Source Details

Emission Point Name	Emission Point Label	Activities Undertaken
Unit 3 -Impingement Scrubber Exhaust	A1	Main Process emissions point Product washing and filtering
Unit 3 - (Stack 1)	A2	Fume cupboard (FC) emissions. Small scale processing activities
Unit 3 - (Stack 2)	A3	Smaller scale (10l-15l) processing/filtering in fume cupboards FC9-14
Unit 3 - (Stack 3)	A4	20L Tank in one fume cupboard (Sediment)
Unit 3 - (Stack 4)	A5	Hoods over wash measurement tanks - fugitive emissions during tank filling during wash/filter of PLRPS in PF2000 pressure filter + PCX in CT pressure filters wash/filter Batch polymerisation in 200 litre reactor.
Unit 3 - (Stack 5)	A6	Small scale distillations, rotary evaporation, cleaning and rinsing inside fume cupboards in Standards lab. Small scale solvent waste decanting
Unit 3 - Analytical Lab LEV	A7	Sample drying and handling
Unit 2 - Old R&D Lab Vent	A8	Small scale (2-5l) R&D polymerisations and surface modifications
Unit 2- New R&D Lab Vent	A9	Small scale (2-5l) R&D polymerisations and glassware rinsing/washing
Unit 1- Lab Extract (LHS) Column Production Lab LEV	A10	Liquid chromatography column production - column packing
Unit 1 – Lab Extract (RHS)	A11	Liquid chromatography column production - column packing

Figure 1-2: Emissions Sources Locations



Emission source locations are also presented on Drawing 002 (410.064921.00001_DRAWING 002 Site Setting & Emission Points).

1.3 Scope and Objective

The scope of the assessment is to define the risk of emissions to air from the local exhaust vents and the wet scrubber.

The following raw materials have been identified as being used within the processes undertaken at the site and may potentially be emitted from the emission sources:

- Tetrahydrofuran
- Acetone
- Methanol
- Diethylbenzene
- Iso-Amyl Alcohol / 3-Methyl-1-butanol
- Styrene
- Vinylbenzene chloride
- Divinylbenzene
- Toluene
- Ethylene diamine
- Heptane

The objective of the study is to assess the impact of potential emissions against the relevant air quality standards and limits for the protection of human health and ecological receptors. This report presents the approach, detailed methodology and findings of the AERA.

2.0 Legislation and Relevant Guidance

2.1 Environmental Permitting Regulations

The facility is regulated under the Environmental Permitting Regulations (EPR) 2016 (as amended) [1]. The EPR prescribes emission limit values for certain pollutants into the air from certain plant.

2.1.1 Permitting Guidance

Guidance Notes produced by Defra provide a framework for regulation of installations and additional technical guidance produced by the Environmental Agency (EA) are used to provide the basis for permit conditions.

Of relevance to the assessment is the '*Air emissions risk assessment for your environmental permit*'[2] (the AERA guidance). The purpose of this guidance is to assist operators to assess risks to the environment and human health when applying for a permit under the EPR.

2.1.2 Environmental Assessment Limits (EAL)

The EA has produced Environmental Assessment Levels (EALs) which are a pollutant concentration in ambient air at which no significant risks to public health are expected.

For some of the emitted substances an EAL is not published within the EA's AERA guidance. Where this is the case a new EAL has been derived.

To derive a new EAL, the EA hazard characterisation method for determining tolerable concentrations in air (TCAs) within section 7 and annex 5 of 'Derivation of new environmental assessment levels to air' (2012), has been used. A review of toxicity from suitable databases has been undertaken and presented in Appendix A.

Where no suitable data was available to allow derivation of a suitable EAL, the published EAL's for benzene were used as a precautionary approach.

The EALs for the purpose of assessment, for the protection of human health are provided in Table 2-1.

[1] UK Statutory Instruments, 2016 No. 1154 The Environmental Permitting (England and Wales) Regulations 2016

[2] https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit

Table 2-1: Environmental Assessment Limits (EAL)

Pollutant	Annual Standard (µg/m^3)	Short Term (Hourly) Standard (µg/m^3)
Acetone	18,100	362,000
Methanol	2,660	33,300
Styrene	260	800
Tetrahydrofuran	3,000	59,900
Toluene	1,910	8,000
Diethylbenzene	190 (A)	190 (A)
Ethylene diamine	327 (A)	327 (A)
Heptane	4,960 (A)	4,960 (A)
Iso-Amyl Alcohol	174 (A)	174 (A)
Vinylbenzene chloride	5 (B)	30 (B)
Divinylbenzene	3,000 D*(A)	3,000 D*

Table Notes:
(A) – Indicates EAL has been derived. Refer to Appendix A for details.
(B) - Indicates no WEL data available, and insufficient testing data available to allow derivation of appropriate EAL's. Hence the EAL's for Benzene have been applied to provide a conservative assessment.

2.1.3 Protection of Ecological Receptors

The AERA Guidance requires that designated ecological sites should be screened against relevant standards if they are located within the following set distances from the facility.

As per the EA's AERA guidance, the substances detailed in Table 2-1 are not listed as a primary or secondary pollutant that requires consideration of ecological impacts. Therefore, the objective of the assessment is to determine the extent of potential air quality effects, by comparison to relevant guidelines for the protection of human health only.

3.0 Assessment Methodology

The following sections detail the AERA screening assessment methodology.

3.1 AERA screening approach

The AERA guidance provides the following steps for screening emissions:

- Step 1: Calculate the environmental process contribution (PC).
- Step 2: Identify PCs with insignificant environmental impact so that they can be 'screened out'.
- Step 3: For PCs not screened out in Step 2, calculate the predicted environmental concentration (PEC)
- Step 4: Identify emissions that have insignificant environmental impact.
- Step 5: Undertake a detailed assessment for the emissions that cannot be screened out.

Step 1: Calculating Process Contribution

The Long-Term (LT) and Short Term (ST) PCs are calculated by multiplying the dispersion factor, in micrograms per cubic metre per gram per second (µg/m^3/s), by the release rate, in grams per second (g/s).

Consideration is also given for the durations of the release rate of the PC and weighted for emissions durations and averaging periods.

Step 2: Screen out insignificant Process Contributions – Human Health

To screen out a PC from further assessment of it, the PC must meet both of the following criteria:

- the short-term PC is less than 10% of the short-term environmental standard.
- the long-term PC is less than 1% of the long-term environmental standard.

If this criterion is not met, then Step 3 assessment is required.

Step 3: Calculating Predicted Environmental Concentration

For PCs that are not screened out in Step 2 the Predicted Environmental Concentration (PEC) is calculated as the some of the PC and the concentration of that's already present in the environment - the 'background concentration'

The PEC cannot be screened out if the following criteria is not met:

- the short-term PC is less than 20% of the short-term environmental standards minus twice the long-term background concentration.
- the long-term PEC is less than 70% of the long-term environmental standards.

Step 4: Identify emissions that have insignificant environmental impact

All emissions that have been screened out using stages 1, 2 and 3 can be considered to be insignificant and Stage 5 is not required.

Step 5: Undertake a detailed assessment

Detailed atmospheric dispersion modelling is required for emissions sources that cannot be screened out through Stages 1-3 with due consideration to the AERA and dispersion modelling reporting guidance.

3.2 Review of Monitored Data

An emissions monitoring exercise was undertaken at the Agilent Site by ECL during September and October 2023 (ECL Report Number P5595).

SLR has reviewed the ECL report and identified some discrepancies in the data manipulation used to calculate average and maximum results across multiple sampling runs for each emission point. SLR has therefore used the raw monitoring results presented to re-calculate average and maximum emission levels for use in this assessment. These calculations are presented in Appendix B.

SLR understands that site processing typically comprises small scale polymerisation reactions with subsequent purification stages (e.g. filtering and washing, distillation, evaporation, chromatography etc.). Such activities are batch processes, with the specific activities being undertaken varying from day-to-day (or in some cases hour-to-hour). Hence, none of the specific emissions are expected to be continuous in nature, and many will be intermittent and in some cases of relatively short duration.

SLR also understands that the scheduled activities (reactions) undertaken during the monitoring process were representative of activities most likely to lead to the highest level of emissions from each item of plant. An operational log was also provided by Agilent detailing the activities being undertaken in each operational area and recording the chemical / VOC materials in use in each area as monitoring was underway. This allows a comparison to be made between the emission concentrations / rates reported and the activities being undertaken. This also has allowed an estimate to be made of the likely speciated chemical composition of the VOC's emitted to atmosphere.

The data on the estimated percentage composition of the materials being processed in each operational area, has been based upon the raw materials and solvents input to the particular process being undertaken at the time. SLR has reviewed this data and identified:

- Those VOC materials likely to be released via the emission point to air; and
- Those materials that would be consumed within the process and therefore would not be present at any significant level in the vented air e.g. monomers which would be fully reacted within the polymerisation processes and hence are unlikely to be emitted via the process vents.

SLR has calculated the estimated average and maximum emission levels of each VOC predicted to be present in each vent system by multiplying the recorded TVOC concentrations by the estimated percentage of each component present. The calculated mass emission rates (presented as grams of VOC as carbon) has been converted to mass emission rate(s) as the component VOC species. This then allows a direct comparison against the relevant EAL's for each component VOC species.

For some emission points the mix of materials present varies throughout the process, and where this is the case the VOC composition data has been reviewed on an hour-to-hour basis to ensure that this variance has been accounted for.

3.3 Identification of Process Emissions.

It is considered reasonable to assume that solvents used in the various processes, and other high vapour pressure VOC's have the potential to be emitted through the vent systems, and hence these have all been included within the AERA.

A number of monomers (e.g. styrene, vinylbenzene chloride and divinylbenzene) are used within various polymerisation reactions undertaken at the site. These materials will be consumed by the process and as a result they will only be present in the reactors for a short duration which significantly reduces the likelihood of these materials being emitted via the site vents:

- Styrene has a vapour pressure of 6.67 hPa and is typically one of the primary monomers used in the process, hence it is reasonable to assume that there may be potential for some limited emission of styrene from the polymerisation reactors in the early stages of the reaction.
- Vinylbenzene chloride has a vapour pressure of 31Pa, which is very low and hence only just falls into the classification of VOC, it is also typically used in low quantities in any of the polymerisation reactions and is only used in the presence of larger proportions of more volatile VOC species, and hence is unlikely to make any notable contribution to VOC materials within the air vented from the reactor headspace and hence is not expected to be present in any significant quantities in the emissions from the processes
- Divinylbenzene has a vapour pressure of 93.32 Pa, which is relatively low. It is also typically used in low quantities in any of the polymerisation reactions and is only used in the presence of larger proportions of more volatile VOC species, and hence is unlikely to make any notable contribution to VOC materials within the air vented from

the reactor headspace and hence is not expected to be present in any significant quantities in the emissions from the processes.

- Ethylene diamine can also be used as a monomer in certain polymerisation reactions, but for the purposes of this assessment it has been assumed that it is used as a solvent and hence retained within the further assessment.

Whilst the calculation data presented in the appendices includes calculated values for divinylbenzene and vinylbenzene chloride, it is considered that due to their very low vapour pressures, it will be highly unlikely for these materials to actually be present in the air emitted in anything other than trace quantities, if at all.

It is considered that the estimated emissions of monomers present in the vented air (as calculated in Appendix B) is likely to represent a significant overestimate of the actual quantities likely to be emitted, this is particularly the case for those monomers with very low vapour pressures, or that are only used in very small proportions in the process.

As these substances would only be emitted intermittently i.e., when a polymerisation reaction is being undertaken that includes the use of one or more of these materials, and the monomers are only likely to be present within the various polymerisation reaction processes for a very short duration before they are consumed, it is considered appropriate that they should be assessed for short term air quality impacts only.

3.4 Effective Release Height and Dispersion Factors

The emission point(s) terminate at between 0.5-2 m above the highest point of the building roof to optimise dispersion. An effective stack height of 0m dispersion factor have therefore been applied as the release is less than 3m above roof height.

It has been assumed emissions will be released at the calculated level continuously for 8,760 hours per year (i.e. 24 hours per day 7 days per week). Use of this assumption is highly conservative.

Table 3-1: Applied Dispersion Factors (O-m)

Period	Unit	Value
Annual	µg/m^3/s	148
1-Hour	µg/m^3/s	3,900

3.5 Calculation of Process Contribution

For the purpose of assessment, it has been assumed the PC is the sum of a substance emitted from all emission sources. Therefore, providing a conservative assessment assuming all sources are emitting the same substance at the same time.

Long term emissions have been based on the calculated hourly average emissions data derived from the emissions monitoring report.

Short term emissions have been based on the calculated maximum hourly average emissions data derived from the emissions monitoring report.

The Long-Term (LT) and Short Term (ST) PC have been calculated by multiplying the dispersion factor, in micrograms per cubic metre per gram per second (µg/m^3/s), by the release rate, in grams per second (g/s). These are presented in Table 3-2 and 3-3 below.

Table 3-2: Calculation of Long Term Process Contribution (PC)

Substance	Emission Rate (g/s)	Dispersion Factor (µg/m³/s)	Calculated PC (µg/m³)
Acetone	0.24	148	34.94
Methanol	0.16	148	24.12
Styrene	Not Assessed for Long Term Impacts		
Tetrahydrofuran	0.01	148	1.86
Toluene	0.01	148	0.86
Ethanol	0.04	148	5.81
Diethylbenzene	0.0002	148	0.03
Ethylene diamine	0.00001	148	0.001
Heptane	0.0011	148	0.08
Iso-Amyl Alcohol	0.0005	148	0.16
Vinylbenzene chloride	Not Assessed for Long Term Impacts		
Divinylbenzene	Not Assessed for Long Term Impacts		

Table 3-3: Calculation of Short Term Process Contribution (PC)

Substance	Emission Rate (g/s)	Dispersion Factor (µg/m³/s)	Calculated PC (µg/m³)
Acetone	0.71	3900	2,784.80
Methanol	0.60	3900	2,322.86
Styrene	0.004	3900	16.76
Tetrahydrofuran	0.24	3900	932.03
Toluene	0.01	3900	35.86
Ethanol	0.08	3900	301.82
Diethylbenzene	0.0005	3900	2.11
Ethylene diamine	0.00002	3900	2.11
Heptane	0.0015	3900	5.93
Iso-Amyl Alcohol	0.0012	3900	4.67
Vinylbenzene chloride	0.001	3900	2.36
Divinylbenzene	0.01	3900	27.72

4.0 Assessment Results

The results of the assessment of impacts on EALs are presented in Table 4-1 and 4-2 below. The findings are as follows:

- the annual mean PC's do not exceed 1% of the EAL; and
- the short-term PC's do not exceed 10% of the EAL.

The impact is insignificant and further screening it not deemed required.

Table 4-1: Predicted Impacts on Long Term EAL

Substance	Calculated PC (µg/m³)	EAL (µg/m³)	PC as % of EAL	Insignificant (PC<1%)
Acetone	34.94	18,100	0.2%	YES
Methanol	24.12	2,660	1%	YES
Styrene	Not Assessed for Long Term Impacts			
Tetrahydrofuran	1.86	3,000	0.06%	YES
Toluene	0.86	1,910	0.05%	YES
Ethanol	5.81	19,200	0.03%	YES
Diethylbenzene	0.03	190	0.02%	YES
Ethylene diamine	0.001	327	0.0003%	YES
Heptane	0.08	4,960	0.003%	YES
Iso-Amyl Alcohol	0.16	174	0.05%	YES
Vinylbenzene chloride	Not Assessed for Long Term Impacts			
Divinylbenzene	Not Assessed for Long Term Impacts			

Table 4-2: Predicted Impacts on Short Term EAL

Substance	Calculated PC (µg/m³)	EAL (µg/m³)	PC as % of EAL	Insignificant (PC<1%)
Acetone	2,784.80	362,000	0.77%	YES
Methanol	2,322.86	33,300	6.98%	YES
Styrene	16.76	800	2.09%	YES
Tetrahydrofuran	932.03	59,900	1.56%	YES
Toluene	35.86	8,000	0.45%	YES
Ethanol	301.82	576,000	0.05%	YES
Diethylbenzene	2.11	190	1.11%	YES
Ethylene diamine	2.11	190	1.11%	YES
Heptane	5.93	4,960	0.12%	YES
Iso-Amyl Alcohol	4.67	174	2.69%	YES
Vinylbenzene chloride	2.36	30	7.86%	YES
Divinylbenzene	27.72	3,000	0.92%	YES

5.0 Conclusion

This AERA has quantified and assessed the potential air quality impacts associated with potential emissions from the process operations at Agilent Technologies LDA UK Limited's organic polymer manufacturing site located in Church Stretton, Shropshire.

The AERA has concluded that the emissions process contribution can be considered 'insignificant' against relevant long-term and short-term standards for the protection of human health.

Appendix A Derivation of Environmental Assessment Limits

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To derive a new EAL, the Environment Agency hazard characterisation method for determining tolerable concentrations in air (TCAs) within section 7 and annex 5 of 'Derivation of new environmental assessment levels to air' (2012), has been used. A review of toxicity from suitable databases has been undertaken and presented in Table A-1. Derived EALs from this review, along with applied uncertainty factors is presented in Table A-2.

A.1 Review of Toxicity from Suitable Databases

Substance	CAS	EC List No	Other Names	EH40/2005 Workplace exposure limits	European Chemicals Agency (ECHA)
Diethylbenzene	25340-17-4	246-874-9	1,2-diethylbenzene	• n/a	• Workforce - Long Term DNEL 21.2 mg/m³ NOAEC = 95.5 - 190mg/m³ • LC50 for inhalation toxicity (7-hr) in rats is >2100 ppm (11520 mg/m3 highest technically feasible dose with a water bath at 100 degrees C) • Repeat Exposure Toxicity -Inhalation (RAT) NOAEL = 190 mg/m³
Ethylene diamine	107-15-3	203-468-6	1,2,-Diaminoethane, Ethane-1,2-diamine	• n/a	• Public - Long Term DNEL 6.25 mg/m³ • Workforce - Long Term DNEL 25 mg/m³ • Acute Toxicity - Inhalation 4h LC50 14.7 mg/l • Repeat Exposure Toxicity - Inhalation (Rat) NOAEC = 132 ppm (327 mg/m³)
Heptane	142-82-5	205-563-8	Dipropylmethane, n-heptane	• 8-hr TWA = 2085 mg/m3	• Public - Long Term DNEL 447 mg/m³ • Workforce - Long Term DNEL 2,085 mg/m³ • Acute Toxicity - Inhalation - Not Classified • Repeat Exposure Toxicity -Inhalation - Not Classified • 4h LC50 (Rat) >29,290 mg/m³ up to 73,500 mg/m³ • 2085 mg/m3 LTEL
Iso-Amyl Alcohol	123-51-3	204-633-5	3-Methyl-1-butanol	• 8hr TWA = 366 mg/m³	• EU Occupational LTEL = 18.0 mg/m³ • EU Occupational STEL = 37.0 mg/m³

Substance	CAS	EC List No	Other Names	EH40/2005 Workplace exposure limits	European Chemicals Agency (ECHA)
				• WEL= 458 mg/m³ 15 minute STEL	• Workforce - Long Term Exposure - Inhalation - DNEL 73.16mg/m³ • Workforce - Acute / Short term - Inhalation - DNEL 292 mg/m³ • Public - Long Term Exposure - Inhalation - DNEL 13 mg/m³ • Public - Acute / Short term - Inhalation - DNEL 218 mg/m³ • Repeat Exposure Toxicity - NOAEL = 2.16 mg/l
Vinylbenzene chloride	30030-25-2	250-005-9	(chloromethyl)styrene, (chloromethyl)vinylbenzene	• n/a	• Very limited data from a small number of historical laboratory tests. • Not considered adequately robust to derive an EAL. • As a result this material has been assessed using the EAL's for Benzene to provide a conservative assessment
Divinylbenzene	1321-74-0	215-325-5	1,2-diethenylbenzene, 1,2-divinylbenzene	• n/a	• Public - Long Term DNEL 21.4 mg/m³ NOAEC = 535.7 - 3000 mg/m³ • Workforce - Long Term DNEL 120.6 mg/m³ NOAEC = 1510 - 3000 mg/m³ • LC50 for inhalation toxicity (7-hr) in rats is >351,000 mg/m³ • Repeat Exposure Toxicity -Inhalation (RAT) NOAEL = 3000 mg/m³
Table Notes: n/a – substance is not listed within database.					

A.2 Derived Environmental Assessment Levels

Substance	Basis of EAL Derivation (see Table A-1)	Uncertainty Factors Applied	Total Uncertainty Factor	Derived TCA / EAL (µg/m³) Assuming Maximum Uncertainty Factor
Diethylbenzene	NOAEL = 190 mg/m³	10 for inter-species variation 10 for inter-individual variation 1 length of study (NOAEL derived from chronic repeat exposure data) 1 use of NOAEL not LOAEL 1 - 10 as appropriate - factor for severity of effect etc. 100% Relative source contribution - no other local sources	100 - 1000	190
Ethylene diamine	NOAEL = 327 mg/m³	10 for inter-species variation 10 for inter-individual variation 1 length of study (NOAEL derived from chronic repeat exposure data) 1 use of NOAEL not LOAEL 1 - 10 as appropriate - factor for severity of effect etc. 100% Relative source contribution - no other local sources	100 - 1000	327
Heptane	OEL (8hr) = 2085 mg/m³	4.2 for continuous exposure 10 for inter-individual variation 1 as OEL aligns with DNEL which already has an assessment factor applied in its derivation. 1 - 10 as appropriate - factor for severity of effect etc. 100% Relative source contribution - no other local sources	42- 420	4960
Iso-Amyl Alcohol /3-Methyl-1-butanol	OEL (8hr) = 366 mg/m³	4.2 for continuous exposure 10 for inter-individual variation 5 as OEL aligns with LOAEL 1 - 10 as appropriate - factor for severity of effect etc. 100% Relative source contribution - no other local sources	210 - 2100	174

Substance	Basis of EAL Derivation (see Table A-1)	Uncertainty Factors Applied	Total Uncertainty Factor	Derived TCA / EAL (µg/m³) Assuming Maximum Uncertainty Factor
Vinylbenzene chloride	Use of benzene EAL's as an exemplar substance			30 (Short term EAL for Benzene)
Divinylbenzene	NOAEL = 3000 mg/m³	10 for inter-species variation 10 for inter-individual variation 1 length of study (NOAEL derived from chronic repeat exposure data) 1 use of NOAEL not LOAEL 1 - 10 as appropriate - factor for severity of effect etc. 100% Relative source contribution - no other local sources	100 - 1000	3000

Appendix B Consolidation of Monitored Emissions Data

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B.1 Interpretation of Monitored Emissions Data

Plant Area	Chemical in Use	Calculated Average Emission Concentration (over the sampling period) (mgC/m³)	Calculated Maximum Hourly Average Emission Concentration (during the sampling period) (mgC/m³)	Average Mass Emission Rate (gC/h)	Maximum Mass Emission rate (gC/h)
Unit 3 -Impingement Scrubber Exhaust	Acetone	13.87	331.24	25.02	597.72
	Methanol	12.24	250.61	22.08	452.23
	Tetrahydrofuran*	16.71	317.61	30.15	573.13
	Diethylbenzene	0.32	0.90	0.58	1.63
	Iso-Amyl Alcohol	0.32	0.90	0.64	1.81
	Total VOC	35.99 over 2 runs Or highest of 2 runs 41.89	331.24	785	1627
Unit 3 - (Stack 1)	Acetone	8.60	16.96	110.53	217.91
	Ethanol	5.73	11.30	73.69	145.28
	Total VOC	14.33	28.26	184.22	363.19
Unit 3 (Stack 2)	Acetone	13.74	26.92	115.97	227.13
	Methanol	13.74	29.92	115.97	227.13
	Total VOC	27.49	53.84	231.93	454.25
Unit 3 - (Stack 3)	Acetone	20.75	51.55	126.61	314.55
	Total VOC	20.75	51.55	126.61	314.55

Plant Area	Chemical in Use	Calculated Average Emission Concentration (over the sampling period) (mgC/m³)	Calculated Maximum Hourly Average Emission Concentration (during the sampling period) (mgC/m³)	Average Mass Emission Rate (gC/h)	Maximum Mass Emission rate (gC/h)
Unit 3 - (Stack 4)	Acetone 80%	8.90	14.66	54.83	90.34
	Methanol 19%	2.11	3.48	13.02	21.46
	Diethylbenzene trace	0.01	0.02	0.07	0.11
	Iso-amyl alcohol 1%	0.11	0.18	0.68	1.13
	Styrene*	2.13	2.13	13.11	13.11
	Vinylbenzene chloride	0.25	0.25	1.54	1.54
	Divinylbenzene*	0.13	0.13	0.77	0.77
	Total VOC	11.12	18.33	15.42	112.93
Unit 3 - (Stack 5)	Acetone 50%	5.77	6.43	34.81	38.82
	Methanol 45%	5.19	5.79	31.33	34.93
	Toluene** <5%	0.58	0.64	3.48	3.88
	THF* – Trace	0.01	0.01	0.07	0.08
	Total VOC	11.53	12.86	69.63	77.63
Unit 3 - Analytical Lab LEV	Acetone 50%	1.20	1.38	1.61	1.85
	Methanol 50%	1.20	1.38	1.61	1.85
	Total VOC	2.40	2.76	3.21	3.70

Plant Area	Chemical in Use	Calculated Average Emission Concentration (over the sampling period) (mgC/m³)	Calculated Maximum Hourly Average Emission Concentration (during the sampling period) (mgC/m³)	Average Mass Emission Rate (gC/h)	Maximum Mass Emission rate (gC/h)
Unit 2 - Old R&D Lab	Acetone	1.66	3.70	8.33	18.6
	Toluene**	0.41	0.92	2.08	4.65
	Divinylbenzene*	0.10	0.23	0.52	1.16
	Styrene*	0.10	0.23	0.52	1.16
	Ethylene diamine – trace	0.002	0.005	0.01	0.02
	Total VOC	2.07	4.62	10.41	23.25
Unit 2- New R&D Lab	Acetone	1.16	1.85	13.60	21.68
	Toluene	1.16	1.85	13.60	21.68
	Divinylbenzene*	1.16	1.85	13.60	21.68
	Total VOC	2.32	3.69	27.21	43.35
Unit 1- Lab Extract (LHS) Column Production Lab LEV	Acetone 50%	4.48	8.47	32.59	61.62
	Methanol 50%	4.48	8.47	32.59	61.62
	Total VOC	8.96	16.93	65.18	123.23
Unit 1 – Lab Extract (RHS)	Acetone	0.61	0.84	3.34	4.59
	Methanol	0.61	0.84	3.34	4.59
	Heptane	0.61	0.84	3.34	4.59
	Ethylbenzene all 25% approx.	0.61	0.84	3.34	4.59
	Total VOC	2.44	3.36	13.345	18.36

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