Appendix I.1.1: Dust Monitoring Report (ORS, January 2014)

Engineering a Sustainable Future

ORS Consulting Engineers / ORS Building / Marlinstown Office Park / Mullingar, Co. Westmeath / Ireland

ORS Consulting Engineers

T 044 934 2518
F 044 934 4573
E info@ors.ie
W www.ors.ie

Environmental Dust Monitoring
Rehab Glassco,
Unit 4 Osberstown Industrial Park,
Caragh Road,
Naas,
Co. Kildare.

Client	Revision	Date	Compiled	Checked	Approved
Rehab Glassco	D2	27/01/2014	DOD	DH	DC
Unit 4 Osberstown Industrial Park, Caragh Road, Naas, Co. Kildare					

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Executive Summary

Dust deposition was monitored at three locations at the Rehab Glassco site, Osberstown Industrial Park, Caragh Road, Naas, Co. Kildare between the 20th December 2013 and 20th January 2014.

The dust fall concentrations are laid down in the waste facility permit no. WFP-KE-08-0357-01 which specifies a limit of 350 mg m^{-2} day^{-1}. The dust levels measured on site do not exceed this limit.

1 Scope

ORS Environmental Consultants were commissioned by Zeki Mustafa of Rehab Glassco to carry out environmental dust monitoring at the Rehab Glassco plant at Caragh Rd, Naas, Co. Kildare. Monitoring was as a result of requirements set out in the waste facility permit no. WFP-KE-08-0357-01.

The dust deposition monitors were installed on Friday 20th December and left in situ for 31 days. The monitors were collected on Monday 20th January 2014.

Dust is a natural occurring product of the environment with typical background levels in the region of <70mg m^{-2} day^{-1} TA Luft VDI 2119 guidelines. Human activities will generally increase this level due to the creation of hard standing areas, vehicle movements and dust associated with the reduction of dampened areas.

Dust generation within the Rehab Glassco plant is generated from traffic movements within the site, stock piling material, material movement and general day to day activities. Dust monitoring is carried out at the site boundaries to ascertain the potential dust leaving the site.

2 Monitoring Locations

Environmental dust deposition monitoring was carried out at the predetermined locations D1, D2 & D3. The monitoring locations are detailed below in Table 1 and presented in the attached map in Appendix B.

Table 1. Monitoring Locations

Monitoring Locations	Description
D1	Located on the South western boundary of the site adjacent site entrance
D2	Located to the north boundary of the site
D3	Located on the eastern boundary of the site

3 Activities on Site

Activities that take place on the site that may generate dust include the entering / exiting of vehicles from the site via the site entrance, stock piling material and vehicle movements within the site etc.

4 Methodology

The standard method used for monitoring dust deposition is VDI 2119 *'Measurement of Dustfall, Determination of Dustfall using Bergerhoff Instrument (Standard Method)'*, (EPA Guidance Notes). With this method, atmospheric deposits are collected in vessels over a 30-day period ± 2 days. The collected samples are then concentrated and the residue subjected to gravimetric weight analysis.

Collecting jars with a volume of 1.5 litres were placed in the deposition stands. The top of the jar was positioned 1.5 metres above ground level.

4.1 Jar Preparation

Prior to sampling the jars and lids were acid washed and dried in a fan assisted oven at 100°C. The lids were placed on the jars and labelled. On arrival at the site the lids were removed and the jars were placed in wire containers for a period of 30days (± 2 days).

4.2 Sample Preparation

On completion of the collection period the jars were removed and immediately sealed air tight and transported directly to the laboratory.

Sample preparation and analysis was carried out in accordance with the VDI 2119 standard.

5 Calculations

Results were calculated from the formula correlating the dust collected, sampling period and the collecting surface of the jars. Results were expressed as mg m^{-2} d^{-1}.

6 Results

6.1 Dust Gauges

Dust Deposition Results
Results are quoted as mg m^{-2} d^{-1} (milligrams per metre^2 per day)

Monitoring Locations	Dust Deposition mg m^{-2} d^{-1}	Waste Facility Permit Limit 350 mg m^{-2} d^{-1}
D1	45	350
D2	51	350
D3	326	350

The quantity of dust fall is determined as the difference between the gross weight of the evaporating dish and the final weight of the evaporating dish (containing the residue). The quantity is then converted into general reference quantities (mg m^{-2} d^{-1}) using the following formula:

$$X = \frac{G}{F.T}$$

Where;

X = dustfall in g m^{-2} d^{-1}
F = collecting surface in m^2
G = mass of dustfall in g
T = sampling period in days

7 Evaluation of Results

The Rehab Glassco monitoring locations are deemed to be indicative of the level of dust likely to arise from the on-site activities. Monitoring stations were located within the site boundary and were fully exposed to typical on-site activities.

The schedule of conditions for the Rehab Glassco Site states that the total dust depositions arising from the on-site activities shall not exceed 350 mg m^{-2} d^{-1} averaged over a continuous period of thirty days at any position along the boundary of the development.

8 Conclusion

Dustfall limits are laid down in the waste facility permit for the site or issued by the Local Authority or EPA. The dust fall concentrations laid down specifies a limit of 350 mg m^{-2} d^{-1}.

Dust concentrations at all monitoring points are now below the 350 mg m^{-2} d^{-1} limit compared to the previous round of monitoring. It should be noted that the dryer is located adjacent to monitoring location D3 which would result in the elevated dust levels at this location. However it is noted that it is still within limits.

In recent months Rehab Glassco have implemented a number of dust abatement measures to their plant operation in an effort to reduce the amount of dust particles following the previous monitoring period. Shown below is a comparison between current results and those calculated from the previous monitoring period.

Monitoring Location	Dust Deposition July 2013/August 2013 (mg m^{-2} d^{-1})	Dust Deposition December 2013/January 2014 (mg m^{-2} d^{-1})	% Reduction in Dust Deposition
D1	605	45	93%
D2	367	51	86%
D3	850	326	62%

These figures show that the measures employed by Rehab Glassco to reduce the level of measured dust particles from the site, appear to have had a hugely positive effect on dust levels from the site.

Appendix A – Dust Analysis

	Units	Dust		
		D1	D2	D3
Date In (Oven)	dd/mm/yy	20/01/14	20/01/14	20/01/14
Date Out (Oven)	dd/mm/yy	21/01/14	21/01/14	21/01/14
Mass of Undissovled Solids	grams	0.039	0.044	0.283
Calculation of Dust Deposition	mg m^{-2} d^{-1}	44.93	50.7	326.15
Description of Dust		Traces of grey dust matter	Traces of grey dust matter	Large traces of grey dust matter with the presence of plant & organic material
No. of Days Exposed		31	31	31

Appendix B – Dust Monitoring Locations

Appendix I.1.2: Air Emissions Compliance Monitoring Emissions Report – Drying Plant (Air Scientific, April 2014)

Report Title	Air Emissions Compliance Monitoring Emissions Report
Company address	Air Scientific Ltd., 40 Coolraine Heights, Old Cratloe Road, Limerick
Stack Emissions Testing Report Commissioned by	Rehab Glassco
Facility Name	Rehab Glassco
Contact Person	Paul Hodder / Zeki Mustafa
EPA Licence Number	Not applicable
Licence Holder	Not applicable
Stack Reference Number	A2-01
Dates of the Monitoring Campaign	12-03-2014
Job Reference Number	GLASTL4120314 A2-01
Report Written By	Mr. Mark McGarry
Report Approved by	Niamh McMahon
Stack Testing Team	Robert O Brien/ David Noonan
Report Date	28-04-2014
Report Type	Test Report Compliance Monitoring
Version	2
Signature of Approver	N. McMahon Niamh McMahon Quality Supervisor

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All sampling and reporting is completed in accordance with Environmental Protection Agency Air Guidance Note 2 requirements.

Executive Summary

Monitoring Objectives

Overall Aim of the monitoring Campaign

The aim of the monitoring campaign was to demonstrate compliance with a set of emission limit values as specified in the site licence.

Special Requirements

There were no special requirements.

Target Parameters

Total Particulate Matter (TPM)
Carbon Monoxide (CO)
Oxides of Nitrogen (NOx) as NO_2
Total Volatile Organic Carbon (TOC)
Sulphur Dioxide (SO_2)
Volumetric Flow Rates ($m^3.hr^{-1}$)

Emission Limit Values

A2-01	mg.m^{-3}
TPM	No limits
CO	No limits
NOx as NO_2	No limits
TOC	No limits
SO_2	No limits
Volume ($m^3.hr^{-1}$)	No limits

Reference Conditions

Reference Conditions	Value
Oxygen Reference %	Not referenced
Temperature K	273.15
Total Pressure kPa	101.3
Moisture %	Wet

Executive Summary

Overall Results

A2-01	Concentration STP Wet and Unadjusted for O_2				
Parameter	**Units**	**Result**	**MU +/-**	**Limit**	**Compliant**
Total Particulate Matter (TPM)	$mg.m^{-3}$	4.71	0.41	50	Yes
Carbon Monoxide (CO)	$mg.m^{-3}$	826.7	176.3	300	No
Oxides of Nitrogen (NOx) as NO_2	$mg.m^{-3}$	15.1	13.4	50	Yes
Total Volatile Organic Carbon (VOC)	$mg.m^{-3}$	211.9	5.2	80	No
Sulphur Dioxide (SO_2)	$mg.m^{-3}$	17.0	16.2	50	Yes
Volumetric Flow Rate (Ref.)	$m^3.hr^{-1}$	4,096	-	9,000	Yes

Limits are based on proposed licence limits applied for in the licence.

Accreditation details

Air Scientific Limited	INAB Number: 319T
External Analytical Laboratory	Accreditation number: UKAS 0605

Executive Summary

Process details

Stack Name	A2-01
Process status	Operating as Normal
Capacity (per/hour) (if applicable)	Variable
Continuous or Batch Process	Continuous
Feedstock	Glass
Abatement System	Bag Filters
Abatement Systems Running Status	As Normal
Fuel	LFO
Plume Appearance	White / Grey Plume
Other information	None

Executive Summary

Monitoring, Equipment & Analytical Methods

Parameter	Standard	Technical Procedure	Accredited Testing	Analytical Technique	Equipment / Media	Equipment ID Used on Site
Total Particulate Matter (TPM)	EN13284 - 1:2002	2000	Yes	Gravimetric	Isokinetic Equipment	ASLLK13EQ504 ASLLK13EQ518 ASLLK12EQ506 ASLLK14EQ500 ASLLK13EQ509 ASLLK13EQ502 ASLLK12EQ516
Carbon Monoxide (CO)	EN15058:2006	2004	No	NCIR By Horiba PG-250	Horiba	ASLLK12EQ525 ASLLK12EQ526
Oxides of Nitrogen (NOx) as NO_2	EN14792:2006	2002	Yes	Chemiluminescence	Horiba	ASLLK12EQ525 ASLLK12EQ526
Total Volatile Organic Carbon (TOC)	EN12619:2012	2009	Yes	Flame Ionisation Detection	FID	ASLLK14EQ500
Sulphur Dioxide (SO2)	NDIR AG2	2003	Yes	Non Dispersive Infra Red	Horiba	ASLLK12EQ525 ASLLK12EQ526
Oxygen (%)	EN14789	2008	Yes	Paramagnetic/ Zirconia	Horiba	ASLLK12EQ525 ASLLK12EQ526
Water Vapour (%)	EN14790:2005	2007	Yes	Gravimetric	Impingers	ASLLK13EQ504 ASLLK13EQ518 ASLLK12EQ506 ASLLK14EQ500 ASLLK13EQ509 ASLLK13EQ502 ASLLK12EQ516
Stack Gas Temperature	EN 16911:2013	2005	Yes	Thermocouple	Thermocouple	
Stack Gas Velocity	EN 16911:2013	2005	Yes	Pitot tubes	Meter / Pitot	
Volumetric Flow Rate	EN 16911:2013	2005	Yes	Calculation	Calculation	

Sampling Deviations

Parameter	Deviation
EN15058:2006	Cal gas 79 in 2000 range
EN14792:2006	None
EN12619:2012	None
NDIR AG2	None
EN14789	None
EN14790:2005	None
EN 16911:2013	1 line used on the duct – restricted access to second line
EN 16911:2013	1 line used on the duct – restricted access to second line
EN 16911:2013	1 line used on the duct – restricted access to second line

Reference Documents

Risk Assessment (RA)	SOP 1011
Site Review (SR)	SOP 1015
Site Specific Protocol (SSP)	SOP 1015

Suitability of Sample Location

General Information	A2-01
Permanent/Temporary	Temporary
Inside/ Outside	Outside

Platform Details		
Irish EPA Technical Guidance Note AG1 / BS EN 15259 Platform Requirements	**Value**	**Comment**
Sufficient Working area to manipulate probe and measuring instruments	Ok	1 line from the platform provided
Platform has 2 handrails (approx. 0.5m & 1.0 m high)	Yes	-
Platform has vertical base boards (approx. 0.25 m high)	Yes	-
Platform has chains / self-closing gates at top of ladders	Yes	-
There are no obstructions present which hamper insertion of sampling equipment	Yes	-
Safe Access Available	Yes	-
Easy Access Available	Yes	To 1 line on the plane

Sampling Location / Platform Improvement Recommendations
Permanent structure >5 m^2 would be required in the long term as per EPA guidance AG1 & AG2

BSEN 15259 Homogeneity Test Requirements
Not applicable
Select Option : **1: There is no requirement to perform a BSEN15259 Homogeneity Test on this stack** **2: Test results were obtained from previous Homogeneity test carried out by ASL** **3: Test results were obtained from previous Homogeneity test carried out by Alternative contractor**

Stack Diagram

1. APPENDICES

Appendix I Monitoring Personnel & Equipment

Stack Emissions Monitoring Personnel

Team Leader	**Name**	David Noonan
	System approval	ASL Team Leader Approved
Team Leader	**Name**	Robbie O Brien
	System approval	ASL Technician Approved

Appendix II Stack Raw Data

Title:	***Determination of Total Particulates***				
Method:	EN 13284-1				
Client:	Rehab Glassco				
Log Sheet Complete by:	Mark McGarry		**Uncertainty Data**		
Test Date:	12/03/2014				
Laboratory Used:	RPS		**Temperature at Pump**	8.6	Deg C
Stack Name	A2-1		**Pressure at Pump**	81.595	kPa
Test Time	15:15:24		**Air Volume at Pump**	0.9931	m^3
Moisture Content	10.89	%	**Humidity at Pumps**	0	%
Stack Flow Rate	4096	Nm^3/hr	**Filter Weight**	2.2	mg
Volume of Air Sampled	0.7756	Nm^3	**Front End Weight**	1.9	mg

Balance Calibration	**Weight**	
300.0	-	g
500.0	500.0	g

Inpinger Weights	**Initial**	**Final**	**Difference**
1	473.3	546	72.7
2	461.5	461.4	-0.1
3	367.4	367.2	-0.2
4	664	667.8	3.8
Volume of Air Sampled	0.7756	Nm3	76.2
Moisture Content (EN 14790)	10.89	%	

Leak Check Results	**Result**		**% Leak**
Before Blank	0.39	cc/min	1.5
After Blank	0.39	cc/min	1.5
Before Sample 1	0.39	cc/min	1.5
After Sample 1	0.39	cc/min	1.5
Average Flow Rate	25.62	cc/min	1.5
Standard Maximum	0.5124	cc/min	2%
Back Pressure	69	kPa	

Standard Criteria to be Met	**Result**	**Standard Requirement**
Angle of Flow	Pass	<15 Degrees
Negative Flow in the Stack	Pass	None
Pitot Pressure Difference	Pass	>5Pa
Ratio of Flow Measurement	Pass	<3:1

Pitot Tube Leak Check	**Result**	
Positive Pressure	Pass	-
Negative Pressure	Pass	-

Number of Ports	1	2
Straight length before sample point	Pass	> 5 Hydraulic Diameters
Straight length after sample point	Pass	> 5 Hydraulic Diameters from fan or bend / >2 from stack exit

Sample Calculations

Blank (Filter and Front Wash Combined)	0.57	mg
Sample 1 (Filter and Front Combined)	4.1	mg
Volume of Air Sampled	0.8704267	Nm^3
Blank Result	0.65	mg/Nm^3
Sample Result	4.71	mg/Nm^3
Emission Limit Value	50	mg/Nm^3

Blank as Percentage of ELV	1.3	%	**Standard Requirement**	**<10% ELV**

Isokinetic Criterion Compliance

Isokinetic Variation	%	-0.2
Allowable IsoKinetic Range	%	From -5 to + 15%
Iso Kineticity Acceptable	-	Yes

DUCT AND GAS SPECIFICATION – Isokinetic Sample

Name			GLASSCO.A2.01
Section			Circular
Diameter		[m]	0.48
Area		[m^2]	0.18
Port	B	[#]	1
Points	P	[#]	8
Density	ρn	[$^{kg}/_{m^3}$]	1.291
Carbon dioxide	CO_2	[%]	1.3
Oxygen	O_2	[%]	18.7
Water vapor ratio	rw	[0;1]	0.133
Nozzle	nz	[mm]	10
Turbolence factor	ft	[sec]	9

DUCT FLOW RATE

Dry actual	QV_a	[$^{m3}/_h$]	4737
Moist actual	$Q'V_a$	[$^{m3}/_h$]	5464
Moist standard [T_{norm} P_{norm}]	$Q'V_n$	[$^{m3}/_h$]	4096
Dry standard [T_{norm} P_{norm}]	QV_n	[$^{m3}/_h$]	3551

AVERAGE VALUES

Total Points		[#]	1
Velocity	v'_a	[$^m/_{sec}$]	8.389
Stack temperature	t_a	[°C]	93.695
Stack Static Pressure	$P_a$static	[kPa]	101.984
Isokinetic Deviation	DI	[%]	-0.2
Velocity at nozzle	v'_N	[$^m/_{sec}$]	8.367
Probe temperature	t_{probe}	[°C]	21.497
Box temperature	t_{box}	[°C]	13.961
Aux1 temperature	t_{aux1}	[°C]	32.181
Aux2 temperature	t_{aux2}	[°C]	74.763
Stack Differential Pitot Pressure	dP_{pitot}	[Pa]	47.636
Ambient Pressure	P_{amb}	[kPa]	102.004

SAMPLED VOLUMES

Elapsed time	et	[hh:mm:ss]	00:30:00
Total encoder impulses		[#]	19862
Standard Volume [T_{norm} P_{norm}]	V_{gn}	[m^3]	0.7756
Moist Volume at stack conditions	V'_{ga}	[m^3]	0.9585
Volume at dgm conditions	V_{dgm}	[m^3]	0.9931
Gas meter temperature	t_{gm}	[°C]	8.6
Gas Meter Pressure	P_{dgm}	[kPa]	81.595

DUCT AND GAS SPECIFICATION – Preliminary Flow

Name			GLASSCO.A2.01
Section			Circular
Diameter		[m]	0.48
Area		[m^2]	0.18
Port	B	[#]	1
Points	P	[#]	8
Density	ρn	[$^{kg}/_{m^3}$]	1.291
Carbon dioxide	CO_2	[%]	1.3
Oxygen	O_2	[%]	18.7
Water vapour ratio	rw	[0;1]	0.133
Nozzle	nz	[mm]	10
Turbulence factor	ft	[sec]	9

DUCT FLOW RATE

Dry actual	QV_a	[$^{m3}/_h$]	4737
Moist actual	$Q'V_a$	[$^{m3}/_h$]	5464
Moist standard [T_{norm} P_{norm}]	$Q'V_n$	[$^{m3}/_h$]	4096
Dry standard [T_{norm} P_{norm}]	QV_n	[$^{m3}/_h$]	3551

AVERAGE VALUES

Total Points		[#]	1
Velocity	v'_a	[$^m/_{sec}$]	8.389
Stack temperature	t_a	[°C]	93.695
Stack Static Pressure	$P_a$static	[kPa]	101.984
Isokinetic Deviation	DI	[%]	-0.2
Velocity at nozzle	v'_N	[$^m/_{sec}$]	8.367
Probe temperature	t_{probe}	[°C]	21.497
Box temperature	t_{box}	[°C]	13.961
Aux1 temperature	t_{aux1}	[°C]	32.181
Aux2 temperature	t_{aux2}	[°C]	74.763
Stack Differential Pitot Pressure	dP_{pitot}	[Pa]	47.636
Ambient Pressure	P_{amb}	[kPa]	102.004

SAMPLED VOLUMES

Elapsed time	et	[hh:mm:ss]	00:30:00
Total encoder impulses		[#]	19862
Standard Volume [T_{norm} P_{norm}]	V_{gn}	[m^3]	0.7756
Moist Volume at stack conditions	V'_{ga}	[m^3]	0.9585
Volume at dgm conditions	V_{dgm}	[m^3]	0.9931
Gas meter temperature	t_{gm}	[°C]	8.6
Gas Meter Pressure	P_{dgm}	[kPa]	81.595

start ts [timestamp]	Port [###]	Point [###]	Distance [cm]	rw avg [0;1]	t_{fumes} avg [°C]	P_a avg [kPa]	dP pitot avg [Pa]
12/03/2014 15:02:39	1	2	5.1	0.133	91.427	102.01	42.972
12/03/2014 15:03:11	1	3	9.4	0.133	91.792	101.998	47.599
12/03/2014 15:03:42	1	4	15.6	0.133	92.376	102.003	51.652
12/03/2014 15:04:15	1	5	32.5	0.133	91.763	101.996	48.467
12/03/2014 15:04:55	1	6	38.7	0.133	92.137	101.998	44.461
12/03/2014 15:05:27	1	7	43	0.133	91.708	101.996	43.457

Title:	***Determination of Combustion Flue Gases***
Method:	EN 14792 / EN 14789 / EN 12039 / TGN M21
Client:	Rehab Glassco
Log Sheet Complete by:	Mark McGarry
Test Date:	15:07
Stack Name	A2-01

Reference Conditions

Measured Oxygen	17.4	%	
Reference Oxygen	17.4	%	

Parameter		CO	NO	SO_2	O_2
Emission Limit Values	$mg.m^{-3}$ ref				
Instrument Range	ppm	2000	500	1000	25
Span Gas Value	ppm	79	349	650	20.9
Acceptable Gas Range	-	No	Yes	Yes	Yes
Calibration Gas Uncertainty	%	2	2	2	2
Quality Assurance	Units				
Conditioning Unit Temperature	C	2	2	2	2
Average Temperature	< C	2	2	2	2
Allowable Temperature	-	4	4	4	4
Temperature Acceptable	-	Yes	Yes	Yes	Yes
Pump flow rate	l/min.	0.4	0.4	0.4	0.4
Zero Drift	Units				
Zero (Pre)	ppm	0	0	0	0
Zero (Post)	ppm	6	3	5	0.1
Zero drift	ppm	6	3	5	0.1
Allowable Zero Drift (Less than)	ppm	1.58	6.98	13	0.418
Adjustable Zero Drift (Less than)	ppm	3.95	17.45	32.5	1.045
Zero Drift Failure (Greater than)	ppm	3.95	17.45	32.5	1.045
Zero Drift Acceptable	-	No	Yes	Yes	Yes
Span Drift	Units				
Span Down (Pre)	ppm	79	349	650	20.9
Span Down (Post)	ppm	79.5	351	655	20.8
Span Drift	ppm	0.5	2	5	-0.1
Allowable Span Drift (less than)	ppm	1.58	6.98	13	0.418
Adjustable Span Drift (Less than)	ppm	3.95	17.45	32.5	1.045
Span Drift Failure (Greater than)	ppm	3.95	17.45	32.5	1.045
Span Drift Acceptable (Y/N)	-	Yes	Yes	Yes	Yes
Leak Check					
Span Gas Conc.	ppm	79	349	650	20.9
Recorded Conc. down Line	ppm	79	350	654	20.9
Leak Detected	ppm	0	0	4	0
Leak check acceptable (< 2%)	ppm	1.58	6.98	13	0.418
Pass	(Y/N)	Pass	Pass	Pass	Pass
Test Conditions	Units				
Run Ambient Temperature Range	C	13	13	13	13

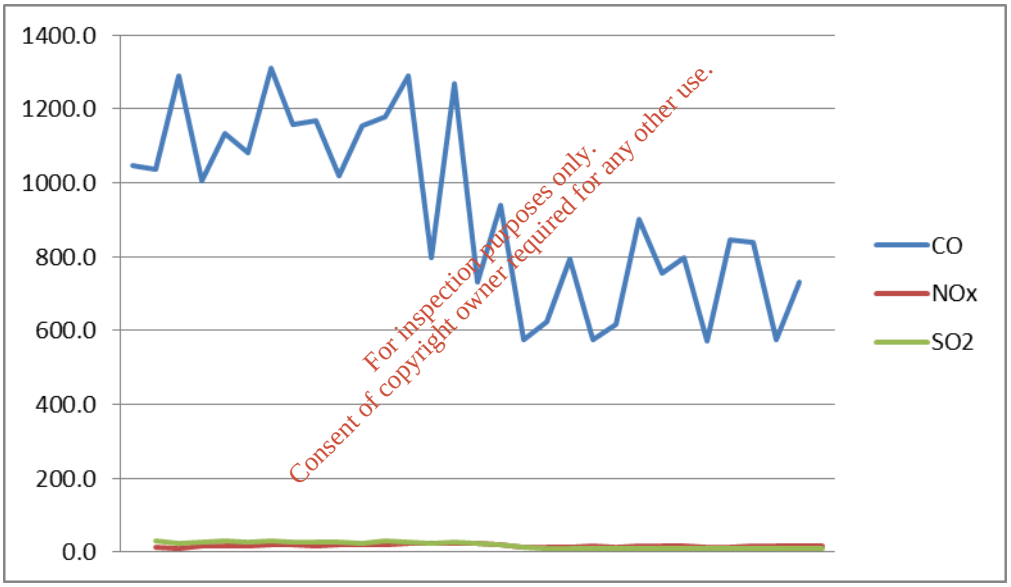
Raw Data

Date/Time	*Data source*	*CO*	*CO_2*	*NOx*	*O_2*	*SO_2*
		ppm	*vol%*	*ppm*	*vol%*	*ppm*
12/03/2014 15:08		507.1	1.4	4.4	18.8	6.3
12/03/2014 15:09		647.2	1.8	4.2	18.2	6.9
12/03/2014 15:10		823.9	1.8	6.2	18.1	7.8
12/03/2014 15:11		527.5	1.5	5.2	18.6	7.1
12/03/2014 15:12		687.2	1.8	6.2	18.2	7.4
12/03/2014 15:13		610.3	1.6	6.9	18.4	7.5
12/03/2014 15:14		901.4	2.0	7.9	17.9	8.3
12/03/2014 15:15		909.3	2.2	8.4	17.5	8.8
12/03/2014 15:16		842.7	2.1	8.2	17.7	8.2
12/03/2014 15:17		770.9	2.2	9.3	17.6	8.4
12/03/2014 15:18		598.0	1.5	6.6	18.6	7.0
12/03/2014 15:19		678.8	1.7	7.9	18.4	7.1
12/03/2014 15:20		855.6	1.9	9.0	18.0	7.3
12/03/2014 15:21		597.4	2.1	11.3	17.6	8.4
12/03/2014 15:22		941.3	2.1	11.0	17.7	7.6
12/03/2014 15:23		467.8	1.5	8.2	18.1	5.6
12/03/2014 15:24		959.1	2.1	8.3	16.4	5.5
12/03/2014 15:25		502.3	1.6	6.6	17.1	4.0
12/03/2014 15:26		570.7	1.7	7.8	16.9	4.1
12/03/2014 15:27		802.9	2.0	9.6	16.5	4.7
12/03/2014 15:28		494.3	1.6	7.7	17.1	4.2
12/03/2014 15:29		568.9	1.8	9.4	16.9	3.7
12/03/2014 15:30		897.3	2.0	10.6	16.5	4.8
12/03/2014 15:31		724.3	1.9	10.2	16.7	4.3
12/03/2014 15:32		777.5	1.9	8.8	16.6	4.1
12/03/2014 15:33		475.4	1.5	7.5	17.3	3.5
12/03/2014 15:34		868.5	2.1	9.5	16.4	4.2
12/03/2014 15:35		886.5	2.2	10.6	16.3	4.5
12/03/2014 15:36		562.6	1.9	10.6	16.6	4.3
12/03/2014 15:37		699.0	1.9	9.6	16.7	3.6
Average		**705.181**	**1.839**	**8.255**	**17.448**	**5.965**

Referenced Data

	CO	*NOx*	*SO_2*
	mg/Nm^3 Reference O_2		
12/03/2014 15:08	1046.5	15.0	29.6
12/03/2014 15:09	1034.6	11.1	25.3
12/03/2014 15:10	1288.5	15.8	27.7
12/03/2014 15:11	1004.1	16.3	30.9
12/03/2014 15:12	1132.3	16.8	28.0
12/03/2014 15:13	1081.3	20.0	30.4
12/03/2014 15:14	1310.1	18.9	27.7
12/03/2014 15:15	1158.2	17.7	25.7
12/03/2014 15:16	1167.9	18.6	25.9
12/03/2014 15:17	1020.0	20.2	25.5
12/03/2014 15:18	1155.5	20.9	30.9
12/03/2014 15:19	1177.2	22.6	28.1
12/03/2014 15:20	1290.4	22.4	25.3
12/03/2014 15:21	798.0	24.7	25.7
12/03/2014 15:22	1270.4	24.3	23.4
12/03/2014 15:23	731.3	21.1	20.0

12/03/2014 15:24	938.5	13.3	12.3
12/03/2014 15:25	576.4	12.5	10.5
12/03/2014 15:26	625.2	13.9	10.2
12/03/2014 15:27	794.3	15.6	10.6
12/03/2014 15:28	573.9	14.6	11.1
12/03/2014 15:29	615.8	16.8	9.1
12/03/2014 15:30	900.9	17.5	10.9
12/03/2014 15:31	754.7	17.4	10.1
12/03/2014 15:32	795.8	14.8	9.6
12/03/2014 15:33	570.5	14.8	9.6
12/03/2014 15:34	845.9	15.2	9.3
12/03/2014 15:35	838.6	16.5	9.7
12/03/2014 15:36	575.3	17.8	10.1
12/03/2014 15:37	731.2	16.4	8.6
Average	**926.8**	**17.5**	**19.1**
Uncertainty of Measurement	**197.7**	**15.1**	**18.2**
Wet	**826.7**	**15.6**	**17.0**
Uncertainty of Measurement	**176.3**	**13.4**	**16.2**



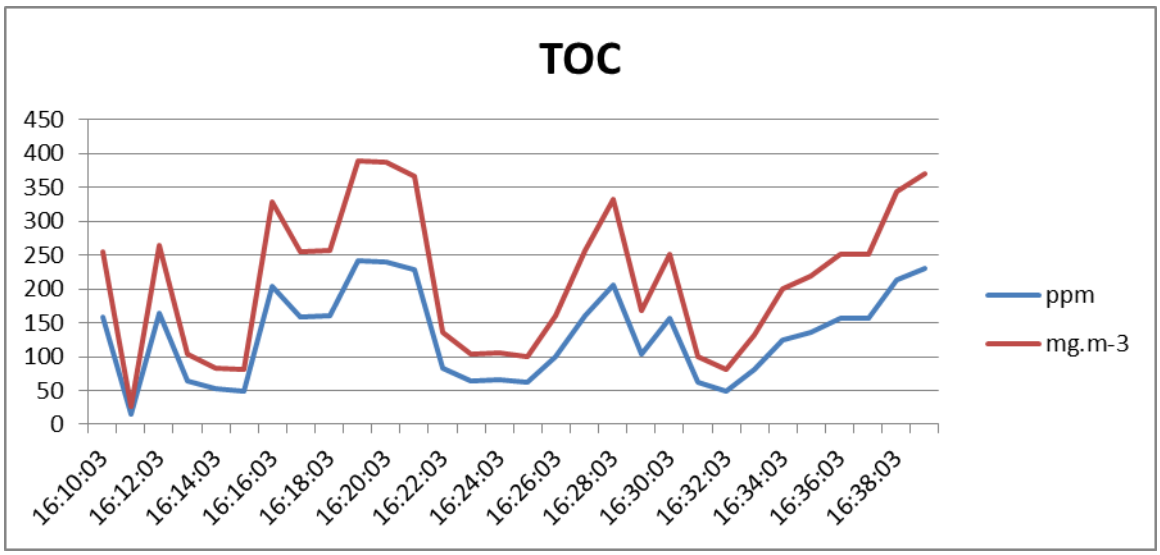
Title:	***Determination of Total Organic Compounds***
Method:	EN 12619:2013
Client:	Rehab Glassco
Log Sheet Complete by:	Mark McGarry
Stack Reference:	A2-1

Licence Limits		
Emission Limit Value	-	$mg.m^{-3}$
Flow Rate Limit	-	$m^3.Hr^{-1}$
Results		
TOC Concentration	211.9	$mg.m^{-3}$
Flow Rate	4,096	$m^3.Hr^{-1}$
Uncertainty of Measurement	5.21	$mg.m^{-3}$
Reference Conditions		
Temperature (K)	273.13	^0K
Pressure (kPa)	101.3	kPa
Gas (Wet or Dry)	-	
Oxygen	-	%
Quality Data		**Units**
Sampling Time	12/03/2014 16:10	-
Instrument Range	1000	ppm
Span Gas Value	650	ppm
Acceptable Gas Range	Yes	50 - 90% of Range
Oven Temperature	181	^0C
Average Temperature	181	^0C
Temperature Acceptable	Yes	Yes or No
Sample line temperature	181	C
Zero Drift		**Units**
Zero Down Sampling Line (Pre)	0	ppm
Zero Down Sampling Line (Post)	4	ppm
Zero drift	4	ppm
Allowable Zero Drift	20	ppm
Zero Drift Acceptable	Yes	Yes or No
Span Drift		**Units**
Span (Pre)	650	ppm
Span (Post)	654	ppm
Span Drift	4	ppm
Allowable Span Drift	20	ppm
Span Drift Acceptable	Yes	Yes or No
Leak Check		
Span Gas Conc.	650	ppm
Recorded Conc. down Line (Pre)	650	ppm
Recorded Conc. down Line (Post)	655	ppm
Leak Result	5	ppm
Leak check acceptable (< 2%)	13.0	(Y/N)
Parameter		
Standard	EN 12619:2013	
Technical Procedure	2009	
Probe material	Stainless Steel	
Filtration Type	Ceramic Filter	
Heated Head Filter Used	Yes	
Heated Line Temperature	180	Deg C
Span Gas Reference Number	ING533	
Span Gas Expiry Date	2016	

Span Gas Start Pressure (bar)	4	bar
Gas Cylinder Concentration (ppm)	650	ppm
Span Gas Uncertainty (%)	2	%
Zero Gas Type	Air	
Number of Sampling Lines Used	1	
Number of Sampling Points Used	1	
Sample Point I.D's	1	
Measured Quantities		
Certified Range of Analyser	1000	ppm
Operational Range of Analyser	1000	ppm
Measured Reading	132	ppm
Non linearity	0.4	ppm
Temperature Dependent Zero drift	0.15	ppm Per Degree
Temperature Dependent Span drift	1	% Per Degree
Cross-sensitivity	0.1	ppm
Leak	5	ppm
Calibration Gas uncertainty	2	ppm

Title:	***Determination of Total Organic Compounds***
Method:	EN 12619
Client:	Rehab Glassco
Log Sheet Complete by:	Mark McGarry
Stack Reference:	A2-1

Run 1	**Time**	**ppm**	**mg.m^{-3}**
1	16:10:03	158	254.4
2	16:11:03	16	25.8
3	16:12:03	164	264.0
4	16:13:03	64	103.0
5	16:14:03	52	83.7
6	16:15:03	50	80.5
7	16:16:03	204	328.4
8	16:17:03	158	254.4
9	16:18:03	160	257.6
10	16:19:03	242	389.6
11	16:20:03	240	386.4
12	16:21:03	228	367.1
13	16:22:03	84	135.2
14	16:23:03	64	103.0
15	16:24:03	66	106.3
16	16:25:03	62	99.8
17	16:26:03	100	161.0
18	16:27:03	160	257.6
19	16:28:03	206	331.7
20	16:29:03	104	167.4
21	16:30:03	156	251.2
22	16:31:03	62	99.8
23	16:32:03	50	80.5
24	16:33:03	82	132.0
25	16:34:03	124	199.6
26	16:35:03	136	219.0
27	16:36:03	156	251.2
28	16:37:03	156	251.2
29	16:38:03	214	344.5
30	16:39:03	230	370.3
Average		**131.6**	**211.9**



Appendix I.1.3: Air Emissions Compliance Monitoring Emissions Report – Main Process Building Extension (Air Scientific, January 2015)

Report Title	Air Emissions Compliance Monitoring Emissions Report
Company address	Air Scientific Ltd., 40 Coolraine Heights, Old Cratloe Road, Limerick
Stack Emissions Testing Report Commissioned by	Rehab Glassco Limited
Facility Name	Rehab Glassco Limited
Contact Person	Paul Hodder / Zeki Mustafa
EP icence Number	W0279-01
icence Holder	Rehab Glassco Ltd
Stack Reference Number	A2
Dates of t e onitoring Campaign	17-12-2014
ob Reference Number	REGLTL3171214
Report Written By	Mr. David Noonan
Report ppro ed by	Mr. Mark McGarry
Stack Testing Team	Mark McGarry and Daniel Mullins
Report Date	14-01-2015
Report Type	Test Report Compliance Monitoring
Version	1
Signature of ppro er	**Operations anager**

Opinions and interpretations expresses herein will be outside the scope of Air Scientific Limited INAB accreditation.
This test report shall not be reproduced, without the written approval of Air Scientific Limited.
All sampling and reporting is completed in accordance with Environmental Protection Agency Air Guidance Note 2 requirements.

Executive Summary

onitoring Ob ecti es

O erall im of t e monitoring Campaign

The aim of the monitoring campaign was to demonstrate compliance with a set of emission limit values as specified in the site licence.

Special Requirements

There were no special requirements.

Target Parameters

Carbon Monoxide (CO)
Oxides of Nitrogen (NOx) as NO_2
Total Volatile Organic Carbon (TOC)
Sulphur Dioxide (SO_2)
Volumetric Flow Rates (m .hr^{-1})

Emission imit Values Potentially

	mg m^{-}
CO	300
NOx as NO_2	50
TOC	80
SO_2	50
Volume (m .hr^{-1})	9,500

Reference Conditions

Reference Conditions	Value
Oxygen Reference %	-
Temperature K	273.15
Total Pressure kPa	101.3
Moisture %	Dry

Executi e Summary

O erall Results

	Concentration				
Parameter	**nits**	**Result**	**-**	**imit**	**Compliant**
Carbon Monoxide (CO)	$mg.m^{-3}$	20.3	8.0	300	Yes
Oxides of Nitrogen (NOx) as NO_2	$mg.m^{-3}$	14.7	6.9	50	Yes
Total Volatile Organic Carbon (VOC)	$mg.m^{-3}$	21.5	0.85	80	Yes
Sulphur Dioxide (SO_2)	$mg.m^{-3}$	7.8	7.3	50	Yes
Volumetric Flow Rate (Ref.)	$m .hr^{-1}$	6,005	-	9,500	Yes

ccreditation details

Air Scientific Limited	INAB Number: 319T

Executi e Summary

Process details

Stack Name	A2
Process status	Commissioning Stage
Capacity per our if applicable	Variable
Continuous or Batc Process	Continuous
Feedstock	Glass
batement System	Bag Filters / Cyclones
batement Systems Running Status	As Normal
Fuel	Gas
Plume ppearance	None
Ot er information	None

Executi e Summary

onitoring Equipment nalytical et ods

Parameter	Standard	Tec nical Procedure	ccredited Testing	nalytical Tec nique	Equipment edia	Equipment ID sed on Site
Carbon Monoxide (CO)	EN15058:2006	2004	Yes	NCIR By Horiba PG-250	Horiba	ASLLK12EQ505 ASLLK12EQ506 ASLLK12EQ525 ASLLK12EQ527 ASLLK13EQ500 ASLLK13EQ518 ASLLK14EQ506 ASLLK14EQ510
Oxides of Nitrogen (NOx) as NO_2	EN14792:2006	2002	Yes	Chemiluminescence	Horiba	
Total Volatile Organic Carbon (TOC)	EN12619:2012	2009	Yes	Flame Ionisation Detection	FID	
Sulphur Dioxide (SO2)	NDIR AG2	2003	Yes	Non Dispersive Infra Red	Horiba	
Volumetric Flow Rate	EN 16911:2013	2005	Yes	Manometer / Pitot / Calculation	Manometer / Pitot / Calculation	

Sampling De iations

Parameter	De iation
EN	None
EN	None
EN	None
NDIR G	None
Flow Rates	EN 16911 - in accordance with MID 6911-1

Reference Documents

Risk Assessment (RA)	SOP 1011
Site Review (SR)	SOP 1015
Site Specific Protocol (SSP)	SOP 1015

Suitability of Sample ocation

General Information	
Permanent/Temporary	Permanent
Inside/ Outside	Inside

Platform Details		
Iris EP Tec nical Guidance Note G BS EN Platform Requirements	**Value**	**Comment**
Sufficient Working area to manipulate probe and measuring instruments	Yes	-
Platform has 2 handrails (approx. 0.5m & 1.0 m high)	Yes	-
Platform has vertical base boards (approx. 0.25 m high)	Yes	-
Platform has chains / self-closing gates at top of ladders	No	-
There are no obstructions present which hamper insertion of sampling equipment	Yes	-
Safe Access Available	Yes	-
Easy Access Available	Yes	-

Sampling ocation Platform Impro ement Recommendations
None

BSEN Homogeneity Test Requirements
Not Required

Stack Diagram

-

PPENDICES

ppendix I onitoring Personnel Equipment

Stack Emissions onitoring Personnel

Team eader	**Name**	Mark McGarry
	System appro al	ASL Team Leader Approved
Tec nician	**Name**	Daniel Mullins
	System appro al	ASL Technician Approved

ppendix II Stack Raw Data

Title:	***Determination of Combustion Flue Gases***
Method:	EN 14792 / EN 14789 / EN 12039 / TGN M21
Client:	Rehab Glassco
Test Date:	17/12/2014
Stack Name	A2

Reference Conditions

Measured Oxygen	19.2	%
Reference Oxygen	19.2	%

Parameter		CO	NO	SO_2	O_2
Emission imit Values	$mg.m^{-3}$ ref	300	50	50	-
Instrument Range	ppm	200	500	1000	25
Span Gas Value	ppm	152	352	650	20.9
Acceptable Gas Range	-	Yes	Yes	Yes	Yes
Calibration Gas Uncertainty	%	0.4	0.9	0.8	0.5
uality ssurance	Units				
Conditioning Unit Temperature	C	2	2	2	2
Average Temperature	< C	2	2	2	2
Allowable Temperature	-	4	4	4	4
Temperature Acceptable	-	Yes	Yes	Yes	Yes
Pump flow rate	l/min.	0.4	0.4	0.4	0.4
ero Drift	Units				
Zero (Pre)	ppm	0.4	0	0	0
Zero (Post)	ppm	-0.1	1.3	-1	0.08
Zero drift	ppm	-0.5	1.3	-1	0.08
Allowable Zero Drift (Less than)	ppm	3.04	7.04	13	0.418
Adjustable Zero Drift (Less than)	ppm	7.60	17.6	32.5	1.045
Zero Drift Failure (Greater than)	ppm	7.60	17.6	32.5	1.045
Zero Drift Acceptable	-	Yes	Yes	Yes	Yes
Span Drift	Units				
Span Down (Pre)	ppm	153.8	352.1	647	20.9
Span Down (Post)	ppm	154	358	651	20.6
Span Drift	ppm	0.2	5.9	4	-0.3
Allowable Span Drift (less than)	ppm	3.04	7.04	13	0.418
Adjustable Span Drift (Less than)	ppm	7.6	17.6	32.5	1.045
Span Drift Failure (Greater than)	ppm	7.6	17.6	32.5	1.045
Span Drift Acceptable (Y/N)	-	Yes	Yes	Yes	Yes
eak C eck					
Span Gas Conc.	ppm	152	352	650	20.9
Recorded Conc. down Line	ppm	153.8	352.1	647	20.9
Leak Detected	ppm	1.8	0.1	-3	0
Leak check acceptable (< 2%)	ppm	3.04	7.04	13	0.418
Pass	(Y/N)				
Test Conditions	Units				
Run Ambient Temperature Range	C	16	16	16	16

Raw Data

Date/Time	Data source	CO ppm	CO_2 vol%	NOx ppm	O_2 vol%	SO_2 ppm
18/12/2014 11:38		37.657	0.280	0.871	20.219	3.143
18/12/2014 11:39		17.850	0.738	4.658	19.445	3.333
18/12/2014 11:40		24.908	0.778	5.467	19.379	3.250
18/12/2014 11:41		22.275	0.594	3.383	19.635	3.083
18/12/2014 11:42		9.700	0.973	7.400	19.113	3.083
18/12/2014 11:43		10.000	0.990	7.350	19.157	3.000
18/12/2014 11:44		8.742	1.004	7.392	19.182	2.667
18/12/2014 11:45		10.058	1.012	7.233	18.998	3.500
18/12/2014 11:46		8.208	1.020	7.317	18.974	2.250
18/12/2014 11:47		8.717	1.023	7.417	18.982	3.083
18/12/2014 11:48		9.000	1.029	7.592	18.999	2.667
18/12/2014 11:49		9.625	1.037	7.667	19.013	3.167
18/12/2014 11:50		10.992	1.042	7.575	19.039	2.583
18/12/2014 11:51		10.800	1.047	7.583	19.036	2.333
18/12/2014 11:52		12.933	1.051	7.517	19.043	2.667
18/12/2014 11:53		17.275	1.053	7.300	18.963	2.833
18/12/2014 11:54		15.300	1.055	7.383	19.014	2.333
18/12/2014 11:55		10.767	1.050	7.708	19.050	3.000
18/12/2014 11:56		8.917	1.056	7.742	19.041	2.833
18/12/2014 11:57		7.550	1.062	7.800	18.902	2.500
18/12/2014 11:58		7.967	1.062	7.942	18.957	2.667
18/12/2014 11:59		9.142	1.067	21.592	18.985	2.333
18/12/2014 12:00		12.525	1.065	10.467	18.986	2.833
18/12/2014 12:01		18.542	1.067	8.258	18.985	2.833
18/12/2014 12:02		32.875	0.577	3.992	19.691	1.917
18/12/2014 12:03		16.092	0.892	6.383	19.189	2.750
18/12/2014 12:04		30.925	0.914	6.867	19.118	3.000
18/12/2014 12:05		32.425	0.422	2.417	19.843	2.750
18/12/2014 12:06		24.342	1.054	7.783	18.636	1.333
18/12/2014 12:07		30.350	0.474	4.408	19.826	2.583

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Referenced Data

	CO	*NOx*	*SO_2*
	mg/Nm³ Reference O_2		
18/12/2014 11:38	47.1	1.8	9.0
18/12/2014 11:39	22.3	9.6	9.5
18/12/2014 11:40	31.1	11.2	9.3
18/12/2014 11:41	27.8	6.9	8.8
18/12/2014 11:42	12.1	15.2	8.8
18/12/2014 11:43	12.5	15.1	8.6
18/12/2014 11:44	10.9	15.2	7.6
18/12/2014 11:45	12.6	14.9	10.0
18/12/2014 11:46	10.3	15.0	6.4
18/12/2014 11:47	10.9	15.2	8.8
18/12/2014 11:48	11.2	15.6	7.6
18/12/2014 11:49	12.0	15.7	9.1
18/12/2014 11:50	13.7	15.6	7.4
18/12/2014 11:51	13.5	15.6	6.7
18/12/2014 11:52	16.2	15.4	7.6
18/12/2014 11:53	21.6	15.0	8.1
18/12/2014 11:54	19.1	15.2	6.7
18/12/2014 11:55	13.5	15.8	8.6
18/12/2014 11:56	11.1	15.9	8.1
18/12/2014 11:57	9.4	16.0	7.2
18/12/2014 11:58	10.0	16.3	7.6
18/12/2014 11:59	11.4	44.3	6.7
18/12/2014 12:00	15.7	21.5	8.1
18/12/2014 12:01	23.2	17.0	8.1
18/12/2014 12:02	41.1	8.2	5.5
18/12/2014 12:03	20.1	13.1	7.9
18/12/2014 12:04	38.7	14.1	8.6
18/12/2014 12:05	40.5	5.0	7.9
18/12/2014 12:06	30.4	16.0	3.8
18/12/2014 12:07	37.9	9.1	7.4

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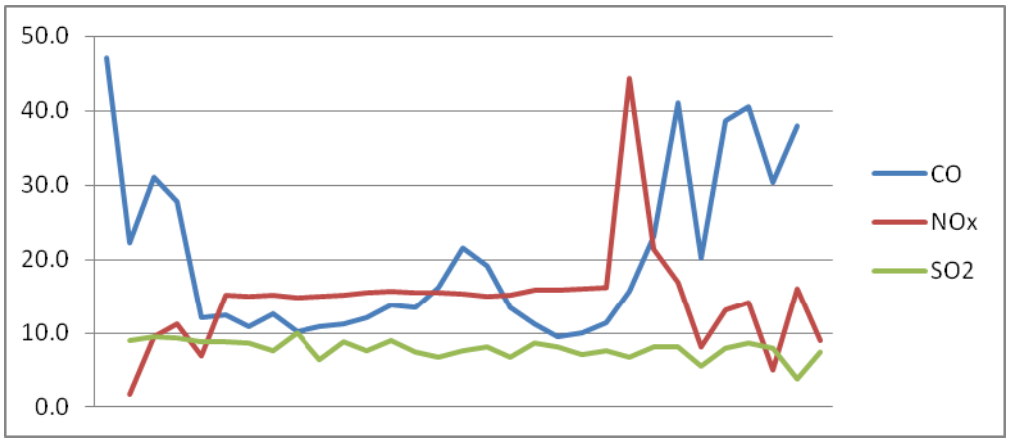
Standard Requirement



Title:	***Determination of Total Organic Compounds***
Method:	EN 12619:2013
Client:	Rehab Glassco
Stack Reference:	A2

icence imits		
Emission Limit Value	80	$mg.m^{-3}$
Flow Rate Limit	9500	$m^3.Hr^{-1}$
Results		
TOC Concentration	21.5	$mg.m^{-3}$
Flow Rate	6,005	$m^3.Hr^{-1}$
Uncertainty of Measurement	0.85	$mg.m^{-3}$
Reference Conditions		
Temperature (K)	273.13	^0K
Pressure (kPa)	101.3	kPa
Gas (Wet or Dry)	0	
Oxygen	19.2	%
Quality Data		**nits**
Sampling Time	11:07	-
Sampling Date	17/12/2014	-
Instrument Range	100	ppm
Span Gas Value	78	ppm
Acceptable Gas Range	Yes	50 - 90% of Range
Oven Temperature	189.6	^0C
Average Temperature	189.6	^0C
Temperature Acceptable	Yes	Yes or No
Sample line temperature	180	C
Zero Drift		**nits**
Zero Down Sampling Line (Pre)	0	ppm
Zero Down Sampling Line (Post)	1.1	ppm
Zero drift	1.1	ppm
Allowable Zero Drift	1.56	ppm
Zero Drift Acceptable	Yes	Yes or No
Span Drift		**nits**
Span (Pre)	77.7	ppm
Span (Post)	76.7	ppm
Span Drift	-1	ppm
Allowable Span Drift	1.56	ppm
Span Drift Acceptable	Yes	Yes or No
Leak Check		
Span Gas Conc.	78	ppm
Recorded Conc. down Line (Pre)	77.7	ppm
Leak Result	-0.3	ppm
Leak check acceptable (< 2%)	1.56	(Y/N)
Parameter		
Standard	EN 12619:2013	
Technical Procedure	2009	
Probe material	Stainless Steal	
Filtration Type	Ceramic	
Heated Head Filter Used	Stainless Steal	
Heated Line Temperature	>180	Deg C
Span Gas Reference Number	ASLLK14ING524	
Span Gas Expiry Date	2017	
Span Gas Start Pressure (bar)	60	bar
Gas Cylinder Concentration (ppm)	78	ppm
Span Gas Uncertainty (%)	0.8	%
Zero Gas Type	Ambient	
Number of Sampling Lines Used	1	
Number of Sampling Points Used	1	

Sample Point I.D's	1	
Certified Range of Analyser	10000	ppm
Operational Range of Analyser	100	ppm
Measured Reading	13	ppm
Non linearity	0.5	ppm
Temperature Dependent Zero drift	0.15	ppm Per Degree
Temperature Dependent Span drift	0.1	% Per Degree
Cross-sensitivity	0.1	ppm
Leak	-0.3	ppm
Calibration Gas uncertainty	0.8	ppm
Calibration Gas uncertainty	0.8	ppm
Stack Concentrations		
Oxygen	19.2	%
Moisture	10.9	%
CO_2	0.916	%

Title:	***Determination of Total Organic Compounds***
Method:	EN 12619:2013
Client:	Rehab Glassco
Stack Reference:	A2

Run 1	**Time**	**ppm**	mg.m^{-3}
1	11:07:00	13.3	21.4
2	11:08:00	12.9	20.8
3	11:09:00	12.0	19.3
4	11:10:00	12.5	20.1
5	11:11:00	13.5	21.7
6	11:12:00	11.0	17.7
7	11:13:00	11.5	18.5
8	11:14:00	11.6	18.7
9	11:15:00	1.9	3.1
10	11:16:00	11.5	18.5
11	11:17:00	12.1	19.5
12	11:18:00	3.2	5.2
13	11:19:00	12.5	20.1
14	11:20:00	12.4	20.0
15	11:21:00	12.6	20.3
16	11:22:00	12.9	20.8
17	11:23:00	13.1	21.1
18	11:24:00	10.9	17.5
19	11:25:00	13.4	21.6
20	11:26:00	10.2	16.4
21	11:27:00	12.4	20.0
22	11:28:00	11.2	18.0
23	11:29:00	10.6	17.1
24	11:30:00	14.6	23.5
25	11:31:00	10.6	17.1
26	11:32:00	13.0	20.9
27	11:33:00	13.4	21.6
28	11:34:00	13.0	20.9
29	11:35:00	19.4	31.2
30	11:36:00	14.5	23.3

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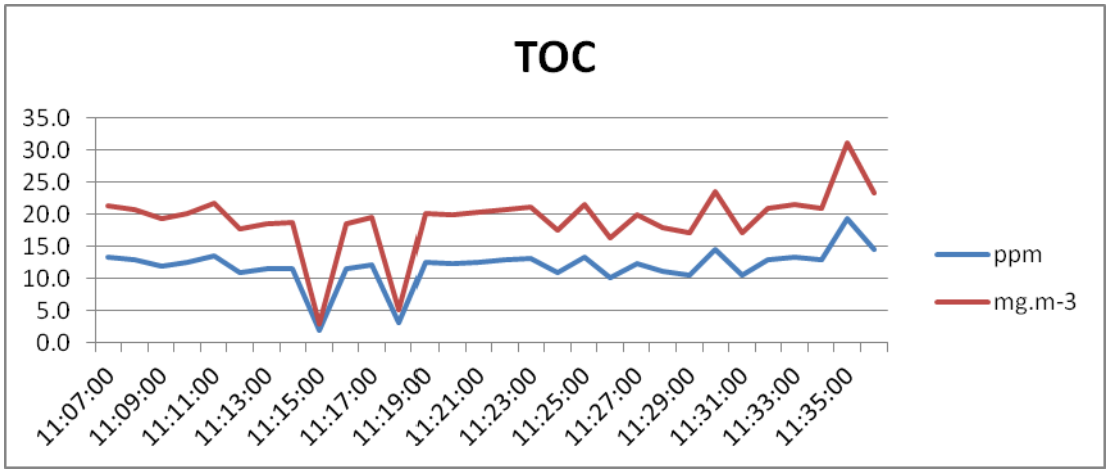


Title:	***Determination of Stack Flow Rate***
Method:	EN 16911
Client:	Rehab Glassco
Stack Reference:	A2

Stack details	**Value**		**nits**
Date of survey	17/12/2014		
Time of survey	11:07		
Type	Circular		
Stack Diameter / Depth, D	0.45	**engt m**	m
Stack Width, W			m
Average Stack Gas Temp., Ta	72.5	345.65	C
Average Static Pressure, P static	0.015		kPa
Average Barometric Pressure, Pb	99.1		kPa
Type of Pitot	S		
Are Water Droplets Present ?	No		
Average Pitot Tube Calibration Coeff, Cp	0.82		
No local negative flow	No		
Highly homogeneous flow stream/gas velocity	Yes		
Sample Port Size	101.6		mm
Initial Pitot Leak Check	Pass		Pa
Final Pitot Leak Check	Pass		Pa
Orientation of Duct	Vertical		
Pitot Tube Cp	0.998		
Number of Lines Available	2		
Number of Lines Used	2		

Sampling ine

Point	**Distance**	**Pa**	**Temp C**	**Velocity**	**Oxygen**	**Swirl**
1	0.11	153	72.5	15.1	20.9	<15
2	0.34	173	72.5	16.1	20.9	<15
3	-	-	-	-	-	-
4	-	-	-	-	-	-
5	-	-	-	-	-	-
6	-	-	-	-	-	-
7	-	-	-	-	-	-
8	-	-	-	-	-	-
9	-	-	-	-	-	-
10	-	-	-	-	-	-
Average		163	72.5	15.60	20.90	<15.00
Min		153	72.5	15.12	20.9	<15
Max		173	72.5	16.08	20.9	<15

Sampling ine B

Point	**Distance**	**Pa**	**Temp C**	**Velocity**	**Oxygen**	**Swirl**
1	0.11	132	72.5	14.0	20.9	15
2	0.34	164	72.5	15.7	20.9	15
3	-	-	-	-	-	-
4	-	-	-	-	-	-
5	-	-	-	-	-	-
6	-	-	-	-	-	-
7	-	-	-	-	-	-
8	-	-	-	-	-	-
9	-	-	-	-	-	-
10	-	-	-	-	-	-
Average		148	72.5	14.85	20.9	<15.00
Min		132	72.5	14.05	20.9	<15
Max		164	72.5	15.66	20.9	<15

erage stack Gas Velocity	15.23	m/s
Lowest Differential Pressure	132.00	Pa
Lowest Gas Velocity	14.05	m/s
Highest Gas Velocity	16.08	m/s
Average Differential Pressure	155.50	Pa
Velocity Ratio of High to Low (3:1)	1.13	
Average Angle of flow	<15	

Component	**Conc ppm**	**Conc Dry**	**Conc Wet**	**olar ass**
Carbon Dioxide CO2	-	0.916		44.01
Oxygen O2	-	19.2		32
Nitrogen N2	-	79.884		28.1
Moisture (H2O)	-	-	10.9	18.02

Reference Conditions	**nits**	**Numbers**
Temperature	C	273.13
Total Pressure	kPa	101.3
Moisture	%	-
Oxygen (Dry)	%	19.2

General Stack Details

Stack details	**nits**	**Value**		
Stack Diameter / Depth, D	m	0.45		
Stack Width, W	m	0		
Stack Area, A	m^2	0.16		
Average Stack Gas Temp., Ta	C	72.5	345.65	K
Average Static Pressure, P static	kPa	0.015		
Average Barometric Pressure, Pb	kPa	99.1		
Average Pitot Tube Calibration Coeff, Kpt		0.85		

Calc box rea

Circular Duct		**Rectangular Duct**	
R =	0.225	Length (m)	0
R2 =	0.050625	Width (m)	0
Area = Pie*R2	0.16	Area	0

Stack Gas Composition olecular Weig ts

Component	**olar ass**	**Density Kg m p**	**Conc Dry**	**Dry Volume Fraction r**
Carbon Dioxide CO2	44.01	1.96	0.916	0.00916
Oxygen O2	32	1.43	19.2	0.192
Nitrogen N2	28.1	1.25	79.884	0.79884
Moisture (H2O)	18.02	0.80		

where p=M/22.41
pi = r x p

	Dry Conc kg m pi	**Conc wet**	**Wet Volume Fraction r**	**Wet Conc kg m pi**
Carbon Dioxide CO2	0.02	0.82	0.01	0.02
Oxygen O2	0.27	17.11	0.17	0.24
Nitrogen N2	1.00	71.18	0.71	0.89
Moisture (H2O)	-	10.9	0.11	0.09

Calculation of Stack Gas Densities

Determinant	nits	Result
Dry Density (STP), P STD	kg/m^3	1.294
Wet Density (STP), P STW	kg/m^3	1.246
Dry Density (Actual), P Actual	kg/m^3	1.000
Average wet Density (Actual), P ActualW	kg/m^3	0.963

W ere

P STD = sum of component concentrations, kg/m3 (excluding water vapour)
P STW = (P STD + pi of H2O) / (1 + (pi of H2O / 0.8036))
P actual = P STD x (T STP / (P STP)) x (Pa / Ta)
P actual W (at each sampling point) = P STW x (Ts / Ps) x (Pa / Ta)

Calculation of Stack Gas Volumetric Flow rate

Duct gas flow conditions	nits	ctual	REF
Temperature	K	345.65	273.13
Total Pressure	kPa	99.1	101.3
Moisture	%	10.9	-
Oxygen (Dry)	%	19.2	19.2

Gas Volumetric Flow rate	nits	Result
Gas Volumetric Flow Rate (Actual)	m^3/hr	8719
Gas Volumetric Flow Rate (STP, Wet)	m^3/hr	6740
Gas Volumetric Flow rate (STP, Dry)	m^3/hr	6005
Gas Volumetric Flow rate REF to Oxygen	m^3/hr	6005

W ere

Actual = Va * A * 3600
STP Wet =Actual x (Ts / Ta) x (Pa / Ps) x 3600
STP , Dry = STP Wet / (100 - (100 / Water Vapour %))
REF = STP Dry x (100 - Water Vapour %) / (100 - Water Vapour Ref)) x (20.9 - O_2m)/ (20.9 -O_2 Ref)

Sampling Plane Validation Criteria	Value	nits	Requirement	Compliance	et od
Lowest Differential Pressure	132.00	Pa	>5 Pa	Pass	EN16911
Lowest Gas Velocity	14.05	m/s	-	-	-
Highest Gas Velocity	16.08	m/s	-	-	-
Ratio of Above	1.14	:1	<3:1	Pass	EN16911
Mean Velocity	15.23	m/s	-	-	-
Angle of flow	15	degrees	< 15	Pass	EN16911
No local negative flow	No	-	-	-	-
Homogeneous flow	Yes	-	-	-	-

Calculation of stack Gas Velocity V

Velocity at Traverse Point, V = Kcp * Sqroot ((2 * DP) / Density) 322.9837292

W ere

Kpt = Pitot tube calibration coefficient 0.82
Compressibility correction factor, assumed at a constant 0.998 0.998

Appendix I.2.1: Interceptor Monitoring Report (Boylan Engineering, January 2015)

INTERCEPTOR MONITORING REPORT FOR REHAB GLASSCO LTD W0279-01

Client: **REHAB GLASSCO LTD**

Site Location: **UNIT 4 OBERSTOWN INDUSTRIAL PARK CARAGH ROAD NAAS** **COUNTY KILDARE**

Report No.: JN-1488-01-02-01-01- Rev 0

Report Issue: Week 4 December 2014

Produced by: Bróna Keating, B.Sc, Dip. Environmental Eng. M.Sc. MCIWM

Approved by: **Date:** 28th January 2015

Cathal Boylan, BEng, CEng, MIEI
CHARTERED ENGINEER

Boylan Engineering
Company Reg. 430482
Address: Main St., Mullagh, Kells Co. Meath.
Phone: 046 – 928 6000 / 087 – 820 5470
Fax: 046 – 928 6002
Email: info@boylanengineering.ie
Web: www.boylanengineering.ie

Rev.	Date	Description

I SUMMARY

Boylan Engineering (Eng. & Environmental Consultancy) was commissioned by the Rehab Glassco Ltd to carry out interceptor discharge monitoring at Unit 4 Osberstown Industrial Park, Caragh Road, Naas, Co Kildare for December 2014. Rehab Glassco Ltd currently operate under an EPA waste licence which was granted in December 2014. This license is referenced as W0279-01 and was granted subsequent to an application to the EPA which began in 2011. In conjunction with this licence there are various conditions as regards monitoring of emissions form the site. One such requirement is weekly interceptor discharge monitoring and analysis for various parameters. The purpose of such sampling and analysis is to create a data set of results which can then be closely examined within 6 months of receiving of the site licence in a bid to create suitable trigger levels for all parameters. As this exercise is predominantly being undertaken in a bid to establish trigger levels, the EPA have not outline Emission Limit Values. The results of this monitoring are presented in Table 1.0 and 2.0.

Bróna Keating, Environmental Engineer carried out all monitoring. This report shall document the findings.

Table of Contents

1. INTRODUCTION

The purpose of this report is to examine the discharge from the interceptor units at this site to insure that the discharges from these units do not contain contaminants which could potentially cause harm to the surrounding Environs.The following reports give details of the discharge sampling programme conducted on site and also summarises findings and analytical results of sampling from week 1 January 2015.

3.0 METHODOLOGY

2.1 Water Sampling

The following procedure was conducted by Boylan Engineering to ensure accurate waste water monitoring:

- ISO 5667: Guidance on sampling of waters was adhered to.
- Samples were taken by grab sample using a Telescoup and Pendulum beaker.
- Samples are fixed on site using appropriate fixing agents where applicable.

2.2 Sampling Personnel

Sampling was conducted by Bróna Keating B.Sc (Hons)., M.Sc., MCIWM of Boylan Engineering on the 30th December 2014.

2.3 Laboratory Details & Analysis

- Samples were sent to Old Castle Laboratories for analysis of the required parameters in designated cool boxes with ice packs. These boxes insure that samples are maintained at a consistent temperature between 0 ºC and 4ºC on their journey to the laboratory.
- On arrival at the laboratory, samples were stored between 0 ºC and 4 ºC.
- All samples received are inspected by Laboratory Manager.
- All samples are assigned a unique reference number and are recorded on the Laboratory Information Management System (LIMS)
- All staff involved in the analysis of samples hold a minimum honours science degree.
- In the event of a Quality Control Check failure for a given parameter, a note will be included on the analysis report detailing the QC fail.
- Analysis of samples is conducted under the INAB accreditation and associated quality control procedures are employed in every aspect of analysis.
- Analysis methods are listed in Appendix II

2.4 Monitoring Locations

SW1: The monitoring location detailed as SW1 is accessed by means of a ground level manhole situated at the northern side of the drying plant. This unit receives runoff form the western portion of the site which was the original site prior to the 2009 extension.

SW2: The monitoring location detailed as SW2 is accessed by means of a ground level manhole adjacent to the input material stockpiles. This unit receives runoff form the eastern portion of the site which comprises an extension completed in 2009.

2.5 Interpretation of Results

The results obtained from this monitoring even are presented in tabular form in the following section. The EPA have not specified Emission Limit Values within this licence and therefore the results are not compared to any other values. The results of this weekly analysis will be compiled for a number of months so as to establish a set of trigger levels representative of this particular site.

3.0 SUMMARY OF RESULTS

Table 1.0 Week 1 January interceptor discharge monitoring 2015

Monitoring Date:		07/01/2015						
Report Number:		81948						
Method				**TM2128**	**TM2132**	**TM2122**	**-**	**TM2124**
Method Number		**Site Tests**						
Parameter		Visual Inspection	Odour	pH	Conductivity	BOD	Mineral Oil	Total Suspended Solids
Units		-	-	pH @20°C	uS/cm	mg/l	mg/l	mg/l
Limit of Detection		-	-					
Date Testing Initiated		7.1.15		08.01.15				
ELS Ref	**Client Ref**							
81948	SW 1	Clear	None	6.9	-	117	0.267	52
81948	SW 2			7.5	-	>5	0.061	12
NOTES								
1	Sub-contract analysis denoted by *							
2	ND - Concentration was below the limit of detection							

Table 2.0 Historical Results

	Parameter	pH	Conductivity	BOD	Mineral Oil	Total Suspended Solids
	Units	pH @20°C	uS/cm	mg/l	mg/l	mg/l
SW 1	Week 1 January 2015	6.9	-	117	0.267	52
	Week 4 December 2014					
	Week 3 December 2014					
SW 2	Week 1 January 2015	7.5	-	>5	0.061	12
	Week 4 December 2014	7.4	-	5	0.112	16
	Week 3 December 2014	6.87	730	49	1.17	26.5

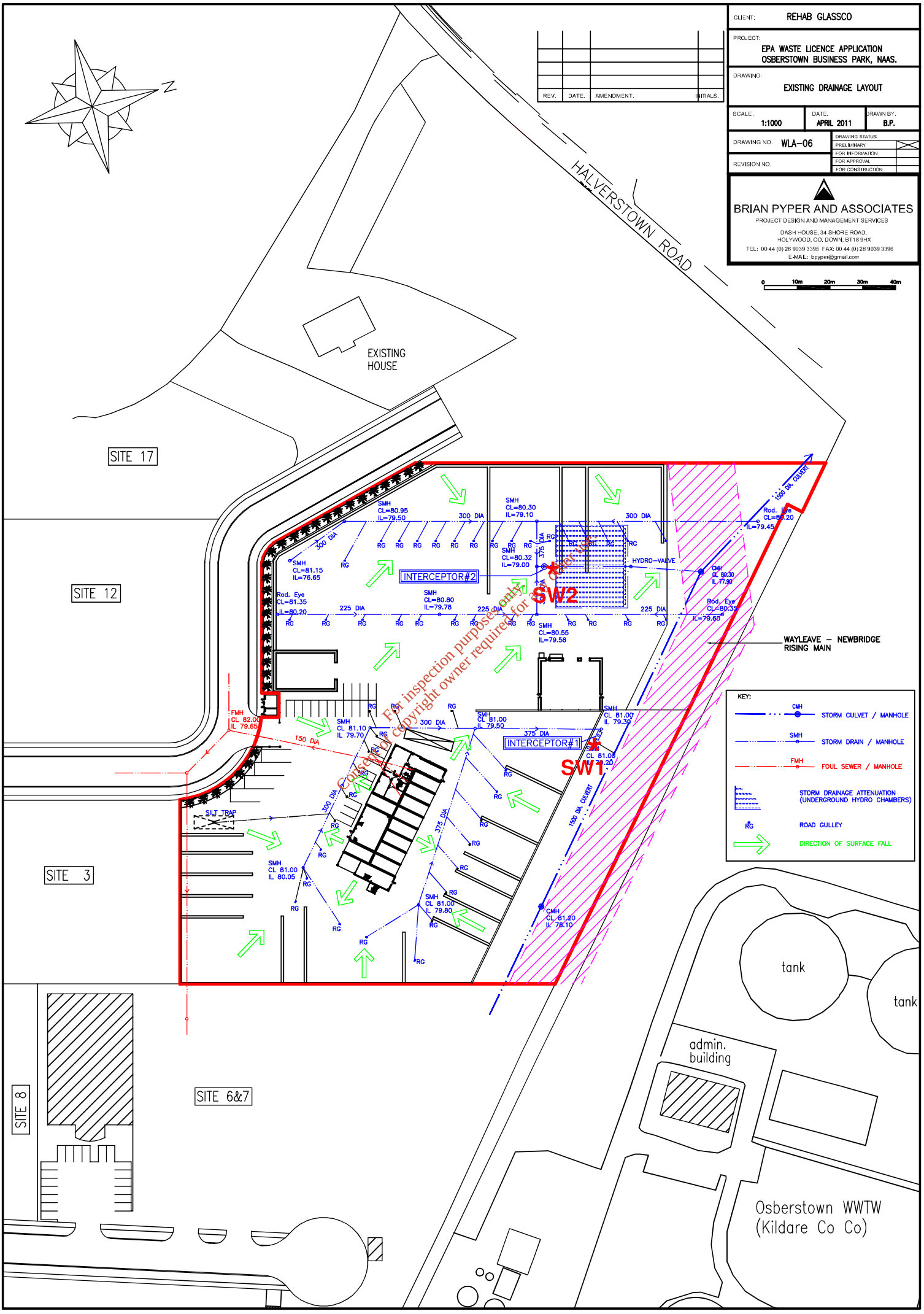
4.0 DISCUSSION

Waste water

Waste water monitoring is carried out weekly at two one waste water monitoring locations at the Rehab Glassco site. The results obtained from SW1 and SW2 are indicative of soiled runoff from a commercial premises.

5.0 CONCLUSION

Samples are currently being obtained on a weekly basis where possible. All results will be submitted to the EPA as well as being compiled for eventual consideration of trigger levels for this site.



ELS LTD INAB ACCREDITATION SCHEDULE SUMMARY SHEET

Miscellaneous (P,G,W,S)
Ammonia/Ammonium 0.007-1mg/l N EW003
Chloride 2.6-250 mg/l EW015
Flouride 0.1 - 2 mg/l EW137
COD 8-1500 mg/l EW094
Nitrate 0.12-50 mg/l N EW034
Nitrite 0.013-1 mg/l N EW035
pH 4 – 10 pH Units EW138
Phosphate 0.009-1 mg/l P EW007
Alkalinity 10-1000mg/l EW062
TOC 0.25-100mg/l EW123
BOD 1-1300mg/l EW001
Total Nitrogen 1-100mg/l N EW140
Total Phosphorous 0.01-40 mg/l P EW143

Miscellaneous (P,G,S)
Bromate 1 to 50ug/l BRO3 (EW137)
Colour 2.5-50mg/l PtCCo (EW021)
Conductivity 25-6000 us/cm EW139
Dissolved Oxygen 1 to 10 mg/l (EW043)
Sulphate 1-250mg/l SO4(EW016)
Suspended Solids 5-1000mg/l (EW013)
Total Dissolved Solids 15-1000mg/l (EW046)
Total Hardness 3-330mg/l CaCO3 (EM099)
Total Oxidised Nitrogen 0.138-51mg/l N (EW051)
Turbidity 0.11-150 NTU (EW136)
TKN Calculation 1-49 mg/l (EW010)

Metals EM130 (P,G,S)
Aluminium 5.0 – 500 µg/l
Antimony 0.1 – 10µg/l
Arsenic 0.2 - 20µg/l
Barium 1.0 - 100µg/l
Boron 0.02 – 2mg/l
Cadmium 0.1 – 10µg/l
Calcium 1.0 – 100mg/l
Chromium 1.0 - 100µg/l
Cobalt 1.0 - 100µg/l
Copper 3 - 4000µg/l
Iron 20.0 - 500µg/l
Lead 0.3 - 30µg/l
Magnesium 0.3 – 20mg/l
Manganese 1.0 - 100µg/l
Mercury 0.02 - 2µg/l
Molybdenum 1.0 - 100µg/l
Nickel 0.5 - 50µg/l
Potassium 0.2 – 20mg/l
Selenium 0.2 - 20µg/l
Sodium 0.5 – 50mg/l
Strontium 1.0 - 100µg/l
Tin 1.0 - 100µg/l
Vanadium 1.0 - 100µg/l
Zinc 1.0 - 100µg/l

SI439 Potable Water VOCs & THM
EO025 (P,G,S)
Benzene 0.1-35 µg/l
1.2-Dichloroethane 0.1-35 µg/l
Tetrachloroethene 0.1-35 µg/l
Trichloroethene 0.1-35 µg/l
Chloroform 1.0-150 µg/l
Bromoform 1.0-35 µg/l
Dibromochloromethane 1.0-35 µg/l
Bromodichloromethane 2.0-35 µg/l

Other VOC's EO025 (P,G,S)
Bromomethane 0.5 - 35 µg/l
Ethyl Ether/Diethyl Ether 0.5 - 35 µg/l
11 Dichloroethene 0.5 - 35 µg/l
Iodomethane/Mehyl Iodide 0.5 - 35 µg/l
Carbon Disulphide 0.5 - 35 µg/l
Allyl Chloride 0.5 - 35 µg/l
Methylene Chloride/DCM 5.0 - 35 µg/l
2-Propenenitrile/Acrylonitrile 2.0 - 35 µg/l
Chlormethyl Cyanide 0.5 - 35 µg/l
Hexachlorobutadiene 0.5 - 35 µg/l
Trans-1,2 Dichloroethene 0.5 - 35 µg/l
MtBE 0.5 - 35 µg/l
11 Dichloroethane 0.5 - 35 µg/l
22 Dichloropropane 0.5 - 35 µg/l
Cis-12 Dichloroethene 0.5 - 35 µg/l
Methyl Acrylate 5.0 - 35 µg/l
Bromochloromethane 0.5 - 35 µg/l
Tetrahydrofuran 5.0 - 35 µg/l
111 Trichloroethane 0.5 - 35 µg/l
1-Chlorobutane 0.5 - 35 µg/l
Carbon Tetrachloride 0.5 - 35 µg/l
11 Dichloropropene 0.5 - 35 µg/l
12 Dichloropropane 0.5 - 35 µg/l
Dibromomethane 0.5 - 35 µg/l
Methyl Methacrylate 0.5 - 35 µg/l
13 Dichloropropene, cis 2.0 - 35 µg/l
MIBK/4 Methyl 2 Pentanone 2.0 - 35 µg/l
Toluene 0.5 - 35 µg/l
13 Dichloropropene,trans 2.0 - 35 µg/l
Ethyl Methacrylate 2.0 - 35 µg/l
112 Trichloroethane 0.5 - 35 µg/l
13 Dichloropropane 0.5 - 35 µg/l
2 Hexanone 1.0 - 35 µg/l
12 Dibromoethane 0.5 - 35 µg/l
Chlorobenzene 0.5 - 35 µg/l
1112 Tetrachloroethane 2.0 - 35 µg/l
Ethyl Benzene 0.5 - 35 µg/l
m & p Xylene 0.5 - 35 µg/l
O Xylene 0.5 - 35 µg/l
Stryene 2.0 - 35 µg/l
Isopropyl Benzene 0.5 - 35 µg/l
Bromobenzene 0.5 - 35 µg/l
1122 Tetrachloroethane 0.5 - 35 µg/l
123 Trichloropropane 2.0 - 35 µg/l
Propyl Benzene 0.5 - 35 µg/l
2-Chlorotoluene 0.5 - 35 µg/l
4 Chlorotoluene 0.5 - 35 µg/l
135 Trimenthylbenzene 0.5 - 35 µg/l
Tert Butyl Benzene 0.5 - 35 µg/l
124 Trimethlbenzene 0.5 - 35 µg/l
Sec Butyl Benzene 0.5 - 35 µg/l
13 Dichlorobenzene 0.5 - 35 µg/l
P Isopropyltoluene 0.5 - 35 µg/l
14 Dichlorobenzene 0.5 - 35 µg/l
12 Dichlorobenzene 0.5 - 35 µg/l
N Butyl Benzene 0.5 - 35 µg/l
Hexachloroethane 5.0 - 35 µg/l
12 Dibromo 3Chloropropane 2.0 - 35 µg/l
124 Trichlorobenzene 0.5 - 35 µg/l
123 Trichlorobenzene 0.5 - 35 µg/l

PAH EO129 (P,G,S)
Range 0.01 - 0.2 µg/l
Acenaphthene
Benzo (a) Anthracene
Benzo (a) Pyrene
Benzo (b) Fluoranthene
Benzo (ghi) Perylene
Benzo (k) Fluoranthene
Chrysene
Dibenzo (ah) Anthracene
Fluoranthene
Fluorene
Indeno (123-cd) Pyrene
Phenanthrene
Pyrene

Acid Herbicides (P,G,S)
Range 0.01 - 0.2 µg/l
2,4,5-T H
2,4-D H
2,4-DB H

Organophosphorus Pesticides(P,G,S)
Range 0.01 - 0.2 µg/l
Famphur OP
Methyl Parathion OP
Parathion OP

Organochlorine Pesticides (P,G,S)
Range 0.01 - 0.2 µg/l
Aldrin
BHC Alpha isomer OC
BHC Beta isomer OC
BHC Delta isomer OC
Dieldrin OC
Endosulphan Alpha isomer OC
Endosulphan Beta isomer OC
Endosulphan Sulphate OC
Endrin OC
Heptachlor Epoxide OC
Heptachlor OC
Lindane OC
P,P' DDE OC
P,P'-DDD OC
P,P'-DDT OC

Notes
1.Sample Matrix:P=Potable Water (Drinking) , G=Ground Water , S=Surface Water, W=Waste Water

ENVIRONMENTAL LABORATORY SERVICES
Acorn Business Campus
Mahon Industrial Park,
Blackrock,
Cork
Ireland
Tel: +353 21 453 6141
Fax: +353 21 453 6149
Web: www.irishwatertesting.com
email: info@elsltd.com

Contact Name	Brona Keating	**Report Number**	
Address	Boylan Engineering Main Street, Mullagh,	**Sample Number**	81948/002
		Date of Receipt	08/01/2015
		Date Started	08/01/2015
Tel No	046 9286000	**Received or Collected**	Fastway
Fax No		**Condition on Receipt**	Good
Customer PO	Not Required	**Date of Report**	27/01/2015
Quotation No	QN003556	**Sample Type**	Surface Waters
Customer Ref	SW 1 January		

LRN		**Category**	**Entity**	
Station		**Template**		
Laboratory	**Analyst**	**SampleDate**	**SampleTime**	**SampleMethod**
SampleReason		**SampleNotes**		

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
BOD									
	BOD		EW001	1		117	mg/L	INAB	
GCFID TPH Split									
	TPH >C10 - C20 (DRO)		EO063	10		193	ug/L		
	Analyst QC Comment QC:Due to low surrogate recovery, result given is indicative								
	TPH >C20 - C40 (MO)		EO063	10		267	ug/L		
	TPH >C6 - C10 (PRO)		EO063	10		<10	ug/L		
	TPH >C6-C40 (TPH)		EO063	10		460	ug/L		
Suspended Solids									
	Suspended Solids		EW013	5		52	mg/L	INAB	
Titralab									
	pH		EW153			6.9	pH Units	INAB	

Signed : _____ 27/01/2015

NOTES
1.This Report shall not be Reproduced except in full, without the permission of the laboratory and only relates to the items tested.
2.SPEC= Allowable limit or parametric value
3.OOS=Result which is outside specification highlighted as OOS-A
4.LOQ=Limit of Quantification or lowest value that can be reported
5.ACCRED=Indicates matrix accreditation for the test,a blank field indicates not accredited
6."*" Indicates sub-contract test

ENVIRONMENTAL LABORATORY SERVICES
Acorn Business Campus
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Blackrock,
Cork
Ireland
Tel: +353 21 453 6141
Fax: +353 21 453 6149
Web: www.irishwatertesting.com
email: info@elsltd.com

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 111T

Contact Name	Brona Keating	**Report Number**	
Address	Boylan Engineering Main Street, Mullagh,	**Sample Number**	81948/003
		Date of Receipt	08/01/2015
		Date Started	08/01/2015
Tel No	046 9286000	**Received or Collected**	Fastway
Fax No		**Condition on Receipt**	Good
Customer PO	Not Required	**Date of Report**	27/01/2015
Quotation No	QN003556	**Sample Type**	Surface Waters
Customer Ref	SW 2 January		

LRN		**Category**	**Entity**	
Station		**Template**		
Laboratory	**Analyst**	**SampleDate**	**SampleTime**	**SampleMethod**
SampleReason		**SampleNotes**		

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
BOD									
	BOD		EW001	1		>5	mg/L	INAB	
	Analyst BOD Comment: Result was outside range for the dilutions used								
GCFID TPH Split									
	TPH >C10 - C20 (DRO)		EO063	10		<10	ug/L		
	TPH >C20 - C40 (MO)		EO063	10		61	ug/L		
	TPH >C6 - C10 (PRO)		EO063	10		<10	ug/L		
	TPH >C6-C40 (TPH)		EO063	10		61	ug/L		
Suspended Solids									
	Suspended Solids		EW013	5		12	mg/L	INAB	
Titralab									
	pH		EW153			7.5	pH Units	INAB	

Signed : _____ 27/01/2015

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Appendix I.6.1: Environmental Noise Survey (ORS, January 2014)

Engineering a Sustainable Future

ORS Consulting Engineers / ORS Building / Marlinstown Office Park / Mullingar, Co. Westmeath / Ireland

ORS Consulting Engineers

T 044 934 2518
F 044 934 4573
E info@ors.ie
W www.ors.ie

Environmental Noise Survey

Rehab Glassco,
Unit 4 Oberstown Industrial Park,
Caragh Road,
Naas,
Co. Kildare

January 2014

Client	Revision	Date	Compiled	Checked	Approved
Rehab Glassco	D2	27/01/2014	DH	DC	
Unit 4 Oberstown Industrial Park, Caragh Road, Naas, Co. Kildare					

Index

0 Executive Summary

An Environmental noise survey was conducted on the 16th and 17th of January 2014 at the Rehab Glassco facility at 1 noise sensitive location outside the boundary of the facility, the location of which is highlighted on the enclosed site layout drawing.

Noise arose on the site from the ingress and egress of vehicles, movement of plant about the site and process noise from the recycling plant. Other contributing sources included traffic movements on the local road, R409 and the M7 motorway. Noise arose from the adjacent site which included vehicle movements and truck engines running constant.

Noise levels were compared to those recommended limits as set out EPA document **Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)** which states that ambient/daily noise levels should not exceed 55dB LAeq, with evening noise levels not exceeding 50dB LAeq and night time noise levels not exceeding 45dB LAeq at noise sensitive locations.

Noise levels for Day Times at the Noise Sensitive Location are within acceptable limits as set out in NG4, however there is exceedance during the evening and night-time monitoring period which was very clearly attributable to external noise sources which are discussed further in this report.

1 Scope

ORS Environmental Consultants were commissioned by Rehab Glassco to conduct a Daytime, evening and Night-time broadband; one-third octave noise for predetermined locations in Oberstown Industrial Park, Caragh Road, Naas, Co. Kildare. All tests were carried out during day-time, evening and night-time operations at the facility. Rehab Glassco is a facility which recycles glass products.

Monitoring at NSL 1 was carried out on the 16th and 17th of January 2014, including day, evening and night-time monitoring.

2 Monitoring Locations

Environmental noise monitoring was carried out at one noise sensitive location (NSL 1). The survey was conducted when the plant was in full operation i.e. normal activities taking place, however with the drying plant only operating between the hours of 7am and 7pm. The hours of waste acceptance (the hours during which the facility accepts waste) are: Monday to Saturday (including bank holidays): 07:00 (7am) to 19:00 (7pm); Sunday: closed.

The hours of operation (the hours during which the facility is operational) are: Monday to Friday (including bank holidays): 24-hours; Saturday: 07:00 (7am) to 23:00 (11pm); Sunday: closed.

The monitoring locations are detailed below in Table 1 and presented in the attached map in Appendix B.

Table 1: Noise Monitoring Location

Monitoring Location	Description
NSL 1	This monitoring point is located to the North of the site, outside of the site next to the boundary to the nearest dwelling. The monitor was positioned facing the Rehab Glassco Facility.
	*All monitoring locations are located at least 2m from any reflective surfaces

3 Activities on Site

Activities which took place at the plant during the monitoring periods included the delivery of glass products to be recycled, running of primary machinery such as hoppers, crushers and dryers which are housed internally. Other activities on site included plant machinery (i.e. Fork-lifts & Loaders), operating around the yard.

4 Durations & Measurements of Surveying

The day-time monitoring was carried out between the daytime hours of 09:00 and 19.00 on the 16th January 2014. The evening and night-time monitoring was conducted on the 16th and 17th January 2014 between the hours of 19:00 and 23:00 for evening measurements and between 23.00 and 02.00 for night time measurements. The following measurement was carried out at each location:

- Day, evening and Night-time Broadband measurements LAeq, LA10, and LA90, over a 15 minute period as set out in "**Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)"** as a minimum survey duration.
- 1/3 octave band frequency analysis.

5 Weather Conditions

While every effort was made to carry out the survey in accordance with the requirements of Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4), regarding weather conditions, it should be noted that this is not always possible.

Ideally, measurements should be taken in 'neutral' weather conditions. This means in the absence of wind and precipitation, and ideally in conditions of standard temperature and pressure. Clearly, these conditions very rarely apply. The noise monitor was fitted with a windshield throughout the survey. An average wind speed of less than 5m/sec is the preferred limit when noise measurements are being taken, with 7m/sec an upper limit. On the days in question the wind speed was within limits. In as far as possible, care was be taken to avoid measurements so close to objects as to give rise to wind-derived noises, e.g. trees, pylons, etc.

Wind speed and wind direction have the potential to affect noise propagation and hence the noise measurements. The prevailing weather conditions at the time of measurement was noted and recorded in the survey report. Prior to each monitoring period a measurement of wind strength and direction was taken using a portable anemometer. A wind speed of 1-2m/s was measured coming from Northerly direction.

6 Instrumentation & Methodology

Measurements were made using a Bruel & Kjaer 2250 integrating sound level meter (SLM) with selective 1:1 or 1:3 octave band filters. Calibration was carried out on site using a Bruel & Kjaer acoustic calibrator at 94dB (A). The meter was calibrated before and after the monitoring round. Factory calibration certificates for the SLM and the acoustic calibrator, detailing equipment serial numbers, calibration traceability and recalibration dates are presented in Appendix C of this report. A "Windshield" was also fitted to the sound meter at all stages of monitoring.

The sound level meter was mounted at 1.5m above ground level. A sample period for the noise measurements was selected to be 15 minute intervals.

7 Glossary of Terms

Ambient noise: The total encompassing sound in a given situation at a given time usually composed of sound from many sources, near and far.

Background Noise Level: The A-weighted sound pressure level of the residual noise at the assessment position that is exceeded for 90 per cent of a given time interval, T. (L_{A90}, T).

Criterion Noise Level: The long-term mean value of the noise level that must not be exceeded. This is generally stipulated in the waste permit and it may be applied to a noise source, a boundary of the activity or to noise sensitive locations in the vicinity of the facility.

1/3 Octave Band Analysis: Frequency analysis of sound such that the frequency spectrum is subdivided into bands of one–third of an octave each. An octave is taken to be a frequency interval, the upper limit of which is twice the lower limit (the unit of frequency is the Hertz, Hz).

dB (decibel): The scale in which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the RMS pressure of the sound field and the reference pressure of 20 micro-pascals (20 µPa).

dBA or dB(A): An 'A-weighted decibel' - a measure of the overall noise level of sound across the audible frequency range (20 Hz – 20 kHz) with A-frequency weighting (i.e. 'A'–weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.

Facade Level: Noise levels at locations 1m from the facade of a building are described by the term *Facade Levels* and are subject to higher noise levels than those in open areas (free-field conditions) due to reflection effects.

Free-field Conditions: These are conditions in which the radiation from sound sources is unaffected by the presence of any reflecting boundaries. In practice, it is a field in which the effects of the boundaries are negligible over the frequency range of interest. In environmental noise, true free-field measurement conditions are seldom achieved and generally the microphone will be positioned at a height between 1.2 and 1.5 metres above ground level. To minimise the influence of reflections, measurements are generally made at least 3.5 metres from any reflecting surface other than the ground.

Hz (Hertz): The unit of sound frequency in cycles per second.

Impulsive Noise: A noise that is of short duration (typically less than one second), the sound pressure level of which is significantly higher than the background. In determining whether a tonal adjustment applies, reference must be made to ISO 1996-2 (1987) - Section 4.1.

Impulse Exponential – Time-Weighting: This is a time-weighting which is available on some sound level meters and it represents an arbitrary compromise in an attempt to provide a means to measure the sound level of short-duration impulsive sounds. Impulse time-weighting has a design goal exponential-time constant of 35 ms for sound signals that increase with increasing time and 1.5 seconds for sound signals that decrease with increasing time.

LAeq,T: The equivalent steady sound level in dB containing the same acoustic energy as the actual fluctuating sound level over the given period T.

LAmax: The maximum RMS, A-Weighted sound pressure level occurring within a specified time period; the time weighting fast or slow is usually specified.

Noise: Any sound, that has the potential to cause disturbance, discomfort or psychological stress to a subject exposed to it, or any sound, that could to cause actual physiological harm to a subject exposed to it, or physical damage to any structure exposed to it, is known as noise.

Noise Sensitive Location: Any dwelling house, hotel or hostel, health building, educational establishment, place of worship or entertainment, or any other facility or other area of high amenity which for its proper enjoyment requires the absence of noise at nuisance levels.

Rating level (LAr,T) : The specific noise level, plus any adjustment for the characteristic features of the noise.

Residual noise: The ambient noise remaining at a given position in a given situation when the specific source is suppressed to a degree such that it does not contribute to the ambient noise (residual noise level is measured in terms of LAeq, T).

Root Mean Square (RMS): The RMS value of a set of numbers is the square root of the average of their squares.

Sound Exposure Level (SEL or LAE): Is the measure of the A-Weighted sound energy used to describe noise events such as the passing of a train or aircraft; it is the A-weighted sound pressure level if occurring over a period of 1 second, would contain the same amount of A-weighted sound energy as the event.

Specific noise level: A component of the ambient noise which can be specifically identified by acoustical means and may be associated with a specific source. In BS 4142, there is more precise definition as follows: 'the equivalent continuous A-weighted sound pressure level at the assessment position produced by the specific noise source over a given reference time interval (LAeq, T)'.

Time-weighting: One of the averaging times (Fast, Slow or Impulse) used for the measurement of RMS sound pressure level in sound level meters.

Tonal Noise: Noise which contains a clearly audible tone, i.e. a distinguishable, discrete or continuous note (whine, hiss screech or hum etc.). In determining whether a tonal adjustment applies, reference must be made to ISO 1996-2 (1987) - Section 4.

8 Noise Measurement Data

Table 3: Daytime Monitoring Data 16th January 14			
Monitoring Location	**Time**	**$L_{Aeq,15min}$ dB(A)**	**NG4 Limit dB(A)**
NSL 1	11.39 -11.54	57	55
NSL 1	12.32 - 12.47	55	55
NSL 1	14.18 -14.33	56	55

Table 4: Evening Monitoring Data 16th January 14			
Monitoring Location	**Time**	**$L_{Aeq,15min}$ dB(A)**	**NG4 Limit dB(A)**
NSL 1	20.24-20.39	55	50

Table 5: Night Monitoring Data 17th January 14			
Monitoring Location	**Time**	**$L_{Aeq,15min}$ dB(A)**	**NG4 Limit dB(A)**
NSL 1	00.11-00.26	56	45
NSL 1	00.28-00.43	55	45

		Table 6: 1/3 Octave Band Analysis (12.50Hz – 400.00Hz)										16th January (Day)			
Monitoring Location	**12.50 Hz**	**16.00 Hz**	**20.00 Hz**	**25.00 Hz**	**31.50 Hz**	**40.00 Hz**	**50.00 Hz**	**63.00 Hz**	**80.00 Hz**	**100.00 Hz**	**125.00 Hz**	**160.00 Hz**	**200.00 Hz**	**250.00 Hz**	**315.00 Hz**	**400.00 Hz**
NSL 1 11.39 -11.54	-2	24	12	16	28	25	29	31	31	31	30	31	31	33	34	37
NSL 1 12.32 - 12.47	-3	22	11	16	29	28	29	32	33	30	31	31	31	32	33	36
NSL 1 14.18 -14.33	-2	22	12	16	30	26	29	30	30	30	33	34	31	32	33	36

		Table 6: 1/3 Octave Band Analysis (500.00Hz – 16000.00Hz)										16th January (Day)			
Monitoring Location	**500.00 Hz**	**630.00 Hz**	**800.00 Hz**	**1000.00 Hz**	**1250.00 Hz**	**1600.00 Hz**	**2000.00 Hz**	**2500.00 Hz**	**3150.00 Hz**	**4000.00 Hz**	**5000.00 Hz**	**6300.00 Hz**	**8000.00 Hz**	**10000.00 Hz**	**12500.00 Hz**	**16000.00 Hz**
NSL 1 11.39 -11.54	42	47	50	50	49	47	43	41	39	34	30	28	22	11	6	4
NSL 1 12.32 - 12.47	40	44	48	48	47	45	40	38	36	32	28	25	21	11	7	4
NSL 1 14.18 -14.33	41	46	49	50	48	45	42	39	37	33	28	24	20	10	6	4

		Table 7: 1/3 Octave Band Analysis (12.50Hz – 400.00Hz)										16th January (Evening)			
Monitoring Location	**12.50 Hz**	**16.00 Hz**	**20.00 Hz**	**25.00 Hz**	**31.50 Hz**	**40.00 Hz**	**50.00 Hz**	**63.00 Hz**	**80.00 Hz**	**100.00 Hz**	**125.00 Hz**	**160.00 Hz**	**200.00 Hz**	**250.00 Hz**	**315.00 Hz**	**400.00 Hz**
NSL 1 20.24-20.39	-7	18	7	8	21	21	26	39	29	28	32	30	30	30	32	34
		Table 7: 1/3 Octave Band Analysis (500.00Hz – 16000.00Hz)										16th January (Evening)			
Monitoring Location	**500.00 Hz**	**630.00 Hz**	**800.00 Hz**	**1000.00 Hz**	**1250.00 Hz**	**1600.00 Hz**	**2000.00 Hz**	**2500.00 Hz**	**3150.00 Hz**	**4000.00 Hz**	**5000.00 Hz**	**6300.00 Hz**	**8000.00 Hz**	**10000.00 Hz**	**12500.00 Hz**	**16000.00 Hz**
NSL 1 20.24-20.39	39	45	49	49	47	46	40	37	30	24	20	18	14	11	7	4

		Table 8: 1/3 Octave Band Analysis (12.50Hz – 400.00Hz)										17th January (Night)			
Monitoring Location	**12.50 Hz**	**16.00 Hz**	**20.00 Hz**	**25.00 Hz**	**31.50 Hz**	**40.00 Hz**	**50.00 Hz**	**63.00 Hz**	**80.00 Hz**	**100.00 Hz**	**125.00 Hz**	**160.00 Hz**	**200.00 Hz**	**250.00 Hz**	**315.00 Hz**	**400.00 Hz**
NSL 1 00.11-00.26	-3	22	11	9	26	23	28	40	30	29	32	30	31	31	32	35
NSL 1 00.28-00.43	-4	22	11	8	24	24	26	34	27	30	34	34	35	33	33	35

		Table 8: 1/3 Octave Band Analysis (500.00Hz – 16000.00Hz)											17th January (Night)			
Monitoring Location	**500.00 Hz**	**630.00 Hz**	**800.00 Hz**	**1000.00 Hz**	**1250.00 Hz**	**1600.00 Hz**	**2000.00 Hz**	**2500.00 Hz**	**3150.00 Hz**	**4000.00 Hz**	**5000.00 Hz**	**6300.00 Hz**	**8000.00 Hz**	**10000.00 Hz**	**12500.00 Hz**	**16000.00 Hz**
NSL 1 00.11-00.26	40	46	50	50	48	47	42	38	34	30	24	19	12	7	4	2
NSL 1 00.28-00.43	36	43	48	51	48	45	41	35	31	26	22	17	12	7	4	3

9 Interferences

Below is a comprehensive breakdown of all the noise interference and sources that occurred at NSL 1 during each monitoring period.

Noise Sources/Interferences – NSL	
Date	
16th January 2014 11.39 -11.54	• Lorries reversing and Tipping Glass within the Rehab Compound. • Traffic noise from M7 was quite prominent • Truck movements at nearby facility • Birdsong • Light Rain
16th January 2014 12.32 - 12.47	• Birdsong • A number of lorries were noted to enter the adjacent site and were left idling for long periods. • Road noise from the nearby R409 to the East, Local road to the North of the Site and the M7
16th January 2014 14.18 -14.33	• Road noise from the nearby R409 to the East • Traffic noise from M7 was quite prominent • Truck movements at nearby facility
16th January 2014 20.24-20.39	• Distant traffic noise (M7) • Vehicle movement at adjacent site (i.e. reversing, idling engines) • Light rain
17th January 2014 00.11-00.26	• Constant traffic noise (M7) • Vehicle movement at adjacent site (air brakes and reversing sirens) • Vehicle movement at adjacent site

10 Evaluation of Measurement Data

Tables 3 to 8 summarises the monitoring data for each period of noise monitoring which was carried out on site. From this monitoring the noise levels recorded ranged from 55dB (A) to 57dB (A) during the day, 55dB (A) during the evening and 55dB (A) during the night-time period.

These, in the main, are considered not to comply with the recommended Noise Level limits as set out in EPA document **Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4) 2012.**

On review of the one-third octave band analysis tonal noise qualities were recorded at 16Hz. The 16Hz level recorded maybe attributable to the truck engines running constant on the adjacent site which was quite prominent during the monitoring period. The frequency of 16Hz in which tonal noise was detected is below 20Hz and therefore is not audible to the human ear.

11 Conclusion

As can be seen there is a significant exceedance in noise levels experienced at NSL 1.

It was noted during the monitoring period that, noise from the Rehab Glassco facility is barely audible and intermittent. Since the first monitoring round was undertaken in November 2012, Rehab Glassco have made efforts to minimise the generation of any excess noise emanating from the site through a combination of mitigation measures including revised work / operation practices and boundary screening.

Given the above results it can be concluded that any exceedance in noise limits is attributable to external influences such as the constant traffic noise associated with the R409, M7 and the adjacent 24hr Warehousing Facility and not the Rehab Glassco facility.

Appendix A – Noise Measurement Graphs

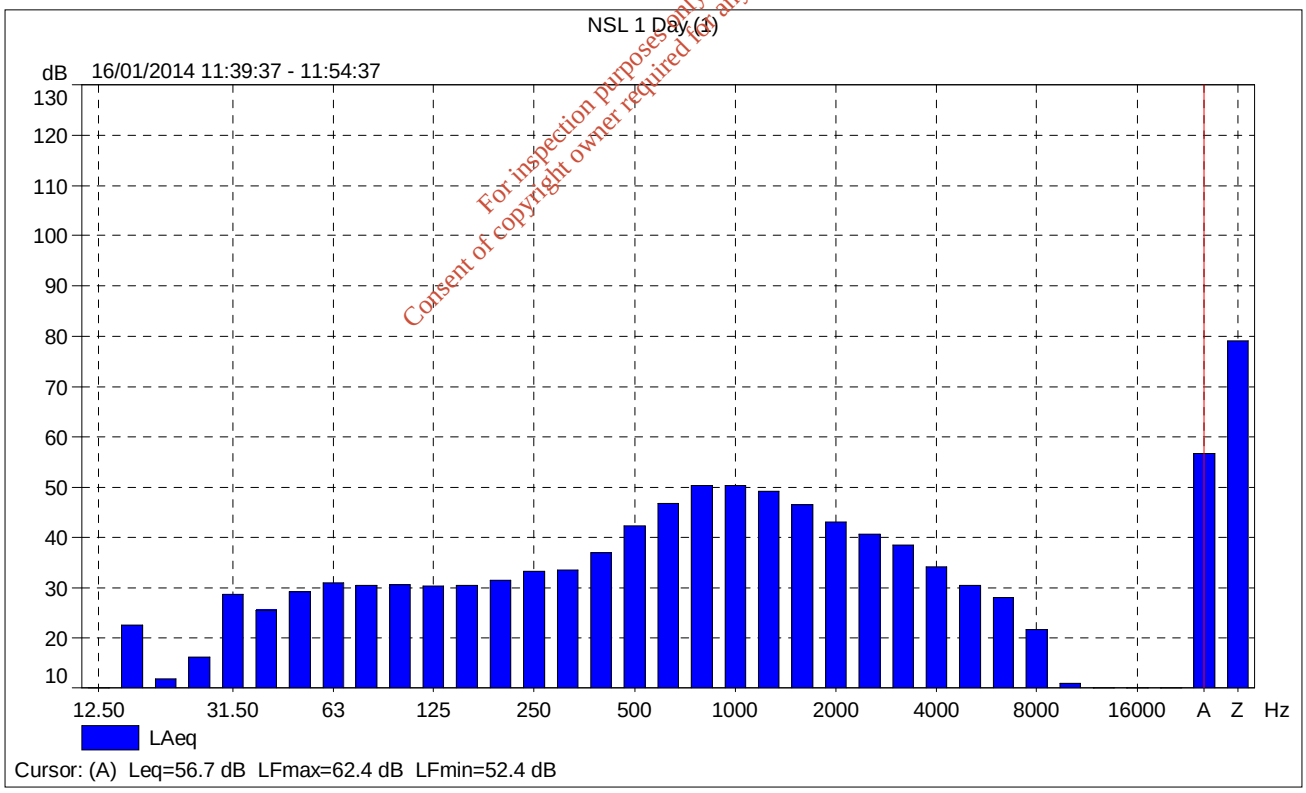
NSL 1 Day (1)

Instrument:		2250-L
Application:		BZ7132 Version 3.0.1
Start Time:		01/16/2014 11:39:37
End Time:		01/16/2014 11:54:37
Elapsed Time:		00:15:00
Bandwidth:		1/3-octave
Max Input Level:		140.63

	Time	Frequency
Broadband (excl. Peak):	FSI	AZ
Broadband Peak:		C
Spectrum:	FS	A

Instrument Serial Number:		2602719
Microphone Serial Number:		2600864
Input:		
Windscreen Correction:		None
Sound Field Correction:		Free-field

Calibration Time:		01/16/2014 11:38:15
Calibration Type:		External reference
Sensitivity:		51.9015118479729 mV/Pa



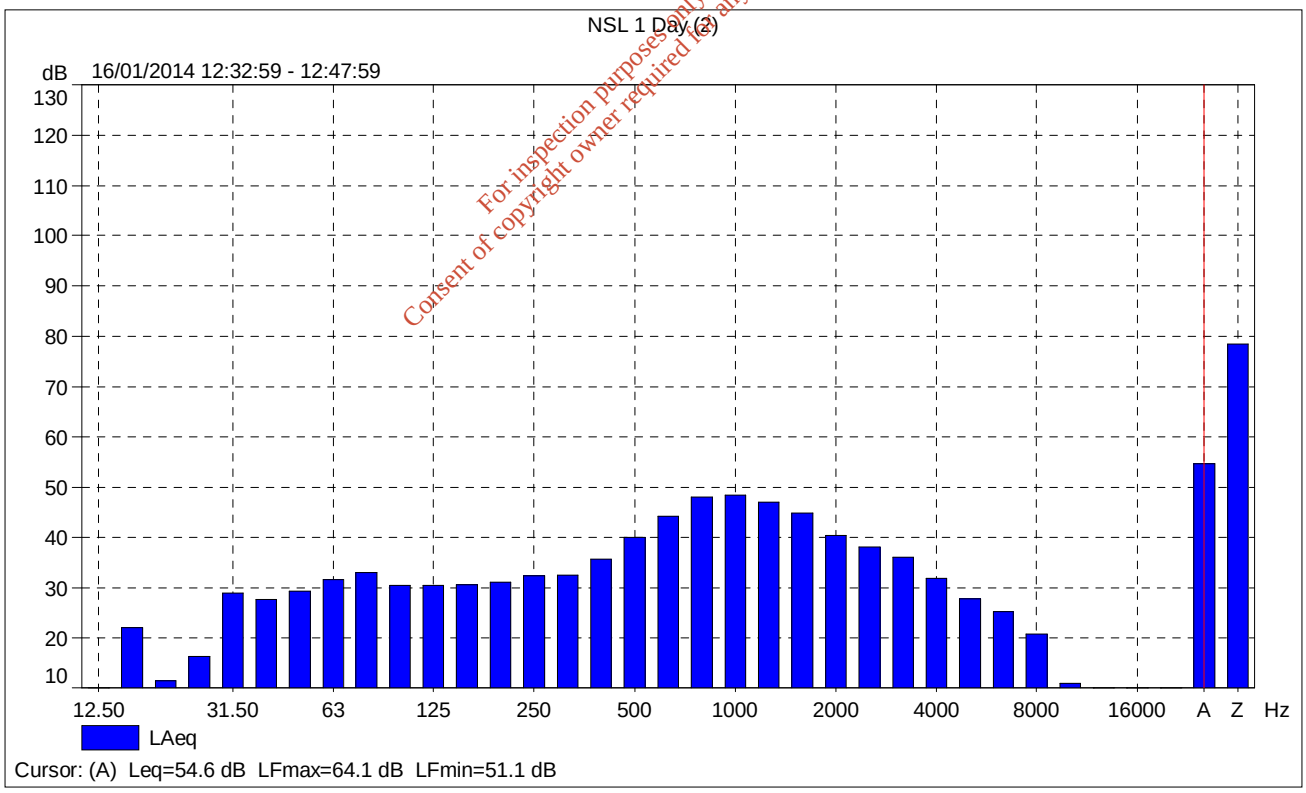
NSL 1 Day (2)

Instrument:		2250-L
Application:		BZ7132 Version 3.0.1
Start Time:		01/16/2014 12:32:59
End Time:		01/16/2014 12:47:59
Elapsed Time:		00:15:00
Bandwidth:		1/3-octave
Max Input Level:		140.63

	Time	Frequency
Broadband (excl. Peak):	FSI	AZ
Broadband Peak:		C
Spectrum:	FS	A

Instrument Serial Number:		2602719
Microphone Serial Number:		2600864
Input:		
Windscreen Correction:		None
Sound Field Correction:		Free-field

Calibration Time:		01/16/2014 11:38:15
Calibration Type:		External reference
Sensitivity:		51.9015118479729 mV/Pa



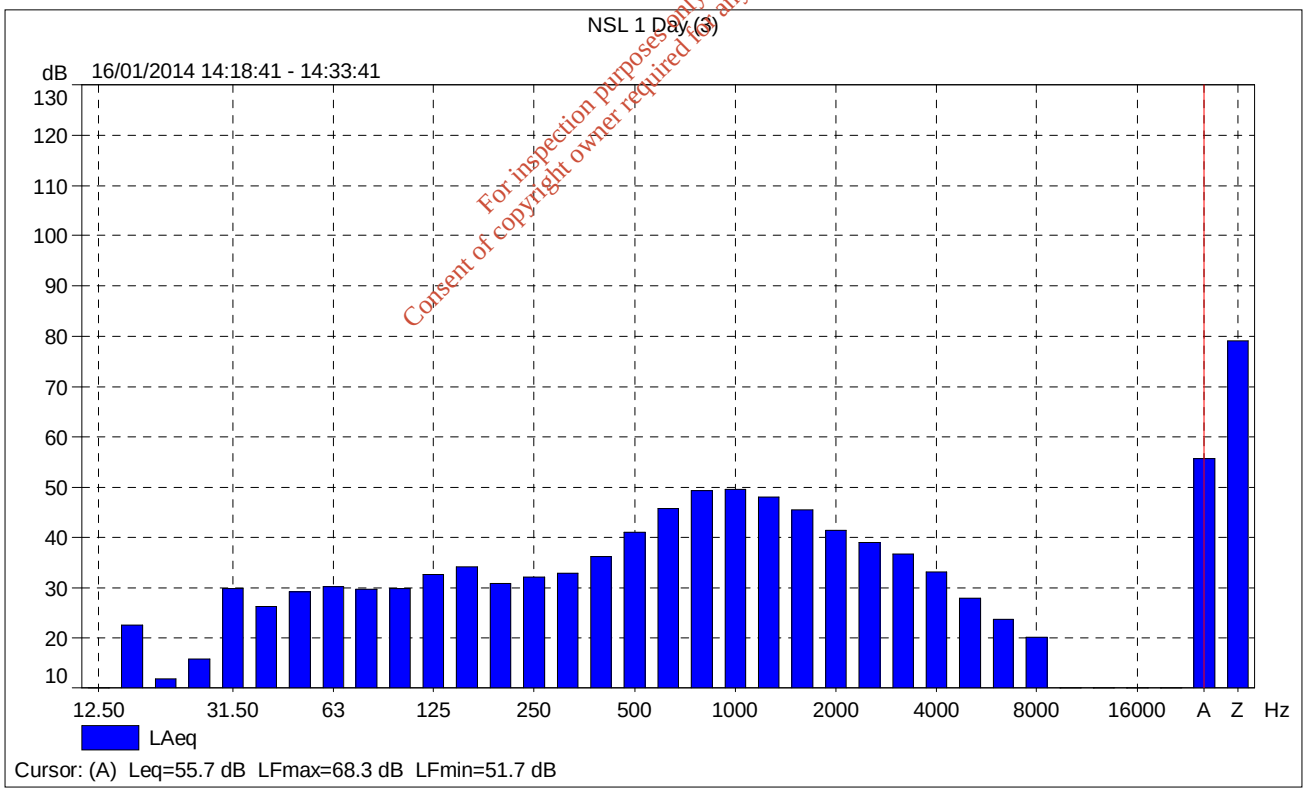
NSL 1 Day (3)

Instrument:		2250-L
Application:		BZ7132 Version 3.0.1
Start Time:		01/16/2014 14:18:41
End Time:		01/16/2014 14:33:41
Elapsed Time:		00:15:00
Bandwidth:		1/3-octave
Max Input Level:		140.63

	Time	Frequency
Broadband (excl. Peak):	FSI	AZ
Broadband Peak:		C
Spectrum:	FS	A

Instrument Serial Number:		2602719
Microphone Serial Number:		2600864
Input:		
Windscreen Correction:		UA-0237
Sound Field Correction:		Free-field

Calibration Time:		01/16/2014 11:38:15
Calibration Type:		External reference
Sensitivity:		51.9015118479729 mV/Pa



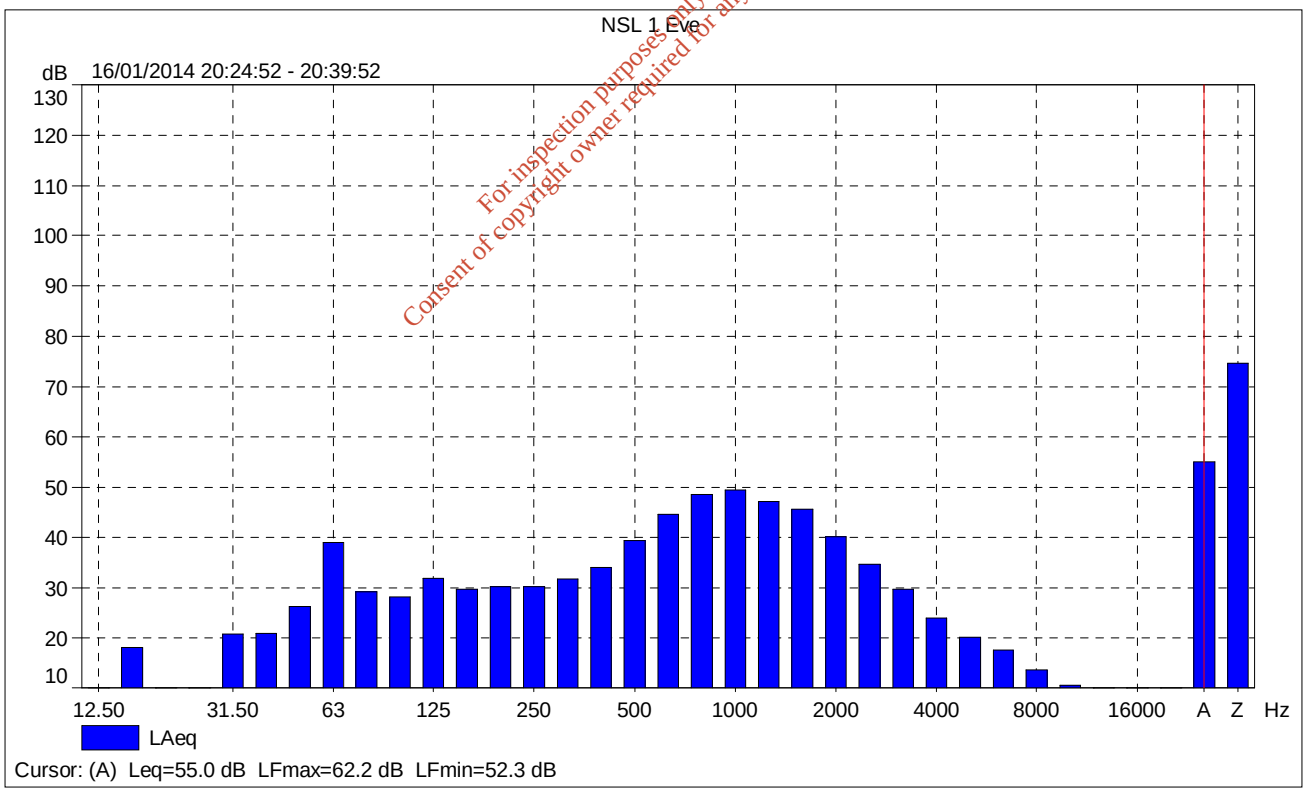
NSL 1 Eve

Instrument:		2250-L
Application:		BZ7132 Version 3.0.1
Start Time:		01/16/2014 20:24:52
End Time:		01/16/2014 20:39:52
Elapsed Time:		00:15:00
Bandwidth:		1/3-octave
Max Input Level:		140.62

	Time	Frequency
Broadband (excl. Peak):	FSI	AZ
Broadband Peak:		C
Spectrum:	FS	A

Instrument Serial Number:		2602719
Microphone Serial Number:		2600864
Input:		
Windscreen Correction:		UA-0237
Sound Field Correction:		Free-field

Calibration Time:		01/16/2014 11:38:15
Calibration Type:		External reference
Sensitivity:		51.9015118479729 mV/Pa



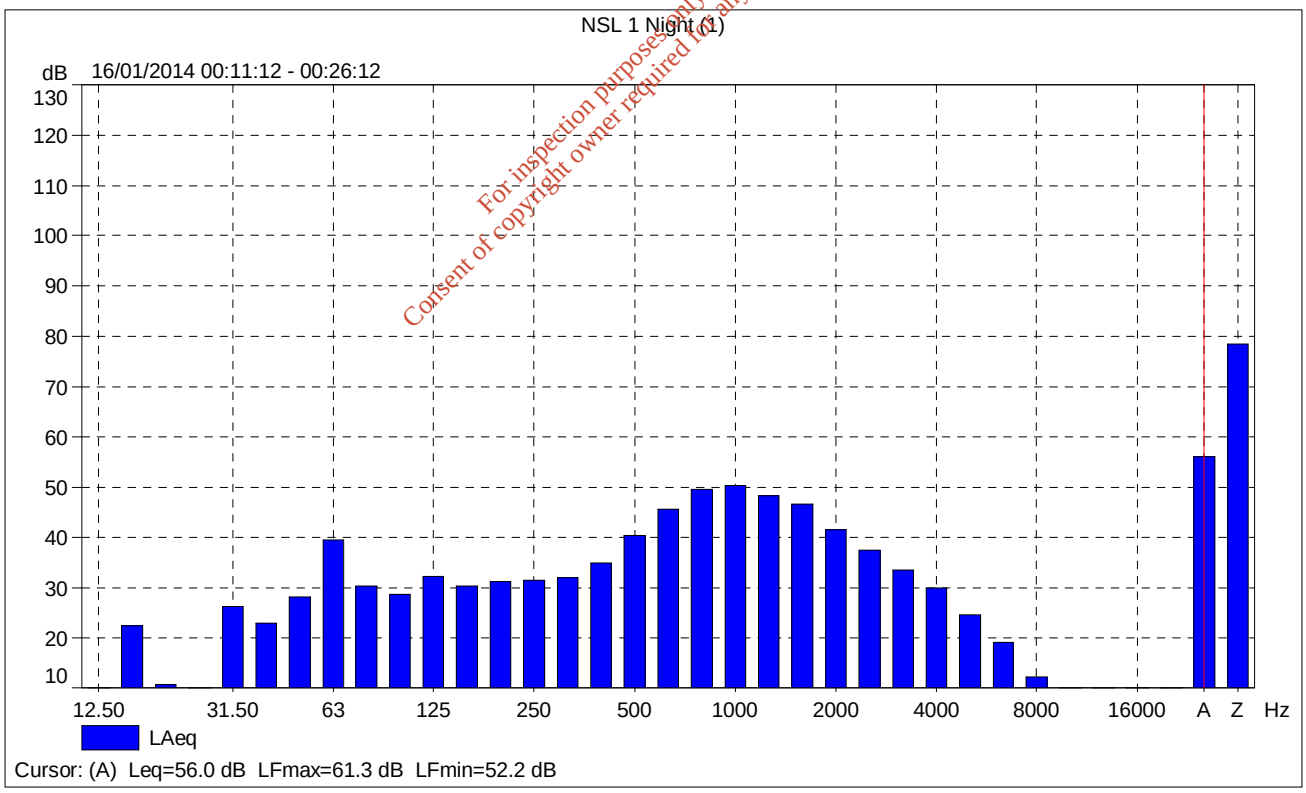
NSL 1 Night (1)

Instrument:		2250-L
Application:		BZ7132 Version 3.0.1
Start Time:		01/16/2014 00:11:12
End Time:		01/16/2014 00:26:12
Elapsed Time:		00:15:00
Bandwidth:		1/3-octave
Max Input Level:		140.62

	Time	Frequency
Broadband (excl. Peak):	FSI	AZ
Broadband Peak:		C
Spectrum:	FS	A

Instrument Serial Number:		2602719
Microphone Serial Number:		2600864
Input:		
Windscreen Correction:		UA-0237
Sound Field Correction:		Free-field

Calibration Time:		01/16/2014 11:38:15
Calibration Type:		External reference
Sensitivity:		51.9015118479729 mV/Pa



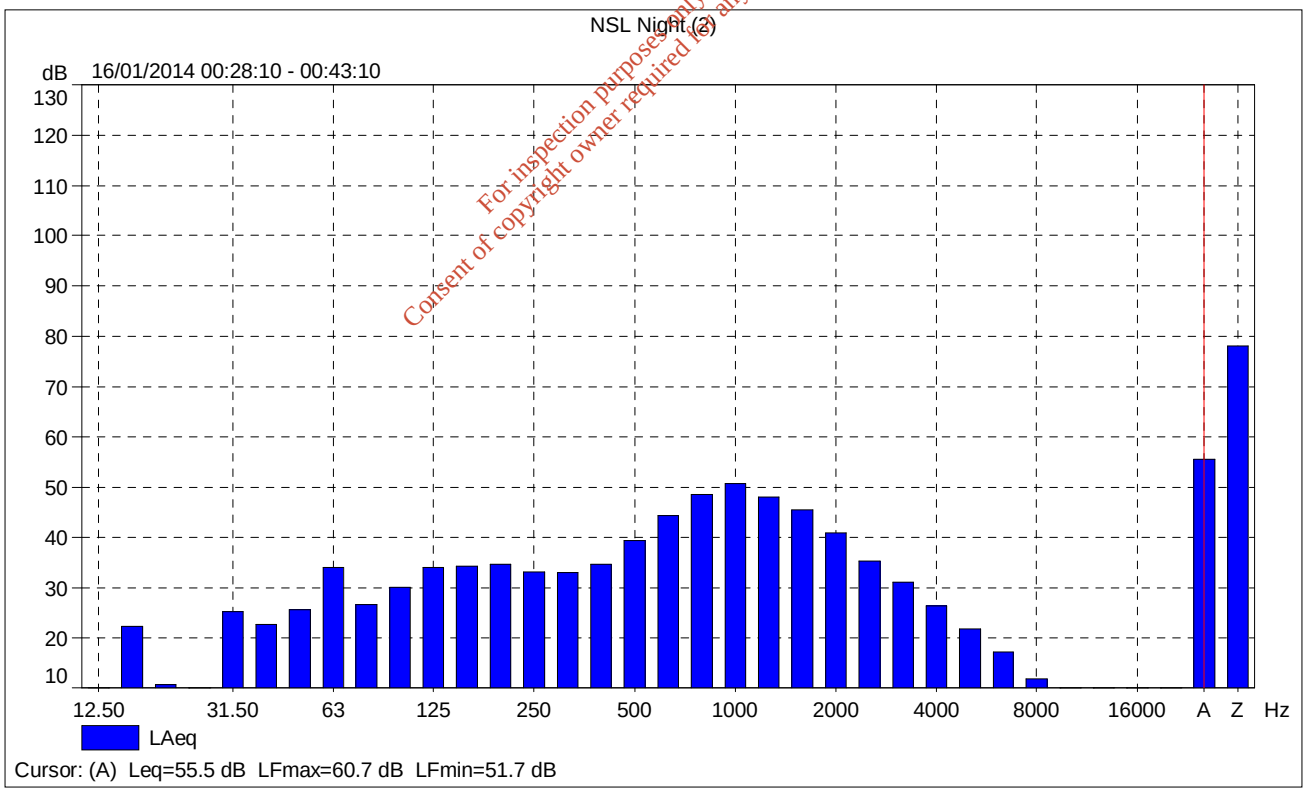
NSL Night (2)

Instrument:		2250-L
Application:		BZ7132 Version 3.0.1
Start Time:		01/16/2014 00:28:10
End Time:		01/16/2014 00:43:10
Elapsed Time:		00:15:00
Bandwidth:		1/3-octave
Max Input Level:		140.62

	Time	Frequency
Broadband (excl. Peak):	FSI	AZ
Broadband Peak:		C
Spectrum:	FS	A

Instrument Serial Number:		2602719
Microphone Serial Number:		2600864
Input:		
Windscreen Correction:		UA-0237
Sound Field Correction:		Free-field

Calibration Time:		01/16/2014 11:38:15
Calibration Type:		External reference
Sensitivity:		51.9015118479729 mV/Pa



Appendix B – Noise Monitoring Locations

A3

R409

PIRVATE DWELLING

NSL 1

REHAB GLASSCO SITE BOUNDARY

REHAB GLASSCO MAIN BUILDING

LEGEND	
	BOUNDARY LINE
Nx	NOISE MONITORING LOCATIONS
NSL	NOISE SENSITIVE LOCATIONS
Dx	DUST MONITORING LOCATIONS
SWx	SURFACEWATER MONITORING LOCATIONS
BHx	GROUNDWATER MONITORING LOCATIONS
	EXISTING WELL/BOREHOLE
Vx	VIBRATION MONITORING LOCATIONS
Ax	AIR MONITORING LOCATIONS
	EXISTING SURFACE WATER PIPES
	EXISTING FOUL SEWER PIPES
	EXISTING WATERMAIN
	EXISTING MANHOLE
F	FOUL SEWER
S	SURFACE WATER
	EXISTING BUILDING
	PROPOSED BUILDING
	NORTH POINT

SITE LAYOUT - NTS

REVISION DATE 31/05/11

REVISION 1

FORM NO FRM-010

ISSUE

ON ORIGINAL

0 10 20 30 40 50mm

REV NO:	DATE:	REVISION NOTE:	DWN BY:	CKD BY:
D1	06/12/12	ISSUED TO CLIENT	DH	DC

SITE LOCATION

Datum: Irish Grid System: Malin Head ITM

CLIENT:	REHAB GLASSCO
PROJECT:	ENVIRONMENTAL NOISE MONITORING AT REHAB GALSSCO SITE, NAAS
TITLE:	SITE LAYOUT NOISE MONITORING LOCATIONS

DRAWN:	CHECKED:	APPROVED:	DRAWING NO:	REV:
DH	DC		101_169_201	D1
DATE: 06/12/12	SCALE: NTS			

ORS
Consulting Engineers
ORS Building, Mullingar, Co. Westmeath
T: +353 (0) 44 934 2518 F: +353 (0) 44 934 4573
E: info@ors.ie W: www.ors.ie
ISO 9001:2008 QUALITY ASSURED COMPANY

Appendix C – Calibration Certificates

Brüel & Kjær

The Calibration Laboratory
Skodsborgvej 307, DK-2850 Nærum, Denmark

ilac-MRA DANAK CAL Reg.nr. 307

CERTIFICATE OF CALIBRATION

No: CDK1307034

CALIBRATION OF

Calibrator:	Brüel & Kjær Type 4231	No: 2605825 Id: -
½ Inch adaptor:	Brüel & Kjær Type UC-0210	
Pattern Approval:	PTB-1.61-4057176	

CUSTOMER

ORS Consulting Engineers
Marlinstown Office Park
Mullingar
Co. Westmeath, Ireland

CALIBRATION CONDITIONS

Preconditioning:	4 hours at 23°C ± 3°C
Environment conditions:	Pressure: 101.4 kPa. Humidity: 51 % RH. Temperature: 23.1 °C.

SPECIFICATIONS

The Calibrator Brüel & Kjær Type 4231 has been calibrated in accordance with the requirements as specified in IEC60942:2003 Annex B Class 1. The accreditation assures the traceability to the international units system SI.

PROCEDURE

The measurements have been performed with the assistance of Brüel & Kjær acoustic calibrator calibration application software Type 7794 (version 2.4) by using procedure P_4231_D04.

RESULTS

Calibration Mode: **Calibration as received.**

The reported expanded uncertainty is based on the standard uncertainty multiplied by a coverage factor $k = 2$ providing a level of confidence of approximately 95 %. The uncertainty evaluation has been carried out in accordance with EA-4/02 from elements originating from the standards, calibration method, effect of environmental conditions and any short time contribution from the device under calibration.

Date of calibration: 2013-09-06

Date of issue: 2013-09-06

Susanne Nygaard
Calibration Technician

Erik Bruus
Approved Signatory

Brüel & Kjær

The Calibration Laboratory
Skodsborgvej 307, DK-2850 Nærum, Denmark

1. Visual Inspection

OK.

2. Measured Values

All stated values are valid at the following environmental reference conditions:

Pressure	101.3 kPa
Temperature	23.0 °C
Relative Humidity	50.0 %

2.1 Sound Pressure Levels

The sound pressure level is measured using the sound calibration comparison method.

Nominal Level [dB]	Accept Limit Lower [dB]	Accept Limit Upper [dB]	Measured Level [dB]	Measurement Uncertainty [dB]
94.00	93.89	94.11	93.93	0.09
114.00	113.89	114.11	113.95	0.09

2.2 Frequency

Nominal Level [Hz]	Accept Limit Lower [Hz]	Accept Limit Upper [Hz]	Measured Frequency [Hz]	Measurement Uncertainty [Hz]
1000	990.10	1009.90	999.98	0.10

2.3 Total Distortion

Distortion mode: [X] TD [ ] THD

Calibration Level [dB]	Accept Limit [%]	Measured Distortion [%]	Measurement Uncertainty [%]
94	2.25	0.56	0.25
114	2.25	0.40	0.25

Note: Acceptance limits are reduced by measurement uncertainty to assure that measured value expanded by the actual expanded uncertainty does not exceed the specified limits as stated in the standard.

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3. Calibration Equipment

	Instrument	Inventory No.
Sound Source, Reference	Brüel & Kjær, Type 4228	124228023
PULSE Analyzer	Brüel & Kjær, Type 3560-C	123560010
Transfer Microphone	Brüel & Kjær, Type 4192-L-001	124192027

4. Comments

As public evidence was available, from a testing organization responsible for approving the results of pattern evaluation tests, to demonstrate that the model of sound calibrator fully conformed to the requirements for pattern evaluation described in Annex A of IEC 60942:2003, the sound calibrator tested is considered to conform to all the class 1 requirements of IEC 60942:2003.

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DANAK

The Danish Accreditation and Metrology Fund - DANAK - is managing the Danish accreditation scheme based on a contract with the Danish Safety Technology Authority under the Danish Ministry of Economics and Business Affairs who is responsible for the legislation on accreditation in Denmark.

The fundamental criteria for accreditation are described in DS/EN ISO/IEC 17025: "General requirements for the competence of testing and calibration laboratories", and in DS/EN ISO/IEC 15189 "Medical laboratories – Particular requirements for quality and competence" respectively. DANAK uses guidance documents to clarify the requirements in the standards, where this is considered to be necessary. These will mainly be drawn up by the "European co-operation for Accreditation (EA)" or the "International Laboratory Accreditation Co-operation (ILAC)" with a view to obtaining uniform criteria for accreditation worldwide. In addition, the Danish Safety Technology Authority issues Technical Regulations prepared by DANAK with specific requirements for accreditation that are not contained in the standards.

In order for a laboratory to be accredited it is, among other things, required:

- *that the laboratory and its personnel are free from any commercial, financial or other pressures, which might influence their impartiality;*
- *that the laboratory operates a documented management system, and has a management that ensures that the system is followed and maintained;*
- *that the laboratory has at its disposal all items of equipment, facilities and premises required for correct performance of the service that it is accredited to perform;*
- *that the laboratory has at its disposal personnel with technical competence and practical experience in performing the services that they are accredited to perform;*
- *that the laboratory has procedures for traceability and uncertainty calculations;*
- *that accredited testing, calibration or medical examination are performed in accordance with fully validated and documented methods;*
- *that accredited services are performed and reported in confidentiality with the customer and in compliance with the customer's request;*
- *that the laboratory keeps records which contain sufficient information to permit repetition of the accredited test, calibration or medical examination;*
- *that the laboratory is subject to surveillance by DANAK on a regular basis;*

Reports carrying DANAK's accreditation mark are used when reporting accredited services and show that these have been performed in accordance with the rules for accreditation.

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CERTIFICATE OF CALIBRATION

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CALIBRATION OF

Sound Level Meter:	Brüel & Kjær Type 2250 Light	No: 2602719	Id: -
Microphone:	Brüel & Kjær Type 4950	No: 2600864	
Preamplifier:	Brüel & Kjær Type ZC-0032	No: 6365	
Supplied Calibrator:	Brüel & Kjær Type 4231	No: 2605825	
Software version:	BZ7131 Version 3.0.1	Pattern Approval:	PENDING
Instruction manual:	BE-1774-11		

CUSTOMER

ORS Consulting Engineers
Marlinstown Office Park
Mullingar
Co. Westmeath, Ireland

CALIBRATION CONDITIONS

Preconditioning: 4 hours at 23°C ± 3°C

Environment conditions: *See actual values in **Environmental conditions** sections.*

SPECIFICATIONS

The Sound Level Meter Brüel & Kjær Type 2250 Light has been calibrated in accordance with the requirements as specified in IEC61672-1:2002 class 1. Procedures from IEC 61672-3:2006 were used to perform the periodic tests.

PROCEDURE

The measurements have been performed with the assistance of Brüel & Kjær Sound Level Meter Calibration System 3630 with application software type 7763 (version 4.5 - DB: 4.50) by using procedure 2250-L-4950.

RESULTS

Calibration Mode: **Calibration as received.**

The reported expanded uncertainty is based on the standard uncertainty multiplied by a coverage factor $k = 2$ providing a level of confidence of approximately 95 %. The uncertainty evaluation has been carried out in accordance with EA-4/02 from elements originating from the standards, calibration method, effect of environmental conditions and any short time contribution from the device under calibration.

Date of calibration: 2011-09-08

Date of issue: 2011-09-08

Steen Vodstrup Andersen
Calibration Technician

Nils Johansen
Approved Signatory

Brüel & Kjær

The Calibration Laboratory
Skodsborgvej 307, DK-2850 Nærum, Denmark

1. Calibration Note

n/a

2. Summary

4.1. Preliminary inspection	Passed
4.2. Environmental conditions, Prior to calibration	Passed
4.3. Reference information	Passed
4.4. Indication at the calibration check frequency	Passed
4.5. Self-generated noise, Microphone installed	Passed
4.6. Acoustical signal tests of a frequency weighting, C weighting	Passed
4.7. Self-generated noise, Electrical	Passed
4.8. Electrical signal tests of frequency weightings, A weighting	Passed
4.9. Electrical signal tests of frequency weightings, C weighting	Passed
4.10. Electrical signal tests of frequency weightings, Z weighting	Passed
4.11. Frequency and time weightings at 1 kHz	Passed
4.12. Level linearity on the reference level range, Upper	Passed
4.13. Level linearity on the reference level range, Lower	Passed
4.14. Toneburst response, Time-weighting Fast	Passed
4.15. Toneburst response, Time-weighting Slow	Passed
4.16. Toneburst response, LAE	Passed
4.17. Peak C sound level, 8 kHz	Passed
4.18. Peak C sound level, 500 Hz	Passed
4.19. Overload indication	Passed
4.20. Environmental conditions, Following calibration	Passed

The sound level meter submitted for periodic testing successfully completed the class 1 tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed.
However, no general statement or conclusion can be made about conformance of the sound level meter to the full requirements of IEC 61672-1:2002 because evidence was not publicly available, from an independent testing organization responsible pattern approvals, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002 and because the periodic test of IEC 61672-3:2006 cover only a limited subset of the specifications in IEC 61672-1:2002.

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3. Instruments

	Instrument	Inventory No.
Generator	Brüel & Kjær, Type 3560	123560014
AmplifierDivider	Brüel & Kjær, Type 3111	123111004
Calibrator	Brüel & Kjær, Type 4226	124226018
Adaptor	Brüel & Kjær, Type WA-0302-B 15 pF	150503009
Voltmeter	Agilent, Type 34970A	142101028

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4. Measurements

4.1. Preliminary inspection

Visually inspect instrument, and operate all relevant controls. (section 5)

Routine Passed

4.2. Environmental conditions, Prior to calibration

Actual environmental conditions prior to calibration. (section 7)

	Measured	
	[Deg / kPa / %RH]	
Air temperature	22.30	
Air pressure	99.57	
Relative humidity	53.00	

4.3. Reference information

Information about reference range, level and channel. (section 19.h + 19.m)

	Value	
	[dB]	
Reference sound pressure level	94	
Reference level range	140	
Channel number	1	

4.4. Indication at the calibration check frequency

Measure and adjust sound level meter using the supplied calibrator. (section 9 + 19.m)

	Measured	Uncertainty	
	[dB / Hz]	[dB / Hz]	
Initial indication (supplied calibrator)	93.89	0.14	
Calibration check frequency (supplied calibrator)	1000.00	1.00	
Adjusted indication (supplied calibrator)	93.85	0.14	

4.5. Self-generated noise, Microphone installed

Self-generated noise measured with microphone submitted for periodic testing. Averaging time is 30 seconds. An anechoic chamber is used to isolate environmental noise. (section 10.1)

	Max	Measured	Deviation	Uncertainty	
	[dB]	[dB]	[dB]	[dB]	
A weighted	17.40	16.16	-1.24	1.00	
Monitor Level	20.40	11.40	-9.00	1.00	

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4.6. Acoustical signal tests of a frequency weighting, C weighting

Frequency weightings measured acoustically with a calibrated multi-frequency sound calibrator. Averaging time is 10 seconds, and the result is the average of 2 measurements. (section 11)

	Coupler Pressure Lc	Mic. Correction C4226	Body Influence	Expected	Measured	Corr. Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty	
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	
1000Hz, Ref. (1st)	94.30	0.15	-0.09	94.24	94.18	94.18	-1.1	1.1	-0.06	0.20	
1000Hz, Ref. (2nd)	94.30	0.15	-0.09	94.24	94.18	94.18	-1.1	1.1	-0.06	0.20	
1000Hz, Ref. (Average)	94.30	0.15	-0.09	94.24	94.18	94.18	-1.1	1.1	-0.06	0.20	
125.89Hz (1st)	94.28	0.00	0.00	94.11	94.25	94.25	-1.5	1.5	0.14	0.20	
125.89Hz (2nd)	94.28	0.00	0.00	94.11	94.25	94.25	-1.5	1.5	0.14	0.20	
125.89Hz (Average)	94.28	0.00	0.00	94.11	94.25	94.25	-1.5	1.5	0.14	0.20	
3981.1Hz (1st)	94.23	1.15	-0.06	92.37	92.17	92.17	-1.6	1.6	-0.20	0.30	
3981.1Hz (2nd)	94.23	1.15	-0.06	92.37	92.18	92.18	-1.6	1.6	-0.19	0.30	
3981.1Hz (Average)	94.23	1.15	-0.06	92.37	92.18	92.18	-1.6	1.6	-0.19	0.30	
7943.3Hz (1st)	93.98	3.85	-0.17	87.33	86.98	86.98	-3.1	2.1	-0.35	0.40	
7943.3Hz (2nd)	93.98	3.85	-0.17	87.33	86.99	86.99	-3.1	2.1	-0.34	0.40	
7943.3Hz (Average)	93.98	3.85	-0.17	87.33	86.98	86.98	-3.1	2.1	-0.35	0.40	

4.7. Self-generated noise, Electrical

Self-generated noise measured in most sensitive range, with electrical substitution for microphone, according to manufactures specifications.

Exceedance of the measured level above the corresponding level given in the instruction manual does not, by itself, mean that the performance of the sound level meter is no longer acceptable for many practical applications. (section 10.2)

	Max	Measured	Uncertainty	
	[dB]	[dB]	[dB]	
A weighted	13.70	12.86	0.30	
C weighted	15.00	13.37	0.30	
Z weighted	20.40	18.91	0.30	

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4.8. Electrical signal tests of frequency weightings, A weighting

Frequency response measured with electrical signal relative to level at 1 kHz in reference range. (section 12)

	Input Level	Expected	Measured	Acoustical Resp.	Body Influence	Corr. Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty
	[dBV]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
1000Hz, Ref.	-24.68	95.00	95.00	-0.04	-0.09	94.87	-1.1	1.1	-0.13	0.12
63.096Hz	1.52	95.00	95.01	0.21	0.00	95.22	-1.5	1.5	0.22	0.12
125.89Hz	-8.58	95.00	95.01	0.10	0.00	95.11	-1.5	1.5	0.11	0.12
251.19Hz	-16.08	95.00	94.97	0.01	0.06	95.04	-1.4	1.4	0.04	0.12
501.19Hz	-21.48	95.00	94.97	-0.03	0.22	95.16	-1.4	1.4	0.16	0.12
1995.3Hz	-25.88	95.00	95.00	-0.04	-0.01	94.95	-1.6	1.6	-0.05	0.12
3981.1Hz	-25.68	95.00	94.91	-0.02	-0.06	94.83	-1.6	1.6	-0.17	0.12
7943.3Hz	-23.58	95.00	94.69	0.02	-0.17	94.54	-3.1	2.1	-0.46	0.12
15849Hz	-18.08	95.00	95.59	0.06	-0.01	95.64	-17.0	3.5	0.64	0.12

4.9. Electrical signal tests of frequency weightings, C weighting

Frequency response measured with electrical signal relative to level at 1 kHz in reference range. (section 12)

	Input Level	Expected	Measured	Acoustical Resp.	Body Influence	Corr. Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty
	[dBV]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
1000Hz, Ref.	-24.68	95.00	95.00	-0.04	-0.09	94.87	-1.1	1.1	-0.13	0.12
63.096Hz	-23.88	95.00	94.97	0.21	0.00	95.18	-1.5	1.5	0.18	0.12
125.89Hz	-24.48	95.00	95.03	0.10	0.00	95.13	-1.5	1.5	0.13	0.12
251.19Hz	-24.68	95.00	95.00	0.01	0.06	95.07	-1.4	1.4	0.07	0.12
501.19Hz	-24.68	95.00	95.04	-0.03	0.22	95.23	-1.4	1.4	0.23	0.12
1995.3Hz	-24.48	95.00	95.03	-0.04	-0.01	94.98	-1.6	1.6	-0.02	0.12
3981.1Hz	-23.88	95.00	94.92	-0.02	-0.06	94.84	-1.6	1.6	-0.16	0.12
7943.3Hz	-21.68	95.00	94.69	0.02	-0.17	94.54	-3.1	2.1	-0.46	0.12
15849Hz	-16.18	95.00	95.56	0.06	-0.01	95.61	-17.0	3.5	0.61	0.12

4.10. Electrical signal tests of frequency weightings, Z weighting

Frequency response measured with electrical signal relative to level at 1 kHz in reference range. (section 12)

	Input Level	Expected	Measured	Acoustical Resp.	Body Influence	Corr. Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty
	[dBV]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
1000Hz, Ref.	-24.68	95.00	95.00	-0.04	-0.09	94.87	-1.1	1.1	-0.13	0.12
63.096Hz	-24.68	95.00	94.98	0.21	0.00	95.19	-1.5	1.5	0.19	0.12
125.89Hz	-24.68	95.00	95.00	0.10	0.00	95.10	-1.5	1.5	0.10	0.12
251.19Hz	-24.68	95.00	95.00	0.01	0.06	95.07	-1.4	1.4	0.07	0.12
501.19Hz	-24.68	95.00	95.00	-0.03	0.22	95.19	-1.4	1.4	0.19	0.12
1995.3Hz	-24.68	95.00	95.00	-0.04	-0.01	94.95	-1.6	1.6	-0.05	0.12
3981.1Hz	-24.68	95.00	94.94	-0.02	-0.06	94.86	-1.6	1.6	-0.14	0.12
7943.3Hz	-24.68	95.00	94.70	0.02	-0.17	94.55	-3.1	2.1	-0.45	0.12
15849Hz	-24.68	95.00	95.62	0.06	-0.01	95.67	-17.0	3.5	0.67	0.12

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4.11. Frequency and time weightings at 1 kHz

Frequency and time weighting measured at 1 kHz with electrical signal in reference range. Measured relative to A-weighted and Fast response. (section 13)

	Expected	Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty	
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	
LAF, Ref.	94.00	94.00	-0.4	0.4	0.00	0.12	
LCF	94.00	94.00	-0.4	0.4	0.00	0.12	
LZF	94.00	94.00	-0.4	0.4	0.00	0.12	
LAS	94.00	93.99	-0.4	0.4	-0.01	0.12	
LAeq	94.00	93.99	-0.4	0.4	-0.01	0.12	

4.12. Level linearity on the reference level range, Upper

Level linearity in reference range, measured at 8 kHz until overload. (section 14)

	Expected	Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty	
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	
94 dB	94.00	94.00	-1.1	1.1	0.00	0.12	
99 dB	99.00	99.00	-1.1	1.1	0.00	0.12	
104 dB	104.00	104.00	-1.1	1.1	0.00	0.12	
109 dB	109.00	109.01	-1.1	1.1	0.01	0.12	
114 dB	114.00	114.02	-1.1	1.1	0.02	0.12	
119 dB	119.00	119.02	-1.1	1.1	0.02	0.12	
124 dB	124.00	124.02	-1.1	1.1	0.02	0.12	
129 dB	129.00	129.03	-1.1	1.1	0.03	0.12	
134 dB	134.00	134.02	-1.1	1.1	0.02	0.12	
135 dB	135.00	135.02	-1.1	1.1	0.02	0.12	
136 dB	136.00	136.02	-1.1	1.1	0.02	0.12	
137 dB	137.00	137.02	-1.1	1.1	0.02	0.12	
138 dB	138.00	138.02	-1.1	1.1	0.02	0.12	
139 dB	139.00	139.02	-1.1	1.1	0.02	0.12	

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4.13. Level linearity on the reference level range, Lower

Level linearity in reference range, measured at 8 kHz down to lower limit, or until underrange. (section 14)

	Expected	Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty	
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	
94 dB	94.00	94.00	-1.1	1.1	0.00	0.12	
89 dB	89.00	88.99	-1.1	1.1	-0.01	0.12	
84 dB	84.00	84.00	-1.1	1.1	0.00	0.12	
79 dB	79.00	78.99	-1.1	1.1	-0.01	0.12	
74 dB	74.00	73.99	-1.1	1.1	-0.01	0.12	
69 dB	69.00	68.99	-1.1	1.1	-0.01	0.12	
64 dB	64.00	63.98	-1.1	1.1	-0.02	0.12	
59 dB	59.00	58.98	-1.1	1.1	-0.02	0.12	
54 dB	54.00	53.99	-1.1	1.1	-0.01	0.12	
49 dB	49.00	48.99	-1.1	1.1	-0.01	0.12	
44 dB	44.00	44.00	-1.1	1.1	0.00	0.12	
39 dB	39.00	39.02	-1.1	1.1	0.02	0.30	
34 dB	34.00	34.04	-1.1	1.1	0.04	0.30	
29 dB	29.00	29.11	-1.1	1.1	0.11	0.30	
28 dB	28.00	28.17	-1.1	1.1	0.17	0.30	
27 dB	27.00	27.19	-1.1	1.1	0.19	0.30	
26 dB	26.00	26.24	-1.1	1.1	0.24	0.30	
25 dB	25.00	25.29	-1.1	1.1	0.29	0.30	

4.14. Toneburst response, Time-weighting Fast

Response to 4 kHz toneburst measured in reference range, relative to continuous signal. (section 16)

	Expected	Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty	
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	
Continuous, Ref.	138.00	138.00	-0.8	0.8	0.00	0.11	
200 ms Burst	137.00	136.99	-0.8	0.8	-0.01	0.11	
2 ms Burst	120.00	119.93	-1.8	1.3	-0.07	0.11	
0.25 ms Burst	111.00	110.87	-3.3	1.3	-0.13	0.11	

4.15. Toneburst response, Time-weighting Slow

Response to 4 kHz toneburst measured in reference range, relative to continuous signal. (section 16)

	Expected	Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty	
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	
Continuous, Ref.	138.00	138.01	-0.8	0.8	0.01	0.11	
200 ms Burst	130.61	130.58	-0.8	0.8	-0.03	0.11	
2 ms Burst	111.01	110.97	-3.3	1.3	-0.04	0.11	

4.16. Toneburst response, LAE

Response to 4 kHz toneburst measured in reference range, relative to continuous signal. (section 16)

	Expected	Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty	
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	
Continuous, Ref.	138.00	138.00	-0.8	0.8	0.00	0.11	
200 ms Burst	131.00	130.98	-0.8	0.8	-0.02	0.11	
2 ms Burst	111.00	110.96	-1.8	1.3	-0.04	0.11	
0.25 ms Burst	102.00	101.86	-3.3	1.3	-0.14	0.11	

4.17. Peak C sound level, 8 kHz

Peak-response to a 8 kHz single- cycle sine measured in least-sensitive range, relative to continuous signal. (section 17)

	Expected	Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty	
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	
Continuous, Ref.	135.00	135.00	-0.4	0.4	0.00	0.11	
Single Sine	138.40	138.64	-2.4	2.4	0.24	0.40	

4.18. Peak C sound level, 500 Hz

Peak-response to a 500 Hz half-cycle sine measured in least-sensitive range, relative to continuous signal. (section 17)

	Expected	Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty	
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	
Continuous, Ref.	135.00	135.00	-0.4	0.4	0.00	0.11	
Half-sine, Positive	137.40	137.11	-1.4	1.4	-0.29	0.40	
Half-sine, Negative	137.40	137.11	-1.4	1.4	-0.29	0.40	

4.19. Overload indication

Overload indication in the least sensitive range determined with a 4 kHz positive/negative half-cycle signal. (section 18)

	Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty	
	[dB]	[dB]	[dB]	[dB]	[dB]	
Continuous	140.00	-0.4	0.4	0.00	0.20	
Half-sine, Positive	141.10	-10.0	10.0	1.10	0.20	
Half-sine, Negative	141.20	-10.0	10.0	1.20	0.20	
Difference	141.20	-1.8	1.8	0.10	0.30	

4.20. Environmental conditions, Following calibration

Actual environmental conditions following calibration. (section 7)

	Measured	
	[Deg / kPa / %RH]	
Air temperature	22.90	
Air pressure	99.50	
Relative humidity	51.00	

Brüel & Kjær

The Calibration Laboratory
Skodsborgvej 307, DK-2850 Nærum, Denmark

DANAK

The Danish Accreditation and Metrology Fund - DANAK - is managing the Danish accreditation scheme based on a contract with the Danish Safety Technology Authority under the Danish Ministry of Economics and Business Affairs who is responsible for the legislation on accreditation in Denmark.

The fundamental criteria for accreditation are described in DS/EN ISO/IEC 17025: "General requirements for the competence of testing and calibration laboratories", and in DS/EN ISO/IEC 15189 "Medical laboratories – Particular requirements for quality and competence" respectively. DANAK uses guidance documents to clarify the requirements in the standards, where this is considered to be necessary. These will mainly be drawn up by the "European co-operation for Accreditation (EA)" or the "International Laboratory Accreditation Co-operation (ILAC)" with a view to obtaining uniform criteria for accreditation worldwide. In addition, the Danish Safety Technology Authority issues Technical Regulations prepared by DANAK with specific requirements for accreditation that are not contained in the standards.

In order for a laboratory to be accredited it is, among other things, required:

- *that the laboratory and its personnel are free from any commercial, financial or other pressures, which might influence their impartiality;*
- *that the laboratory operates a documented management system, and has a management that ensures that the system is followed and maintained;*
- *that the laboratory has at its disposal all items of equipment, facilities and premises required for correct performance of the service that it is accredited to perform;*
- *that the laboratory has at its disposal personnel with technical competence and practical experience in performing the services that they are accredited to perform;*
- *that the laboratory has procedures for traceability and uncertainty calculations;*
- *that accredited testing, calibration or medical examination are performed in accordance with fully validated and documented methods;*
- *that accredited services are performed and reported in confidentiality with the customer and in compliance with the customer's request;*
- *that the laboratory keeps records which contain sufficient information to permit repetition of the accredited test, calibration or medical examination;*
- *that the laboratory is subject to surveillance by DANAK on a regular basis;*
- *that the laboratory shall take out an insurance, which covers liability in connection with the performance of accredited services.*

Reports carrying DANAK's accreditation mark are used when reporting accredited services and show that these have been performed in accordance with the rules for accreditation.

Appendix I.6.2: Environmental Noise Survey (ORS, February 2014)

Engineering a Sustainable Future

ORS Consulting Engineers / ORS Building / Marlinstown Office Park / Mullingar, Co. Westmeath / Ireland

ORS Consulting Engineers

T 044 934 2518
F 044 934 4573
E info@ors.ie
W www.ors.ie

Environmental Noise Survey

Rehab Glassco,
Unit 4 Oberstown Industrial Park,
Caragh Road,
Naas,
Co. Kildare

February 2014

Client	Revision	Date	Compiled	Checked	Approved
Rehab Glassco	D1	21/02/2014	DH	DC	
Unit 4 Oberstown Industrial Park, Caragh Road, Naas, Co. Kildare					

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0 Executive Summary

An Environmental noise survey was conducted on the 20th and 21st of February 2014 at the Rehab Glassco facility at 1 noise sensitive location outside the boundary of the facility, the location of which is highlighted on the enclosed site layout drawing.

Results from a previous noise monitoring period, carried out in January 2014 were seen to exceed recommended levels with some tonal noise present. It was concluded that some of this exceedance could be attributed to external noise sources that were out of the control of the client. In an attempt to conclusively indentify these external noise sources an additional period of noise monitoring was conducted when all operations at the Rehab Glassco plant were stopped.

Noise levels were compared to those recommended limits as set out EPA document **Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)** which states that ambient/daily noise levels should not exceed 55dB LAeq, with evening noise levels not exceeding 50dB LAeq and night time noise levels not exceeding 45dB LAeq at noise sensitive locations.

Noise levels at the Noise Sensitive Location are outside acceptable limits as set out in NG4. As the Rehab Glassco Plant was not in operation during this period of monitoring this exceedance can clearly be attributable to external noise sources which are discussed further in this report.

1 Scope

ORS Environmental Consultants were commissioned by Rehab Glassco to conduct a Daytime, evening and Night-time broadband; one-third octave noise for predetermined locations in Oberstown Industrial Park, Caragh Road, Naas, Co. Kildare. Rehab Glassco is a facility which recycles glass products.

Monitoring at NSL 1 was carried out on the 20th of February 2014, including day, evening and night-time monitoring.

2 Monitoring Locations

Environmental noise monitoring was carried out at one noise sensitive location (NSL 1). The survey was conducted when operations at the plant were stopped. The hours of waste acceptance (the hours during which the facility accepts waste) are: Monday to Saturday (including bank holidays): 07:00 (7am) to 19:00 (7pm); Sunday: closed.

The hours of operation (the hours during which the facility is operational) are: Monday to Friday (including bank holidays): 24-hours; Saturday: 07:00 (7am) to 23:00 (11pm); Sunday: closed.

The monitoring locations are detailed below in Table 1 and presented in the attached map in Appendix B.

Table 1: Noise Monitoring Location

Monitoring Location	Description
NSL 1	This monitoring point is located to the North of the site, outside of the site next to the boundary to the nearest dwelling. The monitor was positioned facing the Rehab Glassco Facility.
	*All monitoring locations are located at least 2m from any reflective surfaces

3 Activities on Site

No activities took place at the site during the monitoring periods.

4 Durations & Measurements of Surveying

The day-time monitoring was carried out between the daytime hours of 09:00 and 19.00 on the 20th February 2014. The evening and night-time monitoring was conducted on the 20th February 2014 between the hours of 19:00 and 23:00 for evening measurements and between 23.00 and 00.00 for night time measurements. The following measurement was carried out at each location:

- Day, evening and Night-time Broadband measurements LAeq, LA10, and LA90, over a 15 minute period as set out in "**Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)"** as a minimum survey duration.
- 1/3 octave band frequency analysis.

5 Weather Conditions

While every effort was made to carry out the survey in accordance with the requirements of Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4), regarding weather conditions, it should be noted that this is not always possible.

Ideally, measurements should be taken in 'neutral' weather conditions. This means in the absence of wind and precipitation, and ideally in conditions of standard temperature and pressure. Clearly, these conditions very rarely apply. The noise monitor was fitted with a windshield throughout the survey. An average wind speed of less than 5m/sec is the preferred limit when noise measurements are being taken, with 7m/sec an upper limit. On the days in question the wind speed was within limits. In as far as

possible, care was be taken to avoid measurements so close to objects as to give rise to wind-derived noises, e.g. trees, pylons, etc.

Wind speed and wind direction have the potential to affect noise propagation and hence the noise measurements. The prevailing weather conditions at the time of measurement was noted and recorded in the survey report. Prior to each monitoring period a measurement of wind strength and direction was taken using a portable anemometer. A wind speed of 1-2m/s was measured coming from Northerly direction.

6 Instrumentation & Methodology

Measurements were made using a Bruel & Kjaer 2250 integrating sound level meter (SLM) with selective 1:1 or 1:3 octave band filters. Calibration was carried out on site using a Bruel & Kjaer acoustic calibrator at 94dB (A). The meter was calibrated before and after the monitoring round. Factory calibration certificates for the SLM and the acoustic calibrator, detailing equipment serial numbers, calibration traceability and recalibration dates are presented in Appendix C of this report. A "Windshield" was also fitted to the sound meter at all stages of monitoring.

The sound level meter was mounted at 1.5m above ground level. A sample period for the noise measurements was selected to be 15 minute intervals.

7 Glossary of Terms

Ambient noise: The total encompassing sound in a given situation at a given time usually composed of sound from many sources, near and far.

Background Noise Level: The A-weighted sound pressure level of the residual noise at the assessment position that is exceeded for 90 per cent of a given time interval, T. (L_{A90}, T).

Criterion Noise Level: The long-term mean value of the noise level that must not be exceeded. This is generally stipulated in the waste permit and it may be applied to a noise source, a boundary of the activity or to noise sensitive locations in the vicinity of the facility.

1/3 Octave Band Analysis: Frequency analysis of sound such that the frequency spectrum is subdivided into bands of one–third of an octave each. An octave is taken to be a frequency interval, the upper limit of which is twice the lower limit (the unit of frequency is the Hertz, Hz).

dB (decibel): The scale in which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the RMS pressure of the sound field and the reference pressure of 20 micro-pascals (20 µPa).

dBA or dB(A): An 'A-weighted decibel' - a measure of the overall noise level of sound across the audible frequency range (20 Hz – 20 kHz) with A-frequency weighting (i.e. 'A'–weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.

Facade Level: Noise levels at locations 1m from the facade of a building are described by the term *Facade Levels* and are subject to higher noise levels than those in open areas (free-field conditions) due to reflection effects.

Free-field Conditions: These are conditions in which the radiation from sound sources is unaffected by the presence of any reflecting boundaries. In practice, it is a field in which the effects of the boundaries are negligible over the frequency range of interest. In environmental noise, true free-field measurement conditions are seldom achieved and generally the microphone will be positioned at a height between 1.2 and 1.5 metres above ground level. To minimise the influence of reflections, measurements are generally made at least 3.5 metres from any reflecting surface other than the ground.

Hz (Hertz): The unit of sound frequency in cycles per second.

Impulsive Noise: A noise that is of short duration (typically less than one second), the sound pressure level of which is significantly higher than the background. In determining whether a tonal adjustment applies, reference must be made to ISO 1996-2 (1987) - Section 4.1.

Impulse Exponential – Time-Weighting: This is a time-weighting which is available on some sound level meters and it represents an arbitrary compromise in an attempt to provide a means to measure the sound level of short-duration impulsive sounds. Impulse time-weighting has a design goal exponential-time constant of 35 ms for sound signals that increase with increasing time and 1.5 seconds for sound signals that decrease with increasing time.

LAeq,T: The equivalent steady sound level in dB containing the same acoustic energy as the actual fluctuating sound level over the given period, T.

LAmax: The maximum RMS, A-Weighted sound pressure level occurring within a specified time period; the time weighting fast or slow is usually specified.

Noise: Any sound, that has the potential to cause disturbance, discomfort or psychological stress to a subject exposed to it, or any sound, that could to cause actual physiological harm to a subject exposed to it, or physical damage to any structure exposed to it, is known as noise.

Noise Sensitive Location: Any dwelling house, hotel or hostel, health building, educational establishment, place of worship or entertainment, or any other facility or other area of high amenity which for its proper enjoyment requires the absence of noise at nuisance levels.

Rating level (LAr,T) : The specific noise level, plus any adjustment for the characteristic features of the noise.

Residual noise: The ambient noise remaining at a given position in a given situation when the specific source is suppressed to a degree such that it does not contribute to the ambient noise (residual noise level is measured in terms of LAeq, T).

Root Mean Square (RMS): The RMS value of a set of numbers is the square root of the average of their squares.

Sound Exposure Level (SEL or LAE): Is the measure of the A-Weighted sound energy used to describe noise events such as the passing of a train or aircraft; it is the A-weighted sound pressure level if occurring over a period of 1 second, would contain the same amount of A-weighted sound energy as the event.

Specific noise level: A component of the ambient noise which can be specifically identified by acoustical means and may be associated with a specific source. In BS 4142, there is more precise definition as

follows: 'the equivalent continuous A-weighted sound pressure level at the assessment position produced by the specific noise source over a given reference time interval (LAeq, T)'.

Time-weighting: One of the averaging times (Fast, Slow or Impulse) used for the measurement of RMS sound pressure level in sound level meters.

Tonal Noise: Noise which contains a clearly audible tone, i.e. a distinguishable, discrete or continuous note (whine, hiss screech or hum etc.). In determining whether a tonal adjustment applies, reference must be made to ISO 1996-2 (1987) - Section 4.

8 Noise Measurement Data

Table 3: Daytime Monitoring Data 20th February 14			
Monitoring Location	**Time**	**$L_{Aeq,15min}$ dB(A)**	**NG4 Limit dB(A)**
NSL 1	15.43 -15.58	56	55
NSL 1	16.01 - 16.16	56	55
NSL 1	18.39 -18.54	55	55

Table 4: Evening Monitoring Data 20th February 14			
Monitoring Location	**Time**	**$L_{Aeq,15min}$ dB(A)**	**NG4 Limit dB(A)**
NSL 1	19.15-19.0	56	50

Table 5: Night Monitoring Data 20th February 14			
Monitoring Location	**Time**	**$L_{Aeq,15min}$ dB(A)**	**NG4 Limit dB(A)**
NSL 1	23.05-23.20	53	45
NSL 1	23.32-23.47	53	45

		Table 6: 1/3 Octave Band Analysis (12.50Hz – 400.00Hz)										20th February (Day)			
Monitoring Location	**12.50 Hz**	**16.00 Hz**	**20.00 Hz**	**25.00 Hz**	**31.50 Hz**	**40.00 Hz**	**50.00 Hz**	**63.00 Hz**	**80.00 Hz**	**100.00 Hz**	**125.00 Hz**	**160.00 Hz**	**200.00 Hz**	**250.00 Hz**	**315.00 Hz**	**400.00 Hz**
NSL 1 15.43-15.58	-5	20	9	10	30	23	29	26	26	28	29	30	31	33	37	43
NSL 1 16.01 – 6.16	2	7	10	14	16	20	24	29	29	30	33	35	35	35	37	39
NSL 1 18.39 -18.54	-9	-3	3	8	13	21	22	26	27	34	33	32	36	35	33	38

		Table 6: 1/3 Octave Band Analysis (500.00Hz – 16000.00Hz)										20th February (Day)			
Monitoring Location	**500.00 Hz**	**630.00 Hz**	**800.00 Hz**	**1000.00 Hz**	**1250.00 Hz**	**1600.00 Hz**	**2000.00 Hz**	**2500.00 Hz**	**3150.00 Hz**	**4000.00 Hz**	**5000.00 Hz**	**6300.00 Hz**	**8000.00 Hz**	**10000.00 Hz**	**12500.00 Hz**	**16000.00 Hz**
NSL 1 15.43-15.58	46	47	44	41	39	37	33	30	27	25	21	16	12	11	6	4
NSL 1 16.01 – 6.16	45	46	49	50	47	45	43	38	36	28	29	28	25	22	16	8
NSL 1 18.39 -18.54	41	46	48	50	48	42	41	35	33	30	26	24	22	18	12	6

		Table 7: 1/3 Octave Band Analysis (12.50Hz – 400.00Hz)											20th February (Evening)			
Monitoring Location	**12.50 Hz**	**16.00 Hz**	**20.00 Hz**	**25.00 Hz**	**31.50 Hz**	**40.00 Hz**	**50.00 Hz**	**63.00 Hz**	**80.00 Hz**	**100.00 Hz**	**125.00 Hz**	**160.00 Hz**	**200.00 Hz**	**250.00 Hz**	**315.00 Hz**	**400.00 Hz**
NSL 1 19.15-19.30	-11	-4	1	10	13	21	23	27	29	28	29	32	30	33	35	40
		Table 7: 1/3 Octave Band Analysis (500.00Hz – 16000.00Hz)											20th February			
Monitoring Location	**500.00 Hz**	**630.00 Hz**	**800.00 Hz**	**1000.00 Hz**	**1250.00 Hz**	**1600.00 Hz**	**2000.00 Hz**	**2500.00 Hz**	**3150.00 Hz**	**4000.00 Hz**	**5000.00 Hz**	**6300.00 Hz**	**8000.00 Hz**	**10000.00 Hz**	**12500.00 Hz**	**16000.00 Hz**
NSL 1 19.15-19.30	43	47	49	50	48	46	40	37	33	28	25	21	17	11	8	6

		Table 8: 1/3 Octave Band Analysis (12.50Hz – 400.00Hz)											20th February (Night)			
Monitoring Location	**12.50 Hz**	**16.00 Hz**	**20.00 Hz**	**25.00 Hz**	**31.50 Hz**	**40.00 Hz**	**50.00 Hz**	**63.00 Hz**	**80.00 Hz**	**100.00 Hz**	**125.00 Hz**	**160.00 Hz**	**200.00 Hz**	**250.00 Hz**	**315.00 Hz**	**400.00 Hz**
NSL 1 23.05 –23.20	-5	21	9	10	18	30	23	28	27	27	28	30	31	31	32	37
NSL 1 23.32-23.47	-4	22	10	7	21	22	22	29	27	28	28	30	32	33	33	37

		Table 8: 1/3 Octave Band Analysis (500.00Hz – 16000.00Hz)										20th February (Night)			
Monitoring Location	**500.00 Hz**	**630.00 Hz**	**800.00 Hz**	**1000.00 Hz**	**1250.00 Hz**	**1600.00 Hz**	**2000.00 Hz**	**2500.00 Hz**	**3150.00 Hz**	**4000.00 Hz**	**5000.00 Hz**	**6300.00 Hz**	**8000.00 Hz**	**10000.00 Hz**	**12500.00 Hz**	**16000.00 Hz**
NSL 1 23.05 – 23.20	41	43	45	45	44	41	39	38	34	30	27	25	21	17	13	6
NSL 1 23.32-23.47	43	45	45	44	45	42	39	32	27	24	19	14	9	5	3	1

9 Interferences

Below is a comprehensive breakdown of all the noise interference and sources that occurred at NSL 1 during each monitoring period.

Noise Sources/Interferences – NSL	
Date	
20th February 2014 Day time	• Traffic noise from M7 was quite prominent • Truck movements at nearby facility • Birdsong • Light Rain • Trees rustling in wind
20th February 2014 Evening	• Birdsong • A number of Lorries were noted to enter the neighbouring warehousing facility and were left idling for long periods. • Road noise from the nearby R409 to the East, Local road to the North of the Site and the M7 • Tractor passing on R409
20th February 2014 Night Time	• Road noise from the nearby R409 to the East • Traffic noise from M7 was quite prominent • Truck movements at nearby facility • Light rain

10 Evaluation of Measurement Data

Tables 3 to 8 summarises the monitoring data for each period of noise monitoring which was carried out on site. From this monitoring the noise levels recorded ranged from 55dB (A) to 57dB (A) during the day, 56dB (A) during the evening and 53dB (A) during the night-time period.

These, in the main, are considered not to comply with the recommended Noise Level limits as set out in EPA document **Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4) 2012.**

On review of the one-third octave band analysis tonal noise qualities were recorded at 16Hz. The 16Hz level recorded maybe attributable to the truck engines running constant on the adjacent site which was quite prominent during the monitoring period. The frequency of 16Hz in which tonal noise was detected is below 20Hz and therefore is not audible to the human ear.

11 Conclusion

Detailed below in tabular format is the noise levels recorded both when the site was fully operational and when the site was shut down. The data highlighted in blue are an average of the readings when the facility is fully operational and the other data is representative of the latest survey when the facility was shut down.

Location	Day dB(L_{Aeq})		Evening dB(L_{Aeq})		Night dB (L_{Aeq})	
Date of Monitoring	20th Feb	16th Jan	20th Feb	16th Jan	20th Feb	16th Jan
NSL	56	**56**	55	**55**	53	**55**
Typical Limits						
	55		50		45	

As can be seen there is no significant reduction in noise levels at the noise sensitive location during each time period when the Rehab Glassco site was not in operation.

It is noted that there is a slight reduction in noise levels during night time period of 2dB. However this difference is not deemed to be significant and would not be attributable to operations at the Rehab Glassco Site. it is also noted that at the time of the 55dB reading an increase of truck movements was noted within the neighbouring warehousing facility site.

Given the above results it can be concluded that any exceedance in noise limits is attributable to external influences such as the constant traffic noise associated with the R409, M7 and the adjacent 24hr Warehousing Facility and not the Rehab Glassco facility.

Appendix A – Noise Measurement Graphs

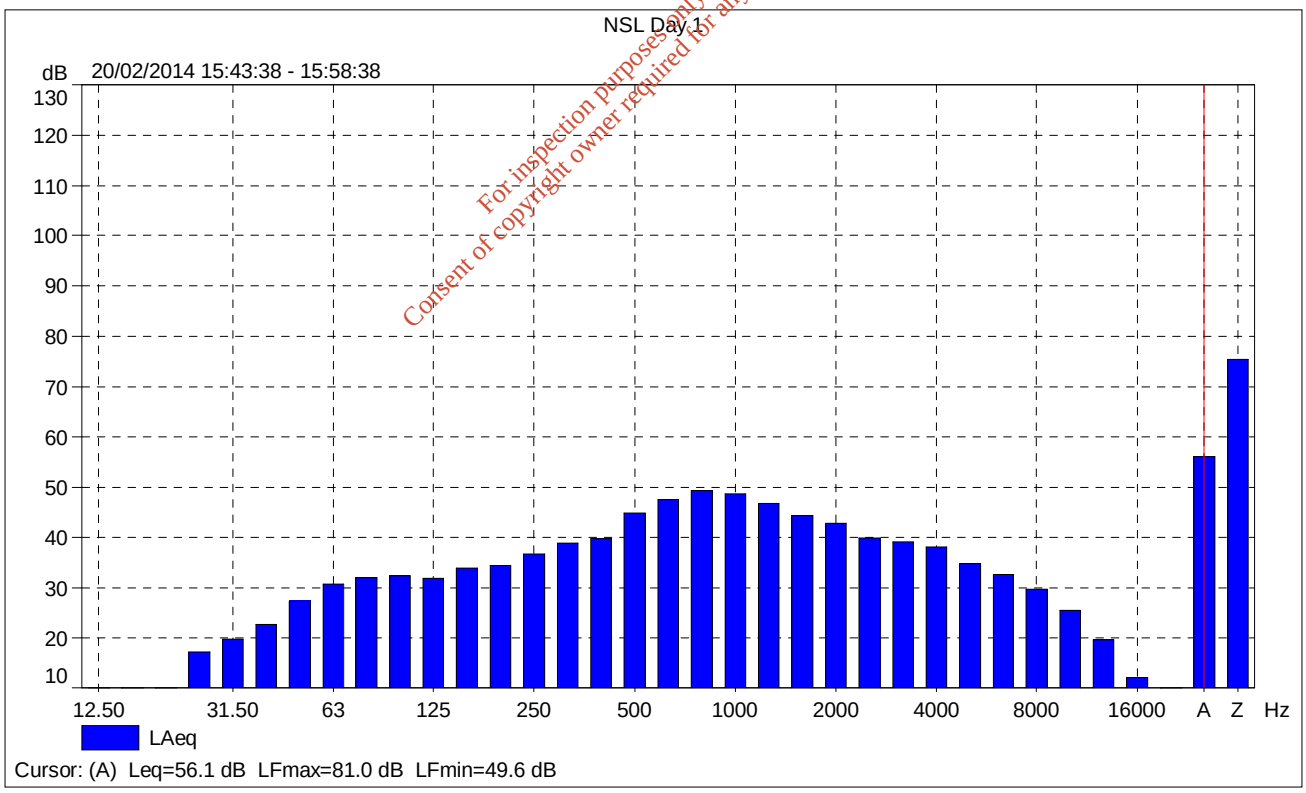
NSL Day 1

Instrument:		2250-L
Application:		BZ7132 Version 3.0.1
Start Time:		02/20/2014 15:43:38
End Time:		02/20/2014 15:58:38
Elapsed Time:		00:15:00
Bandwidth:		1/3-octave
Max Input Level:		140.72

	Time	Frequency
Broadband (excl. Peak):	FSI	AZ
Broadband Peak:		C
Spectrum:	FS	A

Instrument Serial Number:		2602719
Microphone Serial Number:		2600864
Input:		
Windscreen Correction:		UA-0237
Sound Field Correction:		Free-field

Calibration Time:		02/20/2014 15:39:07
Calibration Type:		External reference
Sensitivity:		51.3830631971359 mV/Pa



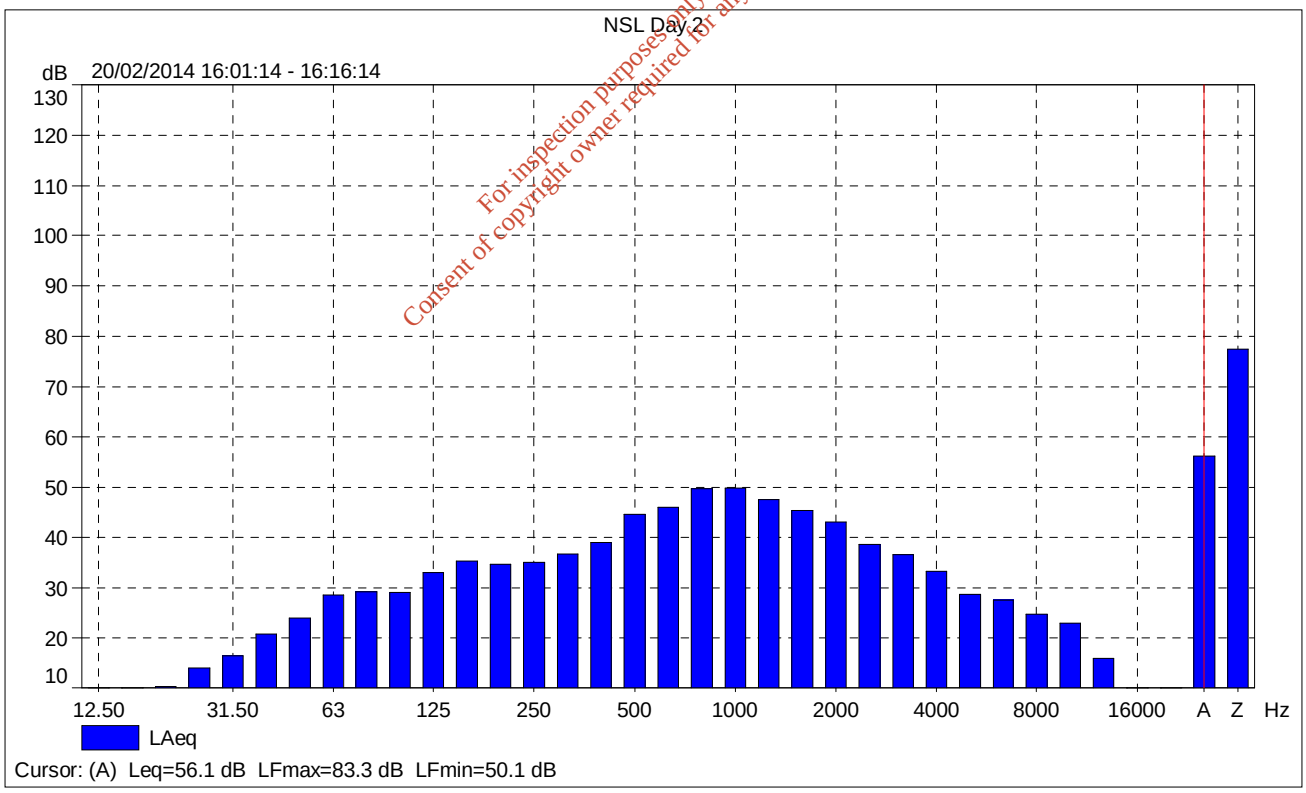
NSL Day 2

Instrument:		2250-L
Application:		BZ7132 Version 3.0.1
Start Time:		02/20/2014 16:01:14
End Time:		02/20/2014 16:16:14
Elapsed Time:		00:15:00
Bandwidth:		1/3-octave
Max Input Level:		140.72

	Time	Frequency
Broadband (excl. Peak):	FSI	AZ
Broadband Peak:		C
Spectrum:	FS	A

Instrument Serial Number:		2602719
Microphone Serial Number:		2600864
Input:		
Windscreen Correction:		UA-0237
Sound Field Correction:		Free-field

Calibration Time:		02/20/2014 15:39:07
Calibration Type:		External reference
Sensitivity:		51.3830631971359 mV/Pa



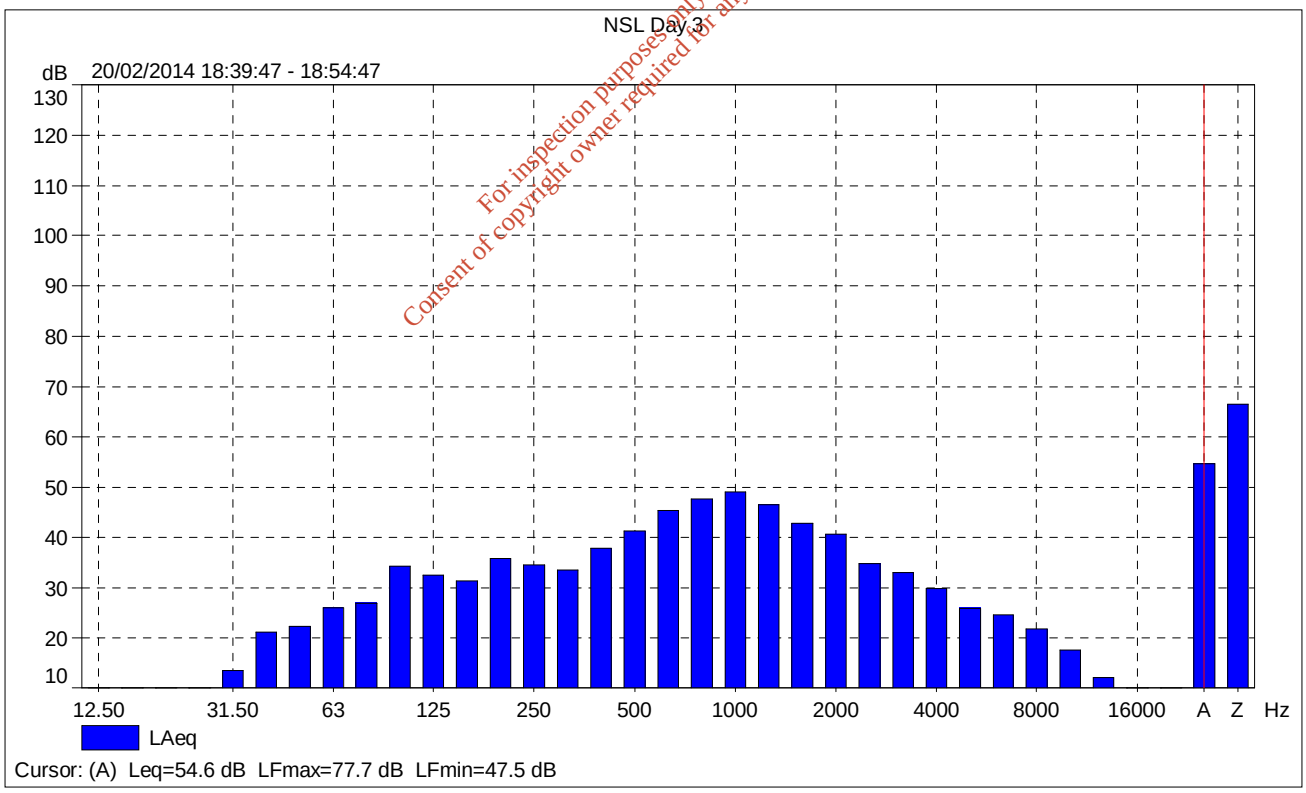
NSL Day 3

Instrument:		2250-L
Application:		BZ7132 Version 3.0.1
Start Time:		02/20/2014 18:39:47
End Time:		02/20/2014 18:54:47
Elapsed Time:		00:15:00
Bandwidth:		1/3-octave
Max Input Level:		140.71

	Time	Frequency
Broadband (excl. Peak):	FSI	AZ
Broadband Peak:		C
Spectrum:	FS	A

Instrument Serial Number:		2602719
Microphone Serial Number:		2600864
Input:		
Windscreen Correction:		UA-0237
Sound Field Correction:		Free-field

Calibration Time:		02/20/2014 15:39:07
Calibration Type:		External reference
Sensitivity:		51.3830631971359 mV/Pa



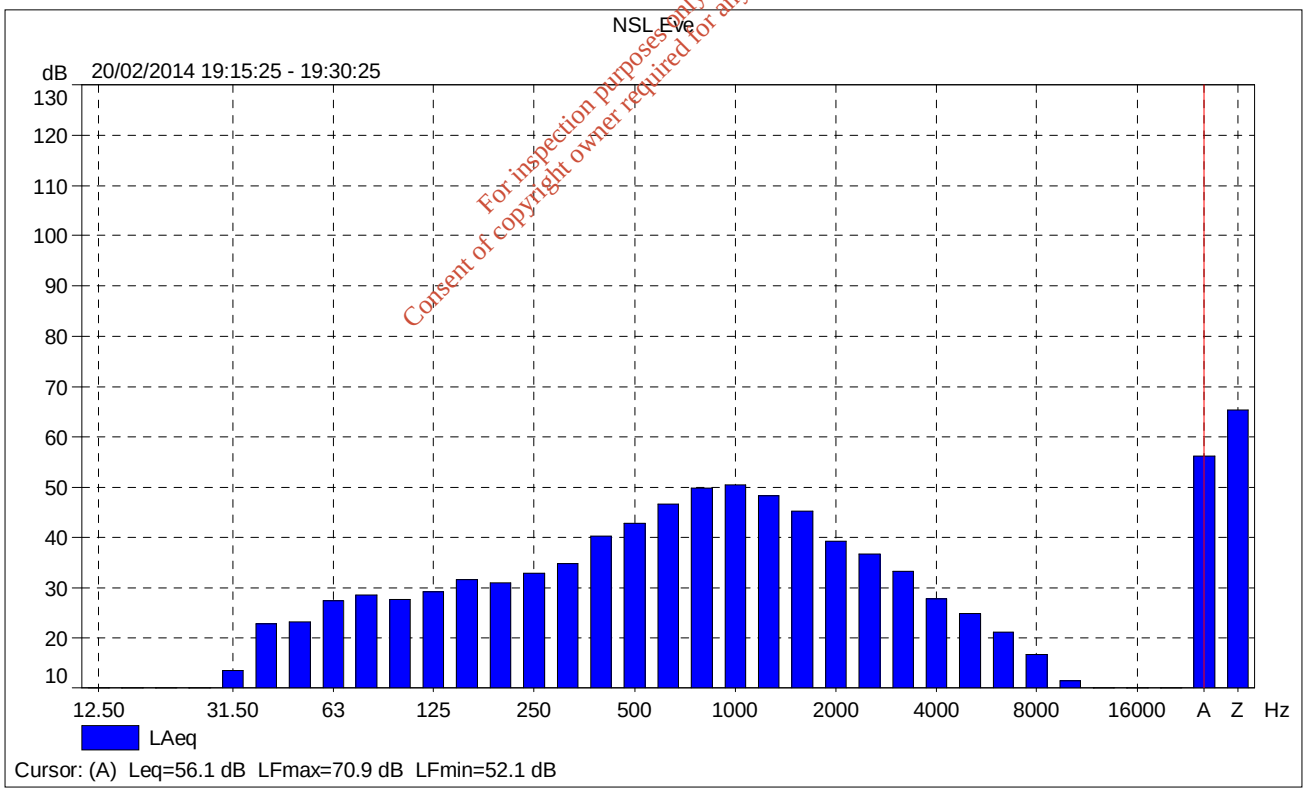
NSL Eve

Instrument:		2250-L
Application:		BZ7132 Version 3.0.1
Start Time:		02/20/2014 19:15:25
End Time:		02/20/2014 19:30:25
Elapsed Time:		00:15:00
Bandwidth:		1/3-octave
Max Input Level:		140.71

	Time	Frequency
Broadband (excl. Peak):	FSI	AZ
Broadband Peak:		C
Spectrum:	FS	A

Instrument Serial Number:		2602719
Microphone Serial Number:		2600864
Input:		
Windscreen Correction:		UA-0237
Sound Field Correction:		Free-field

Calibration Time:		02/20/2014 15:39:07
Calibration Type:		External reference
Sensitivity:		51.3830631971359 mV/Pa



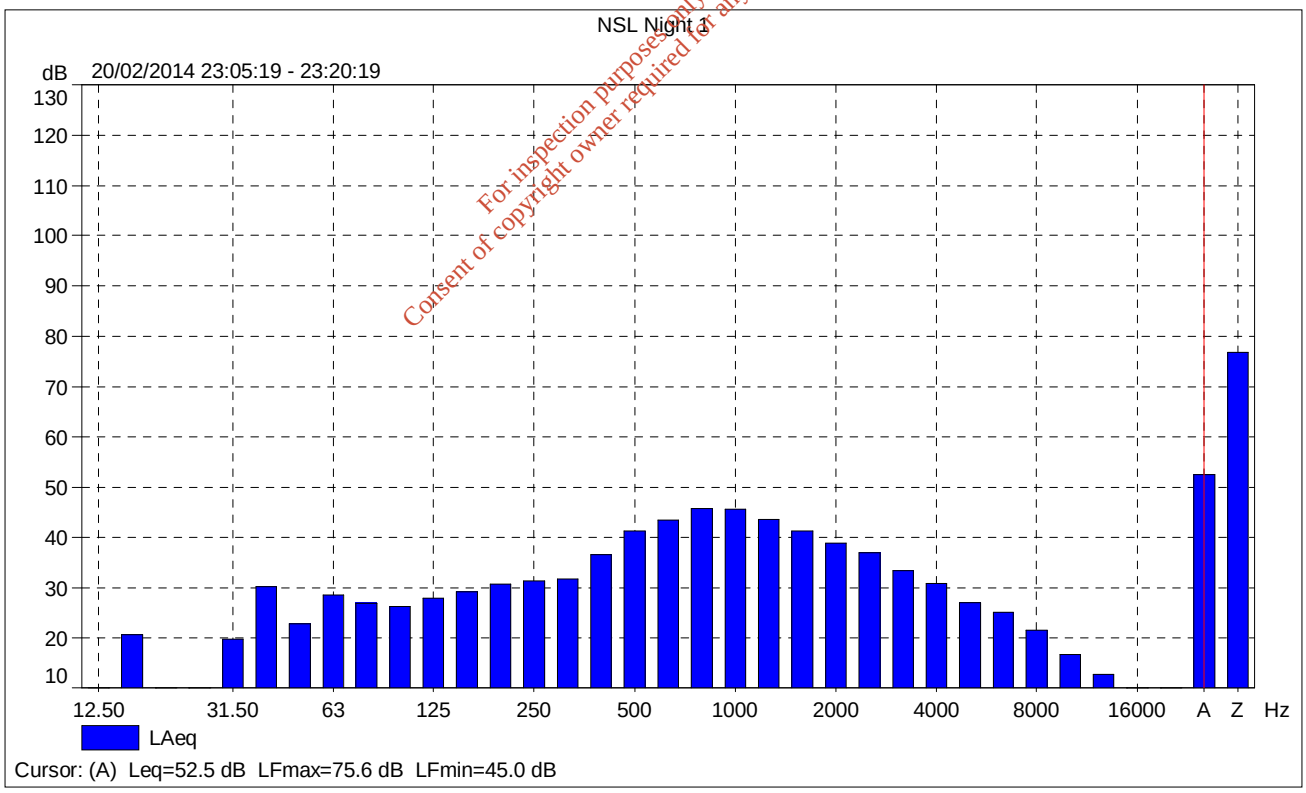
NSL Night 1

Instrument:		2250-L
Application:		BZ7132 Version 3.0.1
Start Time:		02/20/2014 23:05:19
End Time:		02/20/2014 23:20:19
Elapsed Time:		00:15:00
Bandwidth:		1/3-octave
Max Input Level:		140.71

	Time	Frequency
Broadband (excl. Peak):	FSI	AZ
Broadband Peak:		C
Spectrum:	FS	A

Instrument Serial Number:		2602719
Microphone Serial Number:		2600864
Input:		
Windscreen Correction:		None
Sound Field Correction:		Free-field

Calibration Time:		02/20/2014 15:39:07
Calibration Type:		External reference
Sensitivity:		51.3830631971359 mV/Pa



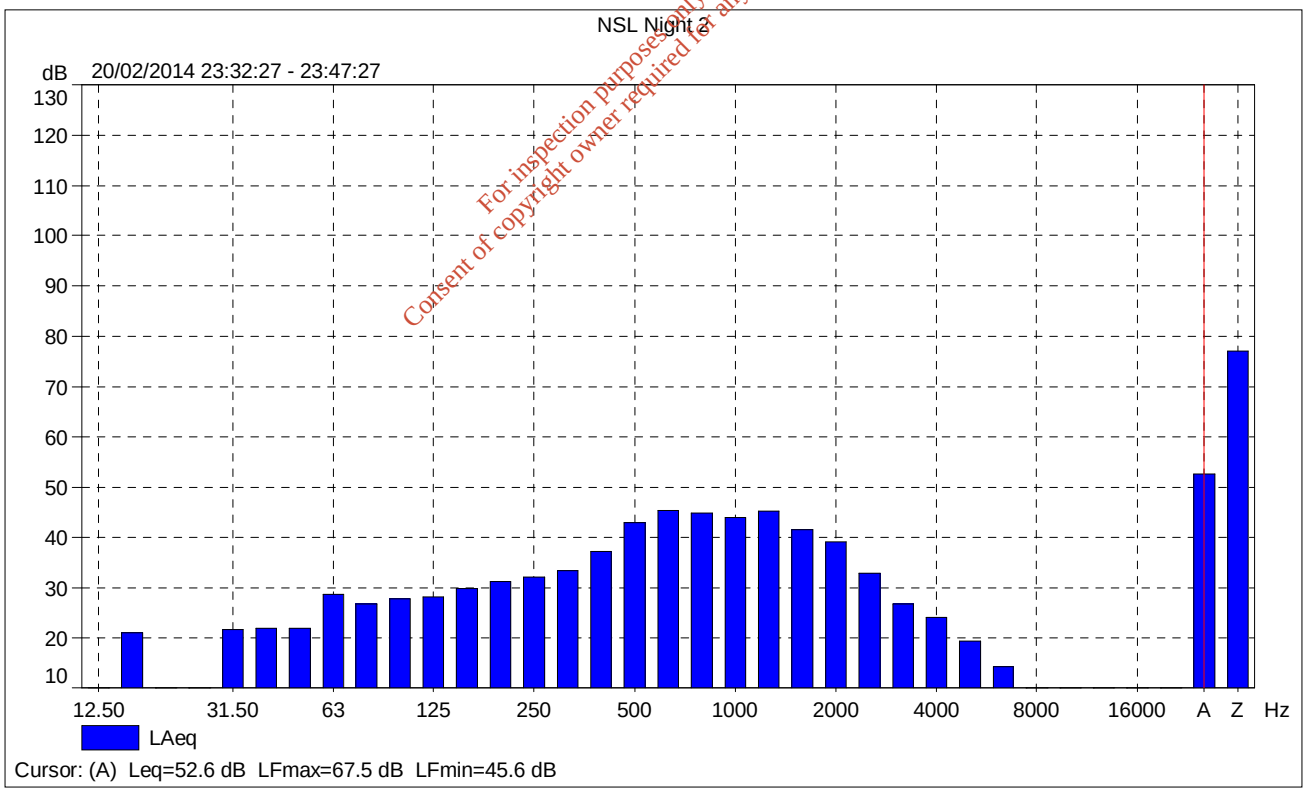
NSL Night 2

Instrument:		2250-L
Application:		BZ7132 Version 3.0.1
Start Time:		02/20/2014 23:32:27
End Time:		02/20/2014 23:47:27
Elapsed Time:		00:15:00
Bandwidth:		1/3-octave
Max Input Level:		140.71

	Time	Frequency
Broadband (excl. Peak):	FSI	AZ
Broadband Peak:		C
Spectrum:	FS	A

Instrument Serial Number:		2602719
Microphone Serial Number:		2600864
Input:		
Windscreen Correction:		None
Sound Field Correction:		Free-field

Calibration Time:		02/20/2014 15:39:07
Calibration Type:		External reference
Sensitivity:		51.3830631971359 mV/Pa



Appendix B – Noise Monitoring Locations

A3

R409

PIRVATE DWELLING

NSL 1

REHAB GLASSCO SITE BOUNDARY

REHAB GLASSCO MAIN BUILDING

LEGEND	
	BOUNDARY LINE
Nx	NOISE MONITORING LOCATIONS
NSL	NOISE SENSITIVE LOCATIONS
Dx	DUST MONITORING LOCATIONS
SWx	SURFACEWATER MONITORING LOCATIONS
BHx	GROUNDWATER MONITORING LOCATIONS
	EXISTING WELL/BOREHOLE
Vx	VIBRATION MONITORING LOCATIONS
Ax	AIR MONITORING LOCATIONS
	EXISTING SURFACE WATER PIPES
	EXISTING FOUL SEWER PIPES
	EXISTING WATERMAIN
	EXISTING MANHOLE
F	FOUL SEWER
S	SURFACE WATER
	EXISTING BUILDING
	PROPOSED BUILDING
	NORTH POINT

SITE LAYOUT - NTS

REVISION DATE 31/05/11

REVISION 1

FORM NO FRM-010

ISSUE

ON ORIGINAL

0 10 20 30 40 50mm

REV NO:	DATE:	REVISION NOTE:	DWN BY:	CKD BY:
D1	06/12/12	ISSUED TO CLIENT	DH	DC

SITE LOCATION

Datum: Irish Grid System: Malin Head ITM

CLIENT:	REHAB GLASSCO
PROJECT:	ENVIRONMENTAL NOISE MONITORING AT REHAB GALSSCO SITE, NAAS
TITLE:	SITE LAYOUT NOISE MONITORING LOCATIONS

DRAWN:	CHECKED:	APPROVED:	DRAWING NO:	REV:
DH	DC		101_169_201	D1
DATE: 06/12/12	SCALE: NTS			

ORS
Consulting Engineers
ORS Building, Mullingar, Co. Westmeath
T: +353 (0) 44 934 2518 F: +353 (0) 44 934 4573
E: info@ors.ie W: www.ors.ie
ISO 9001:2008 QUALITY ASSURED COMPANY

Appendix C – Calibration Certificates

Brüel & Kjær

The Calibration Laboratory
Skodsborgvej 307, DK-2850 Nærum, Denmark

ilac-MRA DANAK CAL. Reg.nr. 307

CERTIFICATE OF CALIBRATION

No: C1107125

CALIBRATION OF

Sound Level Meter:	Brüel & Kjær Type 2250 Light	No: 2602719	Id: -
Microphone:	Brüel & Kjær Type 4950	No: 2600864	
Preamplifier:	Brüel & Kjær Type ZC-0032	No: 6365	
Supplied Calibrator:	Brüel & Kjær Type 4231	No: 2605825	
Software version:	BZ7131 Version 3.0.1	Pattern Approval:	PENDING
Instruction manual:	BE-1774-11		

CUSTOMER

ORS Consulting Engineers
Marlinstown Office Park
Mullingar
Co. Westmeath, Ireland

CALIBRATION CONDITIONS

Preconditioning: 4 hours at 23°C ± 3°C

Environment conditions: *See actual values in **Environmental conditions** sections.*

SPECIFICATIONS

The Sound Level Meter Brüel & Kjær Type 2250 Light has been calibrated in accordance with the requirements as specified in IEC61672-1:2002 class 1. Procedures from IEC 61672-3:2006 were used to perform the periodic tests.

PROCEDURE

The measurements have been performed with the assistance of Brüel & Kjær Sound Level Meter Calibration System 3630 with application software type 7763 (version 4.5 - DB: 4.50) by using procedure 2250-L-4950.

RESULTS

Calibration Mode: **Calibration as received.**

The reported expanded uncertainty is based on the standard uncertainty multiplied by a coverage factor $k = 2$ providing a level of confidence of approximately 95 %. The uncertainty evaluation has been carried out in accordance with EA-4/02 from elements originating from the standards, calibration method, effect of environmental conditions and any short time contribution from the device under calibration.

Date of calibration: 2011-09-08

Date of issue: 2011-09-08

Steen Vodstrup Andersen
Calibration Technician

Nils Johansen
Approved Signatory

Brüel & Kjær

The Calibration Laboratory
Skodsborgvej 307, DK-2850 Nærum, Denmark

1. Calibration Note

n/a

2. Summary

4.1. Preliminary inspection	Passed
4.2. Environmental conditions, Prior to calibration	Passed
4.3. Reference information	Passed
4.4. Indication at the calibration check frequency	Passed
4.5. Self-generated noise, Microphone installed	Passed
4.6. Acoustical signal tests of a frequency weighting, C weighting	Passed
4.7. Self-generated noise, Electrical	Passed
4.8. Electrical signal tests of frequency weightings, A weighting	Passed
4.9. Electrical signal tests of frequency weightings, C weighting	Passed
4.10. Electrical signal tests of frequency weightings, Z weighting	Passed
4.11. Frequency and time weightings at 1 kHz	Passed
4.12. Level linearity on the reference level range, Upper	Passed
4.13. Level linearity on the reference level range, Lower	Passed
4.14. Toneburst response, Time-weighting Fast	Passed
4.15. Toneburst response, Time-weighting Slow	Passed
4.16. Toneburst response, LAE	Passed
4.17. Peak C sound level, 8 kHz	Passed
4.18. Peak C sound level, 500 Hz	Passed
4.19. Overload indication	Passed
4.20. Environmental conditions, Following calibration	Passed

The sound level meter submitted for periodic testing successfully completed the class 1 tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed.
However, no general statement or conclusion can be made about conformance of the sound level meter to the full requirements of IEC 61672-1:2002 because evidence was not publicly available, from an independent testing organization responsible pattern approvals, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002 and because the periodic test of IEC 61672-3:2006 cover only a limited subset of the specifications in IEC 61672-1:2002.

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3. Instruments

	Instrument	Inventory No.
Generator	Brüel & Kjær, Type 3560	123560014
AmplifierDivider	Brüel & Kjær, Type 3111	123111004
Calibrator	Brüel & Kjær, Type 4226	124226018
Adaptor	Brüel & Kjær, Type WA-0302-B 15 pF	150503009
Voltmeter	Agilent, Type 34970A	142101028

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4. Measurements

4.1. Preliminary inspection

Visually inspect instrument, and operate all relevant controls. (section 5)

Routine Passed

4.2. Environmental conditions, Prior to calibration

Actual environmental conditions prior to calibration. (section 7)

	Measured	
	[Deg / kPa / %RH]	
Air temperature	22.30	
Air pressure	99.57	
Relative humidity	53.00	

4.3. Reference information

Information about reference range, level and channel. (section 19.h + 19.m)

	Value	
	[dB]	
Reference sound pressure level	94	
Reference level range	140	
Channel number	1	

4.4. Indication at the calibration check frequency

Measure and adjust sound level meter using the supplied calibrator. (section 9 + 19.m)

	Measured	Uncertainty	
	[dB / Hz]	[dB / Hz]	
Initial indication (supplied calibrator)	93.89	0.14	
Calibration check frequency (supplied calibrator)	1000.00	1.00	
Adjusted indication (supplied calibrator)	93.85	0.14	

4.5. Self-generated noise, Microphone installed

Self-generated noise measured with microphone submitted for periodic testing. Averaging time is 30 seconds. An anechoic chamber is used to isolate environmental noise. (section 10.1)

	Max	Measured	Deviation	Uncertainty	
	[dB]	[dB]	[dB]	[dB]	
A weighted	17.40	16.16	-1.24	1.00	
Monitor Level	20.40	11.40	-9.00	1.00	

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4.6. Acoustical signal tests of a frequency weighting, C weighting

Frequency weightings measured acoustically with a calibrated multi-frequency sound calibrator. Averaging time is 10 seconds, and the result is the average of 2 measurements. (section 11)

	Coupler Pressure Lc	Mic. Correction C4226	Body Influence	Expected	Measured	Corr. Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty	
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	
1000Hz, Ref. (1st)	94.30	0.15	-0.09	94.24	94.18	94.18	-1.1	1.1	-0.06	0.20	
1000Hz, Ref. (2nd)	94.30	0.15	-0.09	94.24	94.18	94.18	-1.1	1.1	-0.06	0.20	
1000Hz, Ref. (Average)	94.30	0.15	-0.09	94.24	94.18	94.18	-1.1	1.1	-0.06	0.20	
125.89Hz (1st)	94.28	0.00	0.00	94.11	94.25	94.25	-1.5	1.5	0.14	0.20	
125.89Hz (2nd)	94.28	0.00	0.00	94.11	94.25	94.25	-1.5	1.5	0.14	0.20	
125.89Hz (Average)	94.28	0.00	0.00	94.11	94.25	94.25	-1.5	1.5	0.14	0.20	
3981.1Hz (1st)	94.23	1.15	-0.06	92.37	92.17	92.17	-1.6	1.6	-0.20	0.30	
3981.1Hz (2nd)	94.23	1.15	-0.06	92.37	92.18	92.18	-1.6	1.6	-0.19	0.30	
3981.1Hz (Average)	94.23	1.15	-0.06	92.37	92.18	92.18	-1.6	1.6	-0.19	0.30	
7943.3Hz (1st)	93.98	3.85	-0.17	87.33	86.98	86.98	-3.1	2.1	-0.35	0.40	
7943.3Hz (2nd)	93.98	3.85	-0.17	87.33	86.99	86.99	-3.1	2.1	-0.34	0.40	
7943.3Hz (Average)	93.98	3.85	-0.17	87.33	86.98	86.98	-3.1	2.1	-0.35	0.40	

4.7. Self-generated noise, Electrical

Self-generated noise measured in most sensitive range, with electrical substitution for microphone, according to manufactures specifications.

Exceedance of the measured level above the corresponding level given in the instruction manual does not, by itself, mean that the performance of the sound level meter is no longer acceptable for many practical applications. (section 10.2)

	Max	Measured	Uncertainty	
	[dB]	[dB]	[dB]	
A weighted	13.70	12.86	0.30	
C weighted	15.00	13.37	0.30	
Z weighted	20.40	18.91	0.30	

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4.8. Electrical signal tests of frequency weightings, A weighting

Frequency response measured with electrical signal relative to level at 1 kHz in reference range. (section 12)

	Input Level	Expected	Measured	Acoustical Resp.	Body Influence	Corr. Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty
	[dBV]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
1000Hz, Ref.	-24.68	95.00	95.00	-0.04	-0.09	94.87	-1.1	1.1	-0.13	0.12
63.096Hz	1.52	95.00	95.01	0.21	0.00	95.22	-1.5	1.5	0.22	0.12
125.89Hz	-8.58	95.00	95.01	0.10	0.00	95.11	-1.5	1.5	0.11	0.12
251.19Hz	-16.08	95.00	94.97	0.01	0.06	95.04	-1.4	1.4	0.04	0.12
501.19Hz	-21.48	95.00	94.97	-0.03	0.22	95.16	-1.4	1.4	0.16	0.12
1995.3Hz	-25.88	95.00	95.00	-0.04	-0.01	94.95	-1.6	1.6	-0.05	0.12
3981.1Hz	-25.68	95.00	94.91	-0.02	-0.06	94.83	-1.6	1.6	-0.17	0.12
7943.3Hz	-23.58	95.00	94.69	0.02	-0.17	94.54	-3.1	2.1	-0.46	0.12
15849Hz	-18.08	95.00	95.59	0.06	-0.01	95.64	-17.0	3.5	0.64	0.12

4.9. Electrical signal tests of frequency weightings, C weighting

Frequency response measured with electrical signal relative to level at 1 kHz in reference range. (section 12)

	Input Level	Expected	Measured	Acoustical Resp.	Body Influence	Corr. Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty
	[dBV]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
1000Hz, Ref.	-24.68	95.00	95.00	-0.04	-0.09	94.87	-1.1	1.1	-0.13	0.12
63.096Hz	-23.88	95.00	94.97	0.21	0.00	95.18	-1.5	1.5	0.18	0.12
125.89Hz	-24.48	95.00	95.03	0.10	0.00	95.13	-1.5	1.5	0.13	0.12
251.19Hz	-24.68	95.00	95.00	0.01	0.06	95.07	-1.4	1.4	0.07	0.12
501.19Hz	-24.68	95.00	95.04	-0.03	0.22	95.23	-1.4	1.4	0.23	0.12
1995.3Hz	-24.48	95.00	95.03	-0.04	-0.01	94.98	-1.6	1.6	-0.02	0.12
3981.1Hz	-23.88	95.00	94.92	-0.02	-0.06	94.84	-1.6	1.6	-0.16	0.12
7943.3Hz	-21.68	95.00	94.69	0.02	-0.17	94.54	-3.1	2.1	-0.46	0.12
15849Hz	-16.18	95.00	95.56	0.06	-0.01	95.61	-17.0	3.5	0.61	0.12

4.10. Electrical signal tests of frequency weightings, Z weighting

Frequency response measured with electrical signal relative to level at 1 kHz in reference range. (section 12)

	Input Level	Expected	Measured	Acoustical Resp.	Body Influence	Corr. Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty
	[dBV]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
1000Hz, Ref.	-24.68	95.00	95.00	-0.04	-0.09	94.87	-1.1	1.1	-0.13	0.12
63.096Hz	-24.68	95.00	94.98	0.21	0.00	95.19	-1.5	1.5	0.19	0.12
125.89Hz	-24.68	95.00	95.00	0.10	0.00	95.10	-1.5	1.5	0.10	0.12
251.19Hz	-24.68	95.00	95.00	0.01	0.06	95.07	-1.4	1.4	0.07	0.12
501.19Hz	-24.68	95.00	95.00	-0.03	0.22	95.19	-1.4	1.4	0.19	0.12
1995.3Hz	-24.68	95.00	95.00	-0.04	-0.01	94.95	-1.6	1.6	-0.05	0.12
3981.1Hz	-24.68	95.00	94.94	-0.02	-0.06	94.86	-1.6	1.6	-0.14	0.12
7943.3Hz	-24.68	95.00	94.70	0.02	-0.17	94.55	-3.1	2.1	-0.45	0.12
15849Hz	-24.68	95.00	95.62	0.06	-0.01	95.67	-17.0	3.5	0.67	0.12

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4.11. Frequency and time weightings at 1 kHz

Frequency and time weighting measured at 1 kHz with electrical signal in reference range. Measured relative to A-weighted and Fast response. (section 13)

	Expected	Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty	
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	
LAF, Ref.	94.00	94.00	-0.4	0.4	0.00	0.12	
LCF	94.00	94.00	-0.4	0.4	0.00	0.12	
LZF	94.00	94.00	-0.4	0.4	0.00	0.12	
LAS	94.00	93.99	-0.4	0.4	-0.01	0.12	
LAeq	94.00	93.99	-0.4	0.4	-0.01	0.12	

4.12. Level linearity on the reference level range, Upper

Level linearity in reference range, measured at 8 kHz until overload. (section 14)

	Expected	Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty	
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	
94 dB	94.00	94.00	-1.1	1.1	0.00	0.12	
99 dB	99.00	99.00	-1.1	1.1	0.00	0.12	
104 dB	104.00	104.00	-1.1	1.1	0.00	0.12	
109 dB	109.00	109.01	-1.1	1.1	0.01	0.12	
114 dB	114.00	114.02	-1.1	1.1	0.02	0.12	
119 dB	119.00	119.02	-1.1	1.1	0.02	0.12	
124 dB	124.00	124.02	-1.1	1.1	0.02	0.12	
129 dB	129.00	129.03	-1.1	1.1	0.03	0.12	
134 dB	134.00	134.02	-1.1	1.1	0.02	0.12	
135 dB	135.00	135.02	-1.1	1.1	0.02	0.12	
136 dB	136.00	136.02	-1.1	1.1	0.02	0.12	
137 dB	137.00	137.02	-1.1	1.1	0.02	0.12	
138 dB	138.00	138.02	-1.1	1.1	0.02	0.12	
139 dB	139.00	139.02	-1.1	1.1	0.02	0.12	

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4.13. Level linearity on the reference level range, Lower

Level linearity in reference range, measured at 8 kHz down to lower limit, or until underrange. (section 14)

	Expected	Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty	
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	
94 dB	94.00	94.00	-1.1	1.1	0.00	0.12	
89 dB	89.00	88.99	-1.1	1.1	-0.01	0.12	
84 dB	84.00	84.00	-1.1	1.1	0.00	0.12	
79 dB	79.00	78.99	-1.1	1.1	-0.01	0.12	
74 dB	74.00	73.99	-1.1	1.1	-0.01	0.12	
69 dB	69.00	68.99	-1.1	1.1	-0.01	0.12	
64 dB	64.00	63.98	-1.1	1.1	-0.02	0.12	
59 dB	59.00	58.98	-1.1	1.1	-0.02	0.12	
54 dB	54.00	53.99	-1.1	1.1	-0.01	0.12	
49 dB	49.00	48.99	-1.1	1.1	-0.01	0.12	
44 dB	44.00	44.00	-1.1	1.1	0.00	0.12	
39 dB	39.00	39.02	-1.1	1.1	0.02	0.30	
34 dB	34.00	34.04	-1.1	1.1	0.04	0.30	
29 dB	29.00	29.11	-1.1	1.1	0.11	0.30	
28 dB	28.00	28.17	-1.1	1.1	0.17	0.30	
27 dB	27.00	27.19	-1.1	1.1	0.19	0.30	
26 dB	26.00	26.24	-1.1	1.1	0.24	0.30	
25 dB	25.00	25.29	-1.1	1.1	0.29	0.30	

4.14. Toneburst response, Time-weighting Fast

Response to 4 kHz toneburst measured in reference range, relative to continuous signal. (section 16)

	Expected	Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty	
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	
Continuous, Ref.	138.00	138.00	-0.8	0.8	0.00	0.11	
200 ms Burst	137.00	136.99	-0.8	0.8	-0.01	0.11	
2 ms Burst	120.00	119.93	-1.8	1.3	-0.07	0.11	
0.25 ms Burst	111.00	110.87	-3.3	1.3	-0.13	0.11	

4.15. Toneburst response, Time-weighting Slow

Response to 4 kHz toneburst measured in reference range, relative to continuous signal. (section 16)

	Expected	Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty	
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	
Continuous, Ref.	138.00	138.01	-0.8	0.8	0.01	0.11	
200 ms Burst	130.61	130.58	-0.8	0.8	-0.03	0.11	
2 ms Burst	111.01	110.97	-3.3	1.3	-0.04	0.11	

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4.16. Toneburst response, LAE

Response to 4 kHz toneburst measured in reference range, relative to continuous signal. (section 16)

	Expected	Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty	
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	
Continuous, Ref.	138.00	138.00	-0.8	0.8	0.00	0.11	
200 ms Burst	131.00	130.98	-0.8	0.8	-0.02	0.11	
2 ms Burst	111.00	110.96	-1.8	1.3	-0.04	0.11	
0.25 ms Burst	102.00	101.86	-3.3	1.3	-0.14	0.11	

4.17. Peak C sound level, 8 kHz

Peak-response to a 8 kHz single- cycle sine measured in least-sensitive range, relative to continuous signal. (section 17)

	Expected	Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty	
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	
Continuous, Ref.	135.00	135.00	-0.4	0.4	0.00	0.11	
Single Sine	138.40	138.64	-2.4	2.4	0.24	0.40	

4.18. Peak C sound level, 500 Hz

Peak-response to a 500 Hz half-cycle sine measured in least-sensitive range, relative to continuous signal. (section 17)

	Expected	Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty	
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	
Continuous, Ref.	135.00	135.00	-0.4	0.4	0.00	0.11	
Half-sine, Positive	137.40	137.11	-1.4	1.4	-0.29	0.40	
Half-sine, Negative	137.40	137.11	-1.4	1.4	-0.29	0.40	

4.19. Overload indication

Overload indication in the least sensitive range determined with a 4 kHz positive/negative half-cycle signal. (section 18)

	Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty	
	[dB]	[dB]	[dB]	[dB]	[dB]	
Continuous	140.00	-0.4	0.4	0.00	0.20	
Half-sine, Positive	141.10	-10.0	10.0	1.10	0.20	
Half-sine, Negative	141.20	-10.0	10.0	1.20	0.20	
Difference	141.20	-1.8	1.8	0.10	0.30	

4.20. Environmental conditions, Following calibration

Actual environmental conditions following calibration. (section 7)

	Measured	
	[Deg / kPa / %RH]	
Air temperature	22.90	
Air pressure	99.50	
Relative humidity	51.00	

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DANAK

The Danish Accreditation and Metrology Fund - DANAK - is managing the Danish accreditation scheme based on a contract with the Danish Safety Technology Authority under the Danish Ministry of Economics and Business Affairs who is responsible for the legislation on accreditation in Denmark.

The fundamental criteria for accreditation are described in DS/EN ISO/IEC 17025: "General requirements for the competence of testing and calibration laboratories", and in DS/EN ISO/IEC 15189 "Medical laboratories – Particular requirements for quality and competence" respectively. DANAK uses guidance documents to clarify the requirements in the standards, where this is considered to be necessary. These will mainly be drawn up by the "European co-operation for Accreditation (EA)" or the "International Laboratory Accreditation Co-operation (ILAC)" with a view to obtaining uniform criteria for accreditation worldwide. In addition, the Danish Safety Technology Authority issues Technical Regulations prepared by DANAK with specific requirements for accreditation that are not contained in the standards.

In order for a laboratory to be accredited it is, among other things, required:

- *that the laboratory and its personnel are free from any commercial, financial or other pressures, which might influence their impartiality;*
- *that the laboratory operates a documented management system, and has a management that ensures that the system is followed and maintained;*
- *that the laboratory has at its disposal all items of equipment, facilities and premises required for correct performance of the service that it is accredited to perform;*
- *that the laboratory has at its disposal personnel with technical competence and practical experience in performing the services that they are accredited to perform;*
- *that the laboratory has procedures for traceability and uncertainty calculations;*
- *that accredited testing, calibration or medical examination are performed in accordance with fully validated and documented methods;*
- *that accredited services are performed and reported in confidentiality with the customer and in compliance with the customer's request;*
- *that the laboratory keeps records which contain sufficient information to permit repetition of the accredited test, calibration or medical examination;*
- *that the laboratory is subject to surveillance by DANAK on a regular basis;*
- *that the laboratory shall take out an insurance, which covers liability in connection with the performance of accredited services.*

Reports carrying DANAK's accreditation mark are used when reporting accredited services and show that these have been performed in accordance with the rules for accreditation.

Brüel & Kjær

The Calibration Laboratory
Skodsborgvej 307, DK-2850 Nærum, Denmark

ilac-MRA DANAK CAL Reg.nr. 307

CERTIFICATE OF CALIBRATION

No: CDK1307034

CALIBRATION OF

Calibrator:	Brüel & Kjær Type 4231	No: 2605825 Id: -
½ Inch adaptor:	Brüel & Kjær Type UC-0210	
Pattern Approval:	PTB-1.61-4057176	

CUSTOMER

ORS Consulting Engineers
Marlinstown Office Park
Mullingar
Co. Westmeath, Ireland

CALIBRATION CONDITIONS

Preconditioning:	4 hours at 23°C ± 3°C
Environment conditions:	Pressure: 101.4 kPa. Humidity: 51 % RH. Temperature: 23.1 °C.

SPECIFICATIONS

The Calibrator Brüel & Kjær Type 4231 has been calibrated in accordance with the requirements as specified in IEC60942:2003 Annex B Class 1. The accreditation assures the traceability to the international units system SI.

PROCEDURE

The measurements have been performed with the assistance of Brüel & Kjær acoustic calibrator calibration application software Type 7794 (version 2.4) by using procedure P_4231_D04.

RESULTS

Calibration Mode: **Calibration as received.**

The reported expanded uncertainty is based on the standard uncertainty multiplied by a coverage factor $k = 2$ providing a level of confidence of approximately 95 %. The uncertainty evaluation has been carried out in accordance with EA-4/02 from elements originating from the standards, calibration method, effect of environmental conditions and any short time contribution from the device under calibration.

Date of calibration: 2013-09-06

Date of issue: 2013-09-06

Susanne Nygaard
Calibration Technician

Erik Bruus
Approved Signatory

Brüel & Kjær

The Calibration Laboratory
Skodsborgvej 307, DK-2850 Nærum, Denmark

1. Visual Inspection

OK.

2. Measured Values

All stated values are valid at the following environmental reference conditions:

Pressure	101.3 kPa
Temperature	23.0 °C
Relative Humidity	50.0 %

2.1 Sound Pressure Levels

The sound pressure level is measured using the sound calibration comparison method.

Nominal Level [dB]	Accept Limit Lower [dB]	Accept Limit Upper [dB]	Measured Level [dB]	Measurement Uncertainty [dB]
94.00	93.89	94.11	93.93	0.09
114.00	113.89	114.11	113.95	0.09

2.2 Frequency

Nominal Level [Hz]	Accept Limit Lower [Hz]	Accept Limit Upper [Hz]	Measured Frequency [Hz]	Measurement Uncertainty [Hz]
1000	990.10	1009.90	999.98	0.10

2.3 Total Distortion

Distortion mode: [X] TD [ ] THD

Calibration Level [dB]	Accept Limit [%]	Measured Distortion [%]	Measurement Uncertainty [%]
94	2.25	0.56	0.25
114	2.25	0.40	0.25

Note: Acceptance limits are reduced by measurement uncertainty to assure that measured value expanded by the actual expanded uncertainty does not exceed the specified limits as stated in the standard.

Brüel & Kjær

The Calibration Laboratory
Skodsborgvej 307, DK-2850 Nærum, Denmark

3. Calibration Equipment

	Instrument	Inventory No.
Sound Source, Reference	Brüel & Kjær, Type 4228	124228023
PULSE Analyzer	Brüel & Kjær, Type 3560-C	123560010
Transfer Microphone	Brüel & Kjær, Type 4192-L-001	124192027

4. Comments

As public evidence was available, from a testing organization responsible for approving the results of pattern evaluation tests, to demonstrate that the model of sound calibrator fully conformed to the requirements for pattern evaluation described in Annex A of IEC 60942:2003, the sound calibrator tested is considered to conform to all the class 1 requirements of IEC 60942:2003.

Brüel & Kjær

The Calibration Laboratory
Skodsborgvej 307, DK-2850 Nærum, Denmark

DANAK

The Danish Accreditation and Metrology Fund - DANAK - is managing the Danish accreditation scheme based on a contract with the Danish Safety Technology Authority under the Danish Ministry of Economics and Business Affairs who is responsible for the legislation on accreditation in Denmark.

The fundamental criteria for accreditation are described in DS/EN ISO/IEC 17025: "General requirements for the competence of testing and calibration laboratories", and in DS/EN ISO/IEC 15189 "Medical laboratories – Particular requirements for quality and competence" respectively. DANAK uses guidance documents to clarify the requirements in the standards, where this is considered to be necessary. These will mainly be drawn up by the "European co-operation for Accreditation (EA)" or the "International Laboratory Accreditation Co-operation (ILAC)" with a view to obtaining uniform criteria for accreditation worldwide. In addition, the Danish Safety Technology Authority issues Technical Regulations prepared by DANAK with specific requirements for accreditation that are not contained in the standards.

In order for a laboratory to be accredited it is, among other things, required:

- *that the laboratory and its personnel are free from any commercial, financial or other pressures, which might influence their impartiality;*
- *that the laboratory operates a documented management system, and has a management that ensures that the system is followed and maintained;*
- *that the laboratory has at its disposal all items of equipment, facilities and premises required for correct performance of the service that it is accredited to perform;*
- *that the laboratory has at its disposal personnel with technical competence and practical experience in performing the services that they are accredited to perform;*
- *that the laboratory has procedures for traceability and uncertainty calculations;*
- *that accredited testing, calibration or medical examination are performed in accordance with fully validated and documented methods;*
- *that accredited services are performed and reported in confidentiality with the customer and in compliance with the customer's request;*
- *that the laboratory keeps records which contain sufficient information to permit repetition of the accredited test, calibration or medical examination;*
- *that the laboratory is subject to surveillance by DANAK on a regular basis;*

Reports carrying DANAK's accreditation mark are used when reporting accredited services and show that these have been performed in accordance with the rules for accreditation.

Appendix J.1.1: Safety Policy Statement

Rehab Glassco

Safety Policy Statement

Rehab Glassco is committed, in so far as is reasonably practicable, to providing a safe and healthy work environment for all staff members, service users, learners, volunteers, visitors, contractors and others who may be affected by our operations.

The organisation will comply with all related Health & Safety legislation, and any relevant codes of practice or safe practice recommendations.

The allocation of responsibilities for safety, and the arrangements and resources being deployed to implement this policy, are outlined in this policy and associated procedures.

It is important that all staff members are familiar with the arrangements for Health and Safety in the organisation and their own service/centre/business, and should incorporate these as an integral part of their work tasks.

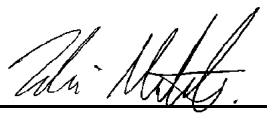
The procedures associated with the policy will be based on an identification of hazards and assessment of the risks to the Health and Safety of staff members and others who may be affected by the activities of Rehab Glassco.

Rehab Glassco is committed to on-going monitoring of safety performance, training and development, communication and continuous improvement in the area of Health & Safety. This policy and the safety statement are available within each service/centre/business within the Rehab Group. Further copies will be available from the relevant Health & Safety Manager/Officer to internal and interested external parties.

This policy will be reviewed periodically to ensure that it remains relevant and appropriate to the organisation. It will be reviewed at least annually and/or following significant changes by the Health & Safety Manager/Officer(s).

Staff members are invited and facilitated to report all Health and Safety issues and concerns and to contribute and co-operate to the improvement of safety, health and welfare in Rehab Glassco through their Supervisor/Manager, or Safety Representative or relevant Health & Safety Manager/Officer.

Details of safety arrangements specific to a service/centre/business shall be set out by each service/centre/business and is available in the relevant procedure or guidelines document/s. In addition, each service/centre/business shall conduct its own risk assessments which will be relevant, up-to-date and specific to the risks of that particular service/centre/business.

SIGNED 

Managing Director

Appendix J.1.2: Certificates for Fire Detection / Alarm System and Fire Extinguishers

HORIZON
SAFETY SYSTEMS
Carlow Gateway Business Centre, Athy Road, Carlow, Ireland
T: 00353 59 9182517 · M: 00 353 86 8262640 · F: 00 353 86 58262640

Fire Detection & Alarm System – Final Certificate of Commissioning

Premises Name or Owner..... Glassco Recycling Plant.....

Address of premises..... Naas, Co. Kildare.....

....

.....

Protected Area(s)..... The Entire Premises.....

..... Naas, Co. Kildare.....

.....

Description of Works..... System provided is of L2/L3 standard.....

.....

.....

Reference Drawings..... N/A.....

.....

System Category: ..... L2/L3.....

Variations to I.S. 3218:2009 and/or the specification: No ☑ Yes ☐ (Listed as attached)

I/We hereby certify that the Fire Detection and Alarm system at the above premises, as detailed above,has been inspected tested and commissioned by me/us in accordance with of I.S. 3218:2009.

I/We confirm my/our competence to undertake this work and to the best of my/our knowledge and ability the commissioning works outlined above comply with the standards for the system category stated above except as outlined on the attached variations (if any).

Comment:.....

.....

Name ....Dave Noack..... Position .....Commissioning Engineer.....

Signed: *pp* Ray Bdger Date: 16/02/2011.

NSAI FIRE ALARMS I.S. 3218:1989 NSAI Certified

HORIZON
SAFETY SYSTEMS
CARLOW GATEWAY BUSINESS CENTRE, ATHY ROAD, CARLOW, IRELAND
T: 00353 59 9182517 · M: 00 353 86 8262640 · F: 00 353 86 58262640

Fire Detection & Alarm System – Final Certificate of Commissioning

Premises Name or Owner..... Rehab Glassco.....

Address of premises.....Unit 4, Osberstown Indstrial Park, Caragh Road, Naas, Co. Kildare.....

....

Protected Area(s)..... The Drying Plant.....

.....

.....

Description of Works..... Commissioning of a conventional fire alarm system in the Drying.....

..... Plant to conform to a L3 System Category.....

.....

Reference Drawings.....HSS-12-016-001-A.....

.....

.....

System Category: ..... L3.....

Variations to I.S. 3218:2009 and/or the specification: No ☑ Yes ☐ (Listed as attached)

I/We hereby certify that the Fire Detection and Alarm system at the above premises, as detailed above,has been inspected tested and commissioned by me/us in accordance with of I.S. 3218:2009.

I/We confirm my/our competence to undertake this work and to the best of my/our knowledge and ability the commissioning works outlined above comply with the standards for the system category stated above except as outlined on the attached variations (if any).

Comment:.....

.....

Name: Graham Brereton..... Position: Commissioning Engineer.....

Signed:pp Ray Bolger Date: 11/05/2012

For And On Behalf Of: Horizon Safety Systems

NSAI FIRE ALARMS I.S. 3218:1989 NSAI Certified

HORIZON
SAFETY SYSTEMS
CARLOW GATEWAY BUSINESS CENTRE, ATHY ROAD, CARLOW, IRELAND
T: 00353 59 9182517 · M: 00 353 86 8262640 · F: 00 353 86 58262640

Fire Detection & Alarm System – Final Certificate of Commissioning

Premises Name or Owner.....Rehab Glassco.....

Address of premises.....Unit 4, Osberstown Indstrial Park, Caragh Road, Naas, Co. Kildare.....

....

Protected Area(s)..... The Garage.....

.....

.....

Description of Works..... Commissioning of a conventional fire alarm system in the Garage.....

..... to conform to a L2/L3 System Category.....

.....

Reference Drawings.....N/A.....

.....

.....

System Category: ..... L2/L3.....

Variations to I.S. 3218:2009 and/or the specification: No ☑ Yes ☐ (Listed as attached)

I/We hereby certify that the Fire Detection and Alarm system at the above premises, as detailed above,has been inspected tested and commissioned by me/us in accordance with of I.S. 3218:2009.

I/We confirm my/our competence to undertake this work and to the best of my/our knowledge and ability the commissioning works outlined above comply with the standards for the system category stated above except as outlined on the attached variations (if any).

Comment:.....

.....

Name: Paul Lehane..... Position: Commissioning Engineer.....

Signed:pp Anthony Mc Mullan Date: 30/11/2012

For And On Behalf Of: Horizon Safety Systems

CERTIFICATE

This is to certify that the fire extinguishers at :

REHAB GLASSCO LTD
UNIT 4 OBERSTOWN BUSINESS PARK
CARRAGH ROAD
NAAS

were inspected and satisfy the requirements of Irish Standard 291:2002

Date of Inspection : 13/05/14

Representative : FRANCIS ROWAN

Signed : Joe Reilly

Administrator

Apex Fire Ltd Moynehall Cavan Co. Cavan
Ph: 049 4371482 Fax: 049 4361159
E_Mail: info@apexfire.ie

Appendix J.1.3: Insurance Certificate

WILLIS
GRAND MILL QUAY, BARROW ST
DUBLIN 4

T: +353 1 661 6211
F: +353 1 661 4369
E: info@willis.ie
W: www.willis.com/Ireland

To Whom It May Concern

Date 30th June 2014

Dear Sir / Madam,

Re: The Rehab Group &/or Subsidiaries &/or Associated Companies

Our Client: The Rehab Group, RehabCare, Newgrove Housing Association Limited, Polio Fellowship of Ireland Ltd, Conquer & Care Lotteries Ltd, Conquer & Care Lotteries (NI) Ltd, National Learning Network Ltd, Stepping Out (Athlone) Ltd, Rehab Enterprises Ltd, RG Recycling Holdings Ltd, Rehab Glass & Cans Ltd, Rehab Glassco Ltd, Rehab Lotteries Ltd, Rehab Net Games Ltd, Rehab Foundation Ltd, The Care Trust Ltd, Clashganna Mills Ltd and Rehab Holdings Ltd.

We confirm that The Rehab Group Ltd and/or Subsidiaries have in force Liability Insurances for the 12 month period commencing 1st July 2014.

Business Description:	Independent not-for-profit organisation working for social and economic inclusion among people with disabilities. Group's activities include Health & Social Care, Training and Development, Commercial (including Recycling, Logistics and Disability Management Consultancy) and Fundraising. Full Business Description available upon request.
Insurers:	RSA Insurance Ireland Limited & QBE Insurance (Europe) Limited
Policy Numbers:	KX93132149 & Y038480QBE0212A
Next Renewal Date:	1st July 2015

Employers Liability:

Cover :	Legal liability for bodily injury to employees arising out of or in connection with our Client's business.
Total Limit of Indemnity:	€65,000,000 any one accident/unlimited any one period

Public/Products Liability:

Cover :	Legal liability for accidental third party bodily injury and/or property damage arising out of or in connection with our Client's business.
Total Limit of Indemnity:	€26,000,000 any one accident/unlimited in any one period but €26,000,000 in the aggregate for Products Liability.
Sudden & Accidental Pollution:	€26,000,000 any one accident/period

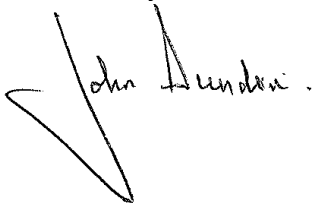
The policy includes an Indemnity to Principals clause.

Subject otherwise to the terms, conditions and exceptions of the policies.

This letter is provided as a courtesy to our client as a matter of information only and confers no rights on the holder. Our duties in relation to this insurance are to our client and we accept no duty of care or responsibility to you or any other third party and any liability to you or any third party is excluded. This letter does not amend, extend or alter the coverage afforded by the policies, nor does it purport to set out all of the policies' terms, conditions and exclusions. The policy terms, conditions, limits and exclusions may alter after the date of this document or the insurance may terminate or be cancelled, and the limits shown may be reduced by paid claims. We have no obligation to advise you of any changes which may be made to the policies or to advise you of their cancellation or termination.

Should you have any queries please contact the undersigned.

Yours faithfully,



JOHN DUNDON
Client Service Executive, Corporate Risks
DD: +353 (0) 1 639 6334
F: + 353 (0) 1 669 4475
E: john.dundon@willis.ie