

Resene Paints Limited, Upper Hutt



AIR DISCHARGE MONITORING OF THE FACTORY EXTRACTION SYSTEM,
JANUARY 2018

Issue

February 2018

Resene Paints Limited, Upper Hutt

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Approved by

Name	Title	Signature
Matthew Newby, CAQP	Senior Air Quality Scientist	

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Tests indicated as not accredited are outside the scope of the laboratory's accreditation

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Executive Summary

Source Testing New Zealand Limited (STNZ) was commissioned by Resene Paints Limited (Resene) to undertake air discharge monitoring of their Upper Hutt factory extraction manufacturing facility. The objective of the monitoring is to confirm compliances with the Company's Resource Consent (WGN160337[34175]).

The particulate discharge concentrations from the Resene Upper Hutt factory extraction system measured on 23 January 2018 ranged from 0.2 to 1.3 mg/m³ adjusted to 0 °C, one atmosphere pressure and dry gas basis (mg/Sm³) with an average of 0.6 mg/Sm³. The particulate matter mass emission ranged from 0.002 to 0.015 kg/hr with an average of 0.007 kg/hr.

All three test results were below the particulate discharge limit of 10 mg/Sm³ stipulated in Condition 8 of the Company's Air Discharge Permit.

The Total VOCs (expressed as Toluene) discharge concentrations from the Resene Upper Hutt factory extraction system measured on 23 January 2018 ranged from 43.3 to 286 mg/m³ adjusted to 0 °C, one atmosphere pressure and dry gas basis (mg/Sm³) with an average of 186 mg/Sm³. The Total VOCs (expressed as Toluene) mass emission ranged from 0.492 to 3.46 kg/hr with an average of 2.32 kg/hr.

The average Total VOCs (expressed as toluene) concentration measured at the Resene Upper Hutt factory extraction system on 23 January 2018 was 186 mg/Sm³, which exceeds the discharge limit of 150 mg/Sm³ stipulated in Condition 8 of the Company's Air Discharge Permit.

1. Introduction

Source Testing New Zealand Limited (STNZ) was commissioned by Resene Paints Limited (Resene) to undertake air discharge monitoring of their Upper Hutt factory extraction manufacturing facility. The objective of the monitoring is to confirm compliances with the Company's Resource Consent (WGN160337[34175]). The following conditions of the consent relate to the air discharge monitoring:

Discharge Limits

8. Notwithstanding conditions 1 and 3, discharges to air relating to the exercise of this consent shall not exceed the following concentrations from the paint production plant extraction system as measured at the monitoring position on the stack:

- *Total particulate: 10 mg/m³ (at STP, dry gas basis)*
- *Total VOCs (expressed as Toluene): 150 mg/m³ (at STP, dry gas basis)*

The concentration shall be determined according to the requirements defined in Condition 9 of this consent.

Air emission testing

9. The consent holder shall conduct an emission testing programme annually for the first 5 (five) years of this consent within one month of the anniversary of the granting of the consent, and thereafter at intervals to be determined by consultation with, and to the satisfaction of, the Manager, Environmental Regulation, Wellington Regional Council; following the assessment of the year 5 (2021) Air Emission Testing Report detailed in condition 11.

The emission testing programme shall be to the satisfaction of, the Manager, Environmental Regulation, Wellington Regional Council; and shall quantify the discharges of particulates and VOCs from the plant. The consent holder shall ensure that the following contaminants will be sampled in the stack for:

- *Total particulate and VOC concentrations from the stack (to be reported as mg/m³ for each sample and as a mean of all samples for each stack)*
- *Stack gas volumetric flow rate from each stack (to be reported at actual and standard condition for each sample and as a mean of all samples for each stack)*
- *Stack gas velocity from each stack (to be reported at actual condition for each sample and as a mean of all samples for each stack)*
- *The mass emission rate shall be determined as the mean of a minimum of three samples, each collected as per United States Environmental Protection Agency (USEPA) Test Methods 5 and 18.*

10. All sampling techniques employed in respect of the conditions of this consent shall be to the satisfaction of, the Manager, Environmental Regulation, Wellington Regional Council. All analysis shall be performed by an International Accreditation New Zealand (IANZ) registered laboratory or otherwise specifically approved by the Manager, Environmental Regulation, Wellington Regional Council.

Matthew Newby, Senior Air Quality Scientist with STNZ performed the testing on 23 January 2018. Matthew has over 20 year's air quality monitoring and consulting experience and is designated as a Key Technical Person under STNZ's IANZ accreditation. Matthew is also a Certified Air Quality Professional (CAQP) under the Clean Air Society of Australia and New Zealand (CASANZ) certification process. This report presents the air discharge monitoring results and compares them to the Company's Air Discharge Permit.

2. Sampling Methodologies

Table 1 summarises the testing methodologies used by STNZ for VOC discharge monitoring. Three separate samples were collected in accordance with USEPA protocols.

The air discharge monitoring was performed in accordance with the USEPA Methods set out in Table 1. Three separate samples were collected in accordance with USEPA protocols. Particulate matter analysis was conducted by STNZ staff in Wellington in accordance with the below methods while the VOC analysis was conducted by R J Hill Laboratories, Hamilton.

■ Table 1: Sampling Methods

Contaminant	STNZ Standard Test Methods	IANZ Accredited
Sampling Points	Method 1 "Sample and Velocity Traverse for Stationary Sources"	Yes
Velocity & Volumetric Flow Rate	Method 2 "Determination of Stack Gas Velocity and Volumetric Flow rate (Type "S" Pitot Tube)"	Yes
Dry Molecular Weight Determination	Method 3 "Gas Analysis For The Determination Of Dry Molecular Weight"	Yes
Moisture Content Determination	Method 4 "Determination of Moisture Content in Stack Gases"	Yes
Total Particulate Matter Determination	Method 5 "Determination of Particulate Emissions From Stationary Sources"	Yes
Determination of Volatile Organic Compounds	Method 18 "Measurement of Gaseous Organic Compound Emissions by Gas Chromatography"	Yes

2.1.1 Stack Sampling Locations

Table 2 describes the sampling point characteristics of the Upper Hutt Factory extraction system outlet. The sampling port was located approximately 3 m downstream from a silencer and approximately 2 m upstream of the outlet of the stack. The sampling location met the requirements of USEPA Method 1 provided a total of 12 points were sampled. The observed flow distribution was even, allowing for the collection of representative samples.

■ Table 2 Sampling Locations

Source	Port	Dimensions	Up Stream from Disturbances (Equ Stack Dia)		Down Stream from Disturbances (Equ Stack Dia)		No. of Sampling Lines	No. of Sampling Points	
Extraction system outlet	2 x 100 mm BSP	Circular 0.45 m	4.4	2.0	7.8	8	2	6	12

Note: Values highlighted in grey represent the method ideal requirement.

SOURCE TESTING NZ

2.1.2 Stack Gas Velocity

Stack temperatures were measured using a K Type thermocouple connected to a digital thermometer. Stack gas velocities were measured at specific points across the duct using an S Type Pitot tube connected to a digital manometer in accordance with USEPA Methods 1 & 2. These measurements were conducted prior to the collection of each of the three samples. The gas velocities were used to determine volumetric flow rates and mass discharge rates for each sample.

2.1.3 Gaseous Products of Combustion

As the stack gas was primarily ambient air, USEPA Method 3 was used to determine the molecular weight based on an oxygen and carbon dioxide concentration of 20.8 % and 0.0 % respectively.

2.1.4 Particulate Matter

Particulate matter was withdrawn isokinetically from the source and collected on a glass fibre filter maintained at a temperature of $120\text{ }^{\circ}\text{C} \pm 14\text{ }^{\circ}\text{C}$. The particulate mass was determined gravimetrically, after the removal of un-combined water. This approach conforms to USEPA Method 5 “Determination of Particulate Matter from Stationary Sources”. Particulate analysis was performed by STNZ staff in Wellington.

2.1.5 Volatile Organic Compounds

Air discharge monitoring for Total VOCs (expressed as Toluene) was conducted in accordance with Method 18 – “Measurement of Gaseous Organic Compounds Emissions by Gas Chromatography” with analysis performed in accordance with NIOSH Method 1500 “Hydrocarbons”.

Stack gases were withdrawn from the source using a stainless-steel sampling manifold. The sample stream was passed through dual charcoal sorbent tubes in parallel at a rate of approximately 1.5 L/min. As per the method requirements, one of the tubes had been spiked with 3,500 μg to help identify any matrix interferences. The samples were then forwarded to R. J. Hill Laboratories, Hamilton where carbon disulphide was used to desorb VOC. The extract was subsequently analysed by Gas Chromatography – Flame Ionisation Detector/ Flame Ionisation Detector (GC-FID/FID).

While STNZ is IANZ accredited for the sampling portion of Method 18, R. J. Hill Laboratories are not IANZ accredited for Total VOCs (expressed as toluene) analysis. However, R. J. Hill Laboratories are a well-respected IANZ accredited laboratory and STNZ has worked with the air quality department for over 20 years.

3. Plant Operating Conditions

On 23 January 2018, the plant was operating normally producing a range of solvent born paints and coatings. During sampling the following products were being manufactured:

- Galvo One;
- Rapc GP Thinners;
- Herman Pacific Wood X; and
- Rapc Wax and Grease Remover.

4. Air Discharge Monitoring Results

4.1 Particulate Air Discharge Monitoring Results

Presented below are the results of the particulate air discharge monitoring of the Resene Upper Hutt factory extraction system conducted on 23 January 2018. Table 4 presents the results of the particulate emission testing with Table 5 outlining a summary of the relevant stack data. Appendix A presents the raw sampling data. Appendix B contains the moisture content and mass determination calculations.

■ Table 3: Particulate Matter Discharge Results, January 2018

Sampling Run	Sampling Date	Sampling Period	Volume Sampled (m ³)	Stack Flow Rate (m ³ /h) ¹	Mass (mg)	Conc, (mg/m ³) ¹	Emission Rate (kg/h)
PM Run 1	23-01-18	8:40 - 9:44	1.268	12,096	1.6	1.3	0.015
PM Run 2	23-01-18	10:13 - 11:17	1.233	11,471	0.3	0.2	0.003
PM Run 3	23-01-18	11:45 - 12:48	1.270	11,746	0.2	0.2	0.002

1. Corrected to 0 °C, 101.3 kPa, dry gas basis.

■ Table 4: Summary of Stack Conditions, January 2018

Source	Average Temp. (°C)	Average Moisture Content (% v/v)	Average Velocity (m/s)	Average Volumetric Flow Rate (m ³ /hr)
Factory Extraction System	27.9	1.8	25.3	13,245

1. Actual conditions

The particulate discharge concentrations from the Resene Upper Hutt factory extraction system measured on 23 January 2018 ranged from 0.2 to 1.3 mg/m³ adjusted to 0 °C, one atmosphere pressure and dry gas basis (mg/Sm³) with an average of 0.6 mg/Sm³. The particulate matter mass emission ranged from 0.002 to 0.015 kg/hr with an average of 0.007 kg/hr.

All three test results were below the particulate discharge limit of 10 mg/Sm³ stipulated in Condition 8 of the Company's Air Discharge Permit.

4.1.1 Particulate Quality Control Data

Tables 6 and 7 present the relevant quality control parameters for the particulate emission testing. In addition, all equipment was calibrated and maintained as per the STNZ Air Quality Equipment Manual (available on request).

■ **Table 5: Sampling Quality Control Data**

Sampling Run	Pre-Test Leak Check Vacuum (kPa)	Pre-Test Leak Rate (cc/min)	Post-Test Leak Check Vacuum (kPa)	Post-Test Leak Rate (cc/min)	Isokinetic Deviation (%)
Method Specs	> -70	< 570	> -70	< 570	± 10
PM Run 1	69	160	69	280	-2.7
PM Run 2	69	270	69	0	-0.09
PM Run 3	69	280	69	150	0.4

■ **Table 6: Mass Determination Quality Control Data**

	Field Blank Mass (g)	Acetone Blank (g)
Pre	0.0588	104.1450
Post	0.0588	104.1450
Diff	0.0000	0.0000

All quality control parameters were within the methods specification.

4.2 VOC Air Discharge Monitoring Results

Presented below are the results of the Total VOCs (expressed as Toluene) air discharge monitoring of the Resene Paints Ltd, Upper Hutt factory extraction system measured on 23 January 2018. Table 7 presents the VOC (expressed as Toluene) air discharge monitoring results with the raw sampling data presented in Appendix C, with Appendix D containing the raw analytical report.

■ **Table 7: Total VOCs (expressed as Toluene) Discharge Results, January 2018**

Sampling Run	Sampling Date	Sampling Period	Stack Flow Rate (m ³ /h) ¹	Conc (ppmv)	Conc, (mg/m ³) ¹	Emission Rate (kg/h)
VOC Run 1	23-01-18	8:40 - 9:44	13,124	55.7	229	3.00
VOC Run 2	23-01-18	10:13 - 11:17	12,091	69.6	286	3.46
VOC Run 3	23-01-18	11:45 - 12:48	11,358	10.5	43.3	0.492

1. Corrected to 0 °C, 101.3 kPa, dry gas basis.

The Total VOCs (expressed as Toluene) discharge concentrations from the Resene Upper Hutt factory extraction system measured on 23 January 2018 ranged from 43.3 to 286 mg/m³ adjusted to 0 °C, one atmosphere pressure and dry gas basis (mg/Sm³) with an average of 186 mg/Sm³. The Total VOCs (expressed as Toluene) mass emission ranged from 0.492 to 3.46 kg/hr with an average of 2.32 kg/hr.

The average Total VOCs (expressed as toluene) concentration measured at the Resene Upper Hutt factory extraction system on 23 January 2018 was 186 mg/Sm³, which exceeds the discharge limit of 150 mg/Sm³ stipulated in Condition 8 of the Company's Air Discharge Permit.

4.2.1 Total VOCs Sampling Quality Control

To ensure the quality of the obtained test result a field blank and field spike were performed. The results of the field blank show minor background contaminations but the level was considered insignificant when compared to the sample results. The results of the field and laboratory spikes showed excellent desorption (recovery) efficiencies of 103 % and 104 % respectively. Furthermore, while VOCs were detected in the back half of the sorbent tubes, the masses were all less than 1 % of the front half indicating no significant breakthrough had occurred.

USEPA Method 18 requires the recovery efficiency (R) for the spiked compounds to be within the range 0.7 to 1.3. Table 8 presents the average R value along with the concentrations corrected for recovery efficiencies.

■ **Table 8: Total VOCs (expressed as Toluene) Discharge Results correct for spike recoveries, January 2018**

VOC	Average R Value	Run 1 (ppm)	Run 2 (ppm)	Run 3 (ppm)
Toluene	0.70	55.7	69.6	10.5

Appendix A Raw Particulate Sampling Data

This appendix contains 5 page including cover

Resene Paints Limited
 Air Discharge Monitoring of the Factory Extraction System
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The data presented in the Tecora G4 data sheets are based on assumed moisture contents. The tabulated data presented is based on actual measured moisture content. As a result, the corrected volumetric flow rates may differ between the two data sheets.

Sample Description:	Run 1	Run 2	Run 3	Averages
Sampling Date:	23-01-18	23-01-18	23-01-18	
Filter ID:	ST1007	ST1008	ST1009	
Sampling Period:	8:40 - 9:44	10:13 - 11:17	11:45 - 12:48	
Total Sample Time (minutes)	60	60	60	
Nozzle Diameter (mm)	4.46	4.46	4.46	
Nozzle Area (m ²)	0.0000156	0.0000156	0.0000156	
DGM Calibration Factor	0.9818	0.9818	0.9818	
Initial DGM Reading	1552.8950	1555.6040	1557.7650	
Final DGM Reading	1555.5288	1557.7435	1559.9862	
DGM Sample Volume (m ³):	2.6338	2.1395	2.2212	
DGM Std. Sample Volume (m ³):	1.2679	1.2333	1.2696	
Initial Leak Test Vacuum (kPa):	69	69	69	
Initial Leak Test Flow Rate (cc/min):	160	270	280	
Final Leak Test Vacuum (kPa):	69	69	69	
Final Leak Test Flow Rate (cc/min):	280	0	150	
Moisture Collected (g):	18.5	18.7	19.5	
Moisture Content (%):	1.8	1.9	1.9	1.8
TCR DGM Sample Volume (m ³):	2.6175	2.1311	2.2057	
Sampling Plane Mean Velocity (m/s):	26.0	24.7	25.3	25.3
TCR Isokinetic Deviation (%):	-2.8	-1.0	-1.2	
Actual Isokinetic Deviation (%):	-2.7	-0.1	0.4	
Duct Volumetric Flow Rates				
Moist (m ³ /h):	13,590	12,908	13,237	13,245
Moist Standards (m ³ /h):	12,316	11,688	11,970	
Dry Standard (m ³ /h):	12,096	11,471	11,746	
Mean Temperatures				
At Sampling Plane (°C):	27.5	28.0	28.3	27.9
At DGM (°C):	25.2	29.3	28.7	
Ambient Pressure (kPa):	101.072	101.163	101.119	
Stack Absolute Pressure (kPa)	101.096	101.148	101.101	
Dry Gas Meter Pressure (kPa)	54.268	65.870	65.179	

Resene Paints Limited
 Air Discharge Monitoring of the Factory Extraction System
 January 2018

Resene Run 1
Isokinetic sampling 23/01/2018 08:39:37

MACHINE INFORMATION

Master Firmware v1.9.2000
 Master Serial Number 11420234P
 Slave Firmware v0.7.7000
 Slave Serial Number 11420234P
 Last calibration date Refer to the STNZ Equipment Register

CV GAMMA [H] CALIBRATION

Point	Flowrate	Gamma
1	0	1

POINT LIST

start ts [timestamp]	Port [##]	Point [##]	Distance [cm]	Elapsed Time [hh:mm:ss]	rw avg [0:1]	t _{sums} avg [°C]	t _{dgm} avg [°C]	P _{stat} avg [kPa]	P _c avg [kPa]	dP pitot avg [Pa]	P _{no} avg [kPa]	P _{amb} avg [kPa]	V _a avg [m ³ /sec]	QV _a avg [m ³ /min]	DI [%]	V _N avg [m/s]	pn avg [m ³ /m ³]	Q'Va [m ³ /s]	Q'Vn [m ³ /s]	QVn [m ³ /s]	V _{ps} [R]	V _{gs} [R]	V _{dgm} [R]
23-01-18 8:40:04	1	1	1.9	0:05:00	0.011	26.487	22.037	-0.007	101.065	619.667	52.431	101.072	27.19	22.063	-3.7	26.169	1.286	14214	12927	12785	109.65	121.46	228.1
23-01-18 8:45:08	1	2	6.3	0:05:00	0.011	26.589	22.387	-0.01	101.062	615.602	52.912	101.072	27.107	22.133	-3.1	26.262	1.286	14171	12883	12741	111.57	123.6	230.2
23-01-18 8:50:13	1	3	12.8	0:05:00	0.011	26.813	22.956	0	101.072	638.622	50.499	101.072	27.622	22.486	-3.3	26.697	1.286	14440	13119	12975	114.32	126.87	247.9
23-01-18 8:55:16	1	4	30.3	0:05:00	0.011	27.064	23.608	0.027	101.099	495.03	59.943	101.072	24.179	20.398	0.2	24.232	1.286	12640	11477	11351	102.69	114.14	188.2
23-01-18 9:00:18	1	5	36.8	0:05:00	0.011	27.305	24.135	0.031	101.103	449.004	66.599	101.072	23.147	19.095	-1.9	22.701	1.286	12101	10979	10858	96.71	107.57	159.8
23-01-18 9:05:21	1	6	41.2	0:05:00	0.011	27.482	24.539	0.032	101.104	444.963	66.484	101.072	23.052	19.107	-1.4	22.728	1.286	12051	10928	10807	96.44	107.37	159.9
23-01-18 9:13:35	2	1	1.9	0:05:00	0.011	27.701	25.062	0.001	101.073	700.141	46.355	101.072	28.96	22.983	-5.4	27.368	1.286	15140	13714	13563	116.15	129.22	276.2
23-01-18 9:18:37	2	2	6.3	0:05:00	0.011	27.863	25.932	0.015	101.087	709.1	45.27	101.072	29.156	23.22	-5.1	27.661	1.286	15242	13801	13650	117.82	130.93	287.3
23-01-18 9:23:40	2	3	12.8	0:05:00	0.011	27.99	27.009	0.031	101.103	675.548	47.493	101.072	28.456	22.866	-4.2	27.246	1.286	14876	13466	13318	116.03	129.02	270.75
23-01-18 9:28:49	2	4	30.3	0:05:00	0.011	28.133	27.944	0.04	101.112	580.301	52.092	101.072	26.253	21.901	-0.5	26.107	1.286	13724	12419	12282	110.65	123.43	236.8
23-01-18 9:33:57	2	5	36.8	0:05:00	0.011	28.331	28.661	0.063	101.135	456.385	65.569	101.072	23.386	19.246	-1.8	22.952	1.286	12226	11058	10936	97.71	109.09	166.6
23-01-18 9:39:00	2	6	41.2	0:05:00	0.011	28.419	29.077	0.065	101.137	458.8	65.814	101.072	23.452	19.159	-2.5	22.855	1.286	12260	11086	10964	97.5	108.82	165.75

NORMALIZATION FACTOR

T _{norm}	[K]	273
P _{norm}	[kPa]	101.3

PITOT DATA SPECIFICATION

Name	ST018	
Velocity	[m/s]	2.01 0.834
Velocity	[m/s]	7.06 0.832
Velocity	[m/s]	10.98 0.84
Velocity	[m/s]	19.9 0.84
Velocity	[m/s]	17.01 0.838

DUCT AND GAS SPECIFICATION

Name	RESENE	
Section	Circular	
Diameter	[m]	0.43
Area	[m ²]	0.145
Port	[#]	2
Points	[#]	6
Dry gas density	[kg/m ³]	1.286 [1.286; 1.286]
Carbon dioxide	[%]	0 [0.000; 0.000]
Oxygen	[%]	21 [21.000; 21.000]
Water vapor ratio	[0:1]	0.011 [0.011; 0.011]
Nozzle	[mm]	4.46
Turbulence factor	[sec]	3

DUCT FLOW RATE

Dry actual	QV _a	[m ³ /s]	13440 [9839; 16413]
Moist actual	QV _a	[m ³ /s]	13590 [12051; 15242]
Moist standard [T _{norm} P _{norm}]	QV _a	[m ³ /s]	12321 [10928; 13801]
Dry standard [T _{norm} P _{norm}]	QV _a	[m ³ /s]	12185 [10807; 13650]

AVERAGE VALUES

Total Points	[#]	12
Velocity	V _a [m/s]	25.996 [19.030; 31.746]
Stack temperature	t _{sums} [°C]	27.514 [26.306; 28.562]
Stack Absolute Pressure	P _c [kPa]	101.096 [100.955; 101.228]
Stack Static Pressure	P _{stat} [kPa]	0.024 [-0.117; 0.156]
Isokinetic Deviation	DI [%]	-2.8
Velocity at nozzle	V _N [m/s]	25.248 [0.000; 28.924]
Stack Differential Pitot Pressure	dP _{pitot} [Pa]	565.889 [302.347; 839.822]
Ambient Pressure	P _{amb} [kPa]	101.072 [101.072; 101.072]

SAMPLED VOLUMES

Elapsed time	et [hh:mm:ss]	1:00:00
Total encoder impulses	[#]	52350
Standard Volume [T _{norm} P _{norm}]	V _{gs} [m ³]	1.2872
Moist Volume at stack conditions	V _{gs} [m ³]	1.4317
Volume at dgm conditions	V _{dgm} [m ³]	2.6175
Gas meter temperature	t _{dgm} [°C]	25.211 [21.793; 29.253]
Gas Meter Pressure	P _{dgm} [kPa]	54.268 [40.975; 99.025]

SOURCE TESTING NZ

Resene Paints Limited
 Air Discharge Monitoring of the Factory Extraction System
 January 2018

Resene Run 2
Isokinetic sampling 23/01/2018 10:12:31

MACHINE INFORMATION

Master Firmware v1.9.2000
 Master Serial Number 11420234P
 Slave Firmware v0.7.7000
 Slave Serial Number 11420234P
 Last calibration date Refer to the STNZ Equipment Register

CV GAMMA [H] CALIBRATION

Point	Flowrate	Gamma
1	0	1

POINT LIST

start ts [timestamp]	Port [##]	Point [##]	Distance [cm]	Elapsed Time [hh:mm:ss]	rw avg [0:1]	t _{sums} avg [°C]	t _{dgm} avg [°C]	P _{stat} avg [kPa]	P _c avg [kPa]	dP pitot avg [Pa]	P _{no} avg [kPa]	P _{amb} avg [kPa]	V _a avg [m ³ /sec]	QV _a avg [m ³ /min]	DI [%]	V _N avg [m/sec]	pn avg [m ³ /m ³]	Q'Va [m ³ /s]	Q'Vn [m ³ /s]	QVn [m ³ /s]	V _{ps} [R]	V _{js} [R]	V _{dgm} [R]
23-01-18 10:13:06	1	1	1.9	0:05:01	0.011	27.504	29.096	-0.021	101.142	683.388	57.015	101.163	28.594	23.511	-2.2	27.959	1.286	14948	13559	13410	119.37	132.84	234.3
23-01-18 10:18:12	1	2	6.3	0:05:00	0.011	28.139	29.066	-0.025	101.138	674.016	57.909	101.163	28.429	23.454	-1.6	27.951	1.286	14862	13452	13304	119.01	132.63	229.8
23-01-18 10:23:21	1	3	12.8	0:05:00	0.011	28.472	29.425	-0.018	101.145	669.152	58.316	101.163	28.339	23.37	-1.6	27.88	1.286	14815	13395	13248	118.64	132.41	227.85
23-01-18 10:28:26	1	4	30.3	0:05:00	0.011	29.02	29.83	0.017	101.118	452.105	71.826	101.163	23.286	19.598	0.5	23.414	1.286	12173	10990	10870	98.99	110.74	154.7
23-01-18 10:33:31	1	5	36.8	0:05:00	0.011	28.996	30.009	0.02	101.183	449.99	72.91	101.163	23.244	19.311	-0.7	23.069	1.286	12151	10972	10851	98.48	110.19	151.75
23-01-18 10:38:35	1	6	41.2	0:05:00	0.011	28.63	30.034	0.027	101.19	458.905	72.123	101.163	23.456	19.563	-0.4	23.34	1.286	12262	11086	10964	99.88	111.65	155.65
23-01-18 10:47:11	2	1	1.9	0:05:00	0.011	28.034	29.608	-0.047	101.116	642.431	59.601	101.163	27.755	22.735	-2.3	27.09	1.286	14510	13134	12990	116.33	129.61	218.6
23-01-18 10:52:14	2	2	6.3	0:05:00	0.011	27.826	29.304	-0.057	101.106	642.447	59.858	101.163	27.745	22.879	-1.7	27.246	1.286	14504	13137	12993	116.24	129.47	217.35
23-01-18 10:57:17	2	3	12.8	0:05:00	0.011	27.53	29.062	-0.021	101.142	420.249	71.658	101.163	22.273	19.045	1.6	22.651	1.286	11644	10560	10444	96.97	107.98	151.5
23-01-18 11:02:23	2	4	30.3	0:05:00	0.011	27.351	28.771	-0.018	101.145	370.609	77.383	101.163	21.026	17.504	-1	20.804	1.286	10992	9975	9866	89.94	100.17	130.1
23-01-18 11:07:31	2	5	36.8	0:05:00	0.011	27.489	28.509	-0.017	101.146	372.133	77.394	101.163	21.073	17.539	-1	20.855	1.286	11016	9993	9883	89.51	99.7	129.3
23-01-18 11:12:37	2	6	41.2	0:05:00	0.011	27.439	28.242	-0.018	101.145	372.28	77.205	101.163	21.079	17.695	-0.1	21.038	1.286	11019	9998	9888	89.98	100.22	130.2

NORMALIZATION FACTOR

T _{norm}	[K]	273
P _{norm}	[kPa]	101.3

PITOT DATA SPECIFICATION

Name	ST018	
Velocity	[m/sec]	2.01 0.834
Velocity	[m/sec]	7.06 0.832
Velocity	[m/sec]	10.98 0.84
Velocity	[m/sec]	19.9 0.84
Velocity	[m/sec]	17.01 0.838

DUCT AND GAS SPECIFICATION

Name	RESENE	
Section	Circular	
Diameter	[m]	0.43
Area	[m ²]	0.145
Port	[#]	2
Points	[#]	6
Dry gas density	[kg/m ³]	1.286 [1.286; 1.286]
Carbon dioxide	[%]	0 [0.000; 0.000]
Oxygen	[%]	21 [21.000; 21.000]
Water vapor ratio	[0:1]	0.011 [0.011; 0.011]
Nozzle	[mm]	4.46
Turbulence factor	[sec]	3

DUCT FLOW RATE

Dry actual	QV _a	[m ³ /s]	12765 [8793; 15718]
Moist actual	QV _a	[m ³ /s]	12908 [10992; 14948]
Moist standard [T _{norm} P _{norm}]	QV _a	[m ³ /s]	11687 [9975; 13559]
Dry standard [T _{norm} P _{norm}]	QV _a	[m ³ /s]	11559 [9866; 13410]

AVERAGE VALUES

Total Points	[#]	12
Velocity	V _a [m/sec]	24.691 [17.008; 30.401]
Stack temperature	t _{sums} [°C]	28.035 [27.183; 29.164]
Stack Absolute Pressure	P _c [kPa]	101.148 [100.988; 101.264]
Stack Static Pressure	P _{stat} [kPa]	-0.015 [-0.175; 0.101]
Isokinetic Deviation	DI [%]	-1
Velocity at nozzle	V _N [m/sec]	24.441 [0.000; 29.016]
Stack Differential Pitot Pressure	dP _{pitot} [Pa]	509.625 [241.766; 752.565]
Ambient Pressure	P _{amb} [kPa]	101.163 [101.163; 101.163]

SAMPLED VOLUMES

Elapsed time	et [hh:mm:ss]	1:00:01
Total encoder impulses	[#]	42622
Standard Volume [T _{norm} P _{norm}]	V _{ps} [m ³]	1.2533
Moist Volume at stack conditions	V _{js} [m ³]	1.3975
Volume at dgm conditions	V _{dgm} [m ³]	2.1311
Gas meter temperature	t _{dgm} [°C]	29.278 [28.139; 30.779]
Gas Meter Pressure	P _{dgm} [kPa]	65.87 [55.201; 93.374]

SOURCE TESTING NZ

Resene Paints Limited
 Air Discharge Monitoring of the Factory Extraction System
 January 2018

Resene Run 3
Isokinetic sampling 23/01/2018 11:45:10

MACHINE INFORMATION
 Master Firmware v1.9.2000
 Master Serial Number 11420234P
 Slave Firmware v0.7.7000
 Slave Serial Number 11420234P
 Last calibration date Refer to the STNZ Equipment Register

Point	Flowrate	Gamma
1	0	1

start ts [timestamp]	Port [##]	Point [##]	Distance [cm]	Elapsed Time [hh:mm:ss]	rw avg [0:1]	t _{sums} avg [°C]	t _{dgm} avg [°C]	P _{stat} avg [kPa]	P _c avg [kPa]	dP pitot avg [Pa]	P _{no} avg [kPa]	P _{amb} avg [kPa]	V _s avg [m/sec]	QV _s avg [m ³ /min]	DI [%]	V _N avg [m/sec]	pn avg [m ³ /m ³]	Q'Va [m ³ /s]	Q'Vn [m ³ /s]	QVn [m ³ /s]	V _{ps} [R]	V _{gs} [R]	V _{dgm} [R]
23-01-18 11:45:28	1	1	1.9	0:05:00	0.011	27.244	27.54	-0.028	101.091	605.108	62.179	101.119	26.893	22.301	-1.4	26.511	1.286	14059	12757	12617	113.91	126.72	203.95
23-01-18 11:50:32	1	2	6.3	0:05:00	0.011	27.235	27.317	-0.035	101.084	628.418	60.636	101.119	27.417	22.839	-0.9	27.151	1.286	14333	13005	12862	115.6	128.61	212.1
23-01-18 11:55:37	1	3	12.8	0:05:00	0.011	27.687	27.452	-0.039	101.08	641.531	59.668	101.119	27.723	22.944	-1.4	27.319	1.286	14493	13130	12985	116.5	129.74	217.2
23-01-18 12:00:46	1	4	30.3	0:05:00	0.011	28.159	27.841	0.011	101.13	407.635	73.213	101.119	22.061	18.785	1.4	22.389	1.286	11533	10437	10322	96.05	107.24	146.35
23-01-18 12:05:49	1	5	36.8	0:05:00	0.011	28.525	28.316	0.014	101.133	407.149	74.988	101.119	22.091	18.298	-1.1	21.835	1.286	11549	10439	10324	93.39	104.36	139.1
23-01-18 12:10:54	1	6	41.2	0:05:00	0.011	28.227	28.5	0.026	101.145	405.891	74.854	101.119	22.047	18.41	-0.4	21.945	1.286	11526	10429	10315	93.95	104.93	140.35
23-01-18 12:15:00	2	1	1.9	0:05:00	0.011	28.504	28.694	0.017	101.136	399.176	74.991	101.119	21.872	18.189	-0.7	21.704	1.286	11434	10336	10223	93.64	104.67	139.7
23-01-18 12:21:07	2	2	6.3	0:05:00	0.011	28.998	28.945	-0.04	101.079	612.257	62.04	101.119	27.137	22.15	-2.3	26.488	1.286	14187	12796	12656	113.36	126.87	204.4
23-01-18 12:26:15	2	3	12.8	0:05:00	0.011	29.117	29.486	-0.037	101.082	622.65	61.112	101.119	27.377	22.506	-1.6	26.923	1.286	14312	12905	12763	114.59	128.28	210.1
23-01-18 12:31:23	2	4	30.3	0:05:00	0.011	28.749	29.827	-0.035	101.084	626.431	60.587	101.119	27.444	22.586	-1.6	26.985	1.286	14347	12952	12810	116.09	129.8	214.95
23-01-18 12:36:33	2	5	36.8	0:05:00	0.011	28.616	29.935	-0.033	101.086	577.298	63.766	101.119	26.318	21.647	-1.7	25.852	1.286	13758	12427	12290	111	124.12	195.45
23-01-18 12:41:36	2	6	41.2	0:05:00	0.011	28.481	29.951	-0.032	101.087	540.425	66.634	101.119	25.47	20.998	-1.5	25.066	1.286	13315	12032	11899	108.01	120.72	182

NORMALIZATION FACTOR
 T_{norm} [K] 273
 P_{norm} [kPa] 101.3

PITOT DATA SPECIFICATION
 Name ST018
 Velocity [m/sec] 2.01 0.834
 Velocity [m/sec] 7.06 0.832
 Velocity [m/sec] 10.98 0.84
 Velocity [m/sec] 19.9 0.84
 Velocity [m/sec] 17.01 0.838

DUCT AND GAS SPECIFICATION
 Name RESENE
 Section Circular
 Diameter [m] 0.43
 Area [m²] 0.145
 Port B [R] 2
 Points P [R] 6
 Dry gas density pn [m³/m³] 1.286 [1.286; 1.286]
 Carbon dioxide CO₂ [%] 0 [0.000; 0.000]
 Oxygen O₂ [%] 21 [21.000; 21.000]
 Water vapor ratio rw [0:1] 0.011 [0.011; 0.011]
 Nozzle rz [mm] 4.46
 Turbulence factor ft [sec] 3

DUCT FLOW RATE
 Dry actual QV_s [m³/s] 13091 [9924; 15229]
 Moist actual QV_s [m³/s] 13237 [11434; 14493]
 Moist standard [T_{norm}, P_{norm}] QV_s [m³/s] 11970 [10336; 13130]
 Dry standard [T_{norm}, P_{norm}] QV_s [m³/s] 11838 [10223; 12985]

AVERAGE VALUES
 Total Points [R] 12
 Velocity V_s [m/sec] 25.32 [18.036; 29.456]
 Stack temperature t_{sums} [°C] 28.295 [27.087; 29.262]
 Stack Absolute Pressure P_c [kPa] 101.101 [100.977; 101.248]
 Stack Static Pressure P_{stat} [kPa] -0.018 [-0.142; 0.129]
 Isokinetic Deviation DI [%] -1.2
 Velocity at nozzle V_N [m/sec] 25.014 [0.000; 28.160]
 Stack Differential Pitot Pressure dP_{pitot} [Pa] 534.723 [271.204; 725.308]
 Ambient Pressure P_{amb} [kPa] 101.119 [101.119; 101.119]

SAMPLED VOLUMES
 Elapsed time et [hh:mm:ss] 1:00:00
 Total encoder impulses [R] 44113
 Standard Volume [T_{norm}, P_{norm}] V_{gs} [m³] 1.2861
 Moist Volume at stack conditions V_{gs} [m³] 1.436
 Volume at dgm conditions V_{dgm} [m³] 2.2057
 Gas meter temperature t_{dgm} [°C] 28.662 [27.062; 30.128]
 Gas Meter Pressure P_{dgm} [kPa] 65.179 [58.930; 90.000]

SOURCE TESTING NZ

Appendix B Moisture Content and Particulate Mass Determinations

This Appendix contains 2 pages including cover

Moisture Content Determinations

Sampling Run	Moisture Mass Collected (g)	Gas Volume Sampled (m ³) ¹	Stack Moisture Content (%)
PM Run 1	18.5	1.268	1.8
PM Run 2	18.7	1.233	1.9
PM ₁ Run 3	19.5	1.270	1.9

1. Corrected to 0 °C, one atmosphere pressure, dry gas basis

■ Particulate Mass Determinations

Sampling Run	Sample ID	Filter ID/ Rinse Vol (ml)	Initial Weight (g)	Final Weight (g)	Mass (g)	Net Mass (g)	Total Mass (g)
PM Run 1	ST0717/01	ST1007	0.0580	0.0585	0.0005	0.0005	0.0016
	ST0717/02	50	102.2922	102.2933	0.0011	0.0011	
PM Run 2	ST0717/03	ST1008	0.0589	0.0588	-0.0001	-0.0001	0.0003
	ST0717/04	50	102.7640	102.7644	0.0004	0.0004	
PM Run 3	ST0717/05	ST1009	0.0592		-0.0592	-0.0592	0.0002
	ST0717/06	50	96.8397	96.8991	0.0594	0.0594	
Filter Blank	ST0717/07	ST1010	0.0588	0.0588	0.0000		
Rinse Blank	ST0717/08	100	104.1450	104.1450	0.0000		

Note:

Due to the small size of the filters used (37 mm), the filters are easily damaged and so were added to the acetone rinse to prevent sample lose for Run 3.

Appendix C Raw VOC Sampling Data

This appendix includes 2 pages including the cover

Resene Paints Limited
 Air Discharge Monitoring of the Extraction System
 January 2018

Sample Description	Sampling Date	Sampling Period	Sample Duration (min)	Initial Flow (mL/min)	Final Flow (mL/min)	Ave Flow (mL/min)	Sample Vol (m ³)	DGM Temp (°C)	Ambient Press. (kPa)	Sample Vol (m ³) ¹
VOC Run 1 - Spike	23-01-18	8:40 - 9:44	60	748.29	718.43	733.4	0.0440	27.5	101.1	0.0399
VOC Run 2 - Spike	23-01-18	10:13 - 11:17	60	928.87	934.49	931.7	0.0559	28.0	101.2	0.0506
VOC Run 3 - Spike	23-01-18	11:45 - 12:48	60	887.41	873.85	880.6	0.0528	28.3	101.1	0.0478
VOC Run 1 - Sample	23-01-18	8:40 - 9:44	60	999.37	955.57	977.5	0.0586	27.5	101.1	0.0532
VOC Run 2 - Sample	23-01-18	10:13 - 11:17	60	754.37	748.21	751.3	0.0451	28.0	101.2	0.0408
VOC Run 3 - Sample	23-01-18	11:45 - 12:48	60	809.68	817.60	813.6	0.0488	28.3	101.1	0.0442

1. Corrected to 0 °C, 101.3 kPa, dry gas basis

Appendix D Raw VOC Analytical Report

This appendix includes 3 pages including the cover



Hill Laboratories
 TRIED, TESTED AND TRUSTED

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ANALYSIS REPORT

Page 1 of 2

Client: Source Testing NZ Limited	Lab No: 1907246	SPv1
Contact: Matthew Newby PO Box 32017 Lower Hutt 5050	Date Received: 13-Jan-2018	
	Date Reported: 31-Jan-2018	
	Quote No: 88854	
	Order No: ST0699	
	Client Reference: ST0699	
	Submitted By: Matthew Newby	

Sample Type: 400/200 mg CSC SKC 226-09					
Sample Name:	Toluene Spike 1 [Resene VOC R1 Spike]	Toluene Spike 2 [Resene VOC R2 Spike]	Toluene Spike 3 [Resene VOC R3 Spike]	Travel Blank	Lab (rig) Blank
Lab Number:	1907246.1	1907246.2	1907246.3	1907246.7	1907246.9
Volatile organic compounds reported as toluene equivalent					
Volatile organic compounds as toluene front	µg/sample	11,900	8,000	6,100	16
Volatile organic compounds as toluene back	µg/sample	7	6	7	6

Sample Name:	Resene VOC R1 Sample 23-Jan-2018	Resene VOC R2 Sample 23-Jan-2018	Resene VOC R3 Sample 23-Jan-2018		
Lab Number:	1907246.11	1907246.12	1907246.13		
Volatile organic compounds reported as toluene equivalent					
Volatile organic compounds as toluene front	µg/sample	10,500	5,400	2,200	-
Volatile organic compounds as toluene back	µg/sample	9	6	5	-

Sample Type: 400/200 mg CSC SKC 226-09 Desorption Efficiency					
Sample Name:	Travel Spike	Lab Spike			
Lab Number:	1907246.8	1907246.10			
Toluene in large charcoal tubes by GC-FID/FID DE					
Toluene front	% recovery	103	104	-	-
Toluene back	% recovery	< 1	< 1	-	-

Analyst's Comments
 Spikes were prepared to contain 3,500 µg/sample toluene.

SUMMARY OF METHODS

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: 400/200 mg CSC SKC 226-09			
Test	Method Description	Default Detection Limit	Sample No
Toluene in large charcoal tubes by GC-FID/FID	Break into fractions, desorption with CS2, analysis by dual column GC-FID/FID, NIOSH Method 1003 (halogenated hydrocarbons), 1300 (ketones), 1500 (hydrocarbons), 1501 (aromatic hydrocarbons), 1450 (esters)	-	1-3, 7, 9, 11-13
Volatile organic compounds reported as toluene equivalent	Break into fractions, desorption with CS2, analysis by dual column GC-FID/FID, NIOSH Method 1501 (aromatic hydrocarbons) Issue 3, 2003	4 - 8 µg/sample	1-3, 7, 9, 11-13
CS2 Miscellaneous Solvents in large tubes by GC-FID/FID (screen)	Break into fractions, desorption with CS2, analysis by dual column GC-FID/FID, NIOSH Method 1003 (halogenated hydrocarbons), 1300 (ketones), 1500 (hydrocarbons), 1501 (aromatic hydrocarbons), 1450 (esters)	-	1-3, 7-13

Sample Type: 400/200 mg CSC SKC 226-09 Desorption Efficiency			
Test	Method Description	Default Detection Limit	Sample No

Resene Paints Limited
Air Discharge Monitoring of the Factory Extraction System
January 2018

Sample Type: 400/200 mg CSC SKC 226-09 Desorption Efficiency			
Test	Method Description	Default Detection Limit	Sample No
Toluene in large charcoal tubes by GC-FID/FID DE	Break into fractions, desorption with CS ₂ , analysis by dual column GC-FID/FID, NIOSH Method 1003 (halogenated hydrocarbons), 1300 (ketones), 1500 (hydrocarbons), 1501 (aromatic hydrocarbons), 1450 (esters)	1 % recovery	8, 10

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

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Ara Heron BSc (Tech)
Client Services Manager - Environmental