Alex Good
Environmental Permitting Manager
Aggregate Industries UK Ltd
Bardon Hall
Copt Oak Road
Markfield
Leicestershire
LE67 9PJ

Tel: 01530 816691
e-mail: Alex.Good@aggregate.com

Our Ref: 101108

18th December 2008

Mr Dave Bass
Environmental Protection Office
Environmental Health Department
Huntingdonshire District Council
Pathfinder House
St. Mary Street
Huntingdon
PE29 3TN

Dear Dave,

Bardon Contracting application for PPC Part B permit

Please find enclosed a completed application for a part B permit as required under the Environmental Permitting [England and Wales] Regulations 2007.

The permit is required to support the development of a new Mobile Recycling Plant, to be based initially at Dacca Farm. I enclose the following documents for your information:

- Completed PPC Application Form [plus two additional copies]
- Supporting information
- The standard application fee of £1514.00 made payable to Huntingdonshire District Council.

I trust I have provided you with sufficient information to process this application. However, please do not hesitate to contact me if you require any additional information.

Could I ask for draft copy of the permit to be made available for review before formal issue?

Yours sincerely
On behalf of Aggregate Industries UK Ltd

Alex Good
Environmental Permitting Manager

Application for a Permit for a Standard Part B Installation

Local Authority Pollution Prevention and Control
Pollution Prevention and Control Act, 1999
Environmental Permitting (England and Wales) Regulations 2007

When to use this form
This environmental permitting regime is known as and referred to as Local Authority Pollution Prevention and Control ('LAPPC'). Installations permitted under this regime are known as Part 'B' installations. Use this form if you are sending an application for a 'Part B' permit to a Local Authority under the Environmental Permitting (England and Wales) Regulations 2007 ("the EP Regulations").

Before you start to fill in this form
You are strongly advised to read relevant parts of the Defra general guidance manual issued for LA-IPPC and LAPPC, republished in 2008 and available at http://www.defra.gov.uk/environment/ppc/localauth/pubs/guidance/manuals.htm. This contains a list of other documents you may need to refer to when you are preparing your application, and explains some of the technical terms used. You will also need to read the relevant Process Guidance note as relevant The EP Regulations can be obtained from The Office of Public Sector Information, or viewed on their website at: http://www.opsi.gov.uk/stat.htm.

Which parts of the form to fill in
You should fill in as much of this form as possible. The appropriate fee must be enclosed with the application to enable it to be processed further. When complete return to:

Environmental Protection Officer, Environmental Health Department, Huntingdonshire District Council, Pathfinder House, St. Mary's Street, Huntingdon PE29 3TN or e-mail: envhealth@huntsdc.gov.uk

If you require any help or advice on how to set out the information we need please contact us at the above address or telephone 01480 388363.

Other documents you may need to submit
There are number of other documents you will need to send us with your application. Each time a request for a document is made in the application form you will need to record a document reference number for the document or documents that you are submitting in the space provided on the form for this purpose. Please also mark the document(s) clearly with this reference number.

Using continuation sheets
In the case of the questions on the application form itself, please use a continuation sheet if you need extra space; but please indicate clearly on the form that you have done so by stating a document reference number for that continuation sheet. Please also mark the continuation sheet itself clearly with the information referred to above.

Copies
Please send the original and [ ] copies of the form and all other supporting material, to assist the Authority in conducting any necessary consultation process. If submitting the form electronically no duplicate copies are required.

A - Introduction

A1.1 Name of the installation

Bardon Contracting Mobile Asphalt Recycling Plant

A1.2 Please give the address of the site of the installation

Steel Close, Little End Road, Eaton Socon

St Neots, Cambridgeshire PostCode: PE19 8TT

Telephone: 01480213513

Ordnance Survey national grid reference *8 characters, for example, SJ 123 456*

TL 168 584

A1.3 Existing authorisations:

Please give details of any existing LAPC or IPC authorisation for the installation, or any waste management licences or water discharge consents, including reference number(s), type(s) and local authority:

New Installation: No additional permits required for this process.

Please provide the information requested below about the “Operator”, which means the person who it is proposed will have control over the installation in accordance with the permit (if granted)

A2.1 The Operator – Please provide the full name of company or corporate body

Aggregate Industries UK Ltd

Trading/business name (if different)

Bardon Contracting

Registered Office address

Aggregate Industries

Bardon Hall, Copt Oak Road

Markfield, Leicestershire Postcode: LE67 9PJ

Principal Office address (if different)

Bardon Contracting

Steel Close, Little End Road, Eaton Socon, St Neots

Cambridgeshire Postcode: PE19 8TT

Company registration number 245717

A2.2 Holding Companies
Is the operator a subsidiary of a holding company within the meaning of Section 736 of the Companies Act 1985?

No ☐ Yes **X**

Name of ultimate holding company

Holcim Ltd

Registered office address

Zurcherstrasse 156

CH-8465 Jona

Switzerland Postcode……

Principal Office address (if different) … N/A……

…… N/A……

…… N/A……

……N/A……..Postcode……
……

Company registration number: CH-160.3.003.050-5

A3.1 Who can we contact about your application?

It will help is to have someone who we can contact directly with any questions about your application. The person you name should have the authority to act on behalf of the operator. This could be an agent or consultant rather than the operator.

Name: Alex Good

Position: Permitting Manager

Address: Bardon Hall

Cropt Oak Road, Markfield

Leicestershire Postcode: LE67 9PJ

Telephone number: 01530816691

Fax number: 01530816666

E. Mail address: Alex.Good@aggregate.com

B About the installation

Please fill in the table below with details of all the current activities in operation at the whole installation.

In **Column 1, Box A**, please identify all activities listed in Schedule 1 to the EP Regulations that are, or are proposed, to be carried out in the stationary technical unit of the installation.

In **Column 1, Box B** please identify any directly associated activities that are, or are proposed, to be carried out on the same site which:

* have a technical connection with the activities in the stationary technical unit
* could have an effect on pollution

In **Column 2, for Boxes A and B** please quote the Chapter number, Section number, then paragraph and sub-paragraph number as shown in Part 2 of Schedule 1 to the EP Regulations [For example, *Manufacturing glass and glass fibre where the use of lead or any lead compound is involved*, would be listed as Chapter 3, Section 3.3, Part B(b)].

B1.1 Installation table for new permit application

COLUMN 1a	**COLUMN 2a**
Activities in the Stationary Technical Unit	**Schedule 1 References**
(a) Any activity not falling within Part A(1) of this Section or of Section 6.2 involving— **(i)** **heating, but not distilling, tar or bitumen in connection with any manufacturing activity, or**	**Schedule 1** **Part 2** **Chapter 6** **Section 6.3** **Part B** **a)** **i)**
COLUMN 1b	**COLUMN 2b**
Directly associated activities	**Schedule 1 References**
Storage (Inc. loading, storage and use) of used asphalt.	

B1.2 Why is the application being made?

X The installation is new

☐ The installation is existing, but changes to the installation or to the EP Regulations means that an LAPPC Part B permit is now required.

B.1.3 Site Maps

Please provide:-

* A suitable map showing the location of the installation clearly defining extent of the installations in red

This is not required due to it being a mobile plant: Part 2) Chapter 2) 14.3)

* A suitable plan showing the layout of activities on the site, including bulk storage of materials, waste storage areas and any external emission points to atmosphere

This is not required due to it being a mobile plant: Part 2) Chapter 2) 14.3)

B2 The Installation

Please provide written information about the aspects of your installation listed below. We need this information to determine whether you will operate the installation in a way in which all the environmental requirements of the EP Regulations are met.

B2.1 Describe the proposed installation and activities and identify the foreseeable emissions to air from each stage of the process (this will include any foreseeable emissions during start up, shut down and any breakdown/abnormal operation)

Introduction:

Bardon Contracting have acquired a new mobile Hot Asphalt Recycling Plant. This is a new innovative process, designed to reheat waste asphalt from construction projects so that the asphalt can be re-used with in the scheme. The plant is being used in conjunction with Bardon Contracting highway contracts in local area.

Plant Equipment

Storage Hopper for used asphalt
Mobile Reheating plant – 1 x Asphalt Drum, 1 x Gas Heater
1 X Storage Hopper for output asphalt
Site Office with welfare facilities
1 x Bunded tank Container
1 X Loading Shovel

Process Description

The recycling process involves the following;

- Suitable Asphalt returned
- Material Inspected and Stockpiled
- Unsuitable material segregation for disposal at site.
- Suitable material loaded to hopper
- Material heated and mixed
- Process material discharge and loaded to sheeted wagons and delivered to contracted site.

Please see additional material for Brochure and photos for more information.

B2.2 Once all foreseeable emissions have been identified in the proposed installation activities, each emission should be characterised (including odour) and quantified.

Atmospheric emissions should be categorised under the following

i. point source, (e.g. chimney / vent, identified by a number and detailed on a plan)
ii. fugitive source (e.g. from stockpiles / storage areas).

If any monitoring has been undertaken please provide the details of emission concentrations and quantify in terms of mass emissions. If no monitoring has been undertaken please state this.

Emission Point	Location	Emission(s)	Emission Type	Emission Limit
1	Output Vent on Hot Asphalt Recycler	Particulates	Point Source	As defined by permit
2	Asphalt Storage after re-heating	Particulates & Odour	Fugitive	No Visible Emissions, minimal odour
3	Gas Oil Tank Vent	Volatile Compounds	Fugitive	Not Applicable
4	Hardstanding Yard Area	Particulates from wind wiping	Fugitive	No visible dust

Please see attached scientific report on emissions.

(Emission concentration = e.g. milligrams per cubic metre of air; mass emission = e.g. grams per hour, tonnes per year)

B2.3 For each emission identified from the installations' activities describe the current and proposed technology and other techniques for preventing or, where that is not practicable, reducing the emissions into the air. If no techniques are currently used and the emission goes directly to the environment, without abatement or treatment then this should be stated

Emission Point	Location	Emission(s)	Abatement
1	Output Vent on Hot Asphalt Recycler	Particulates	No Harmful emission anticipated. No abatement fittes to unit.
2	Asphalt Storage after re-heating	Particulates & Odour	No Harmful emission anticipated as asphalt loaded directly to vehicle and sheeted.
3	Gas Oil Tank Vent	Volatile Compounds	No Harmful emission anticipated therefore no abatement implemented.
4	Hardstanding Yard Area	Particulates from wind wiping	No Harmful emission anticipated, yard to be swept clean

B2.4 Describe the proposed systems to be used in the event of unintentional releases and their consequences. This must identify, assess and minimise the environmental risks and hazards, provide a risk-based assessment of any likely unintentional releases, including the use of historical evidence. If no assessments have been carried out please state.

Unintentional Release to atmosphere of:	Potential Causes included	Potential risk to the environment/surronding area	Historic Evidence	Control Measures	Resultant Risk Factor
Particulates & odour	Unknown & unexpected materials on recycled asphalt, spillages of chemicals.	Nusance from odour and dust	Odour complaint during testing of plant	Material checked and segregated at demolition site. Checked and segregated at recycling site. If odours are produced then plant shut down and clean down	Low

B2.5 Describe the proposed measures for monitoring all identified emissions including any environmental monitoring, and the frequency, measurement methodology and evaluation procedure proposed (e.g. particulate matter emissions, odour etc). Include the details of any monitoring which has been carried out which has not been requested in any other part of this application. If no monitoring is proposed for an emission please state the reason.

Emission Point	Location	Emission(s)	Monitoring Method	Frequency
1	Output Vent on Hot Asphalt Recycler	Particulates	Visual assessment of emission to air and Stack Test	Daily Log and frequency in accordance with PPC
2	Asphalt Storage after re-heating	Particulates & Odour	Visual assessment of emission to air and records of complaints	Daily Log
3	Gas Oil Tank Vent	Volatile Compounds	No Monitoring Proposed	
4	Hardstanding Yard Area	Particulates from wind wiping	Visual assessment of emission to air.	Daily Log

B2.6 Provide detailed procedures and policies of your proposed environmental management techniques, in relation to the installation activities described.

As an operating company of Aggregate Industries UK, Bardon Contracting will operate an environmental management system in accordance with the requirements of the ISO 14001:2004.

The system controls all aspects of environmental management, including document control, training, risk assessment, incidents, internal and external communication.

Specifically the site shall have:

Trained and competent employees, fully conversant in the operation of the concrete batching plant, its impacts and environmental controls (Logbook & Inspections), the management system policies and emergency procedures. A record of all training will be kept and will be available for inspection at the plant.

Access to management supervision and specialist knowledge as and when required

A planned preventive maintenance inspection regime which will include the holding of critical spares (i.e. Rubber loading socks and filters) on site to repair/rectify any malfunctions that may give rise to any abnormal emission as and when these are detected.

A set of emergency procedures to respond to any unforeseen event. These procedures will be practised and evaluated on an ongoing basis.

The activities taking place at this location will be subject to both internal audit and external audit as part of our ISO14001 Registration.

B3 Impact on the Environment

B3.1 Provide an assessment of the potential significant local environmental effects of the foreseeable emissions (e.g. is there a history of complaints and/or is the installation in an air quality management area?)

We don't envisage that the plant will not have any significant environmental effect on the local environment and community from planned routine activities.

There have been a few complaints whilst testing the operations. This was due to high slag content being present in the old asphalt, the plant was shut down and problem rectified. Local procedures and measures are now in place to prevent re-occurrence.

B3.2 Are there any sites of special scientific interest (SSSIs) or European protected sites that are within either

- 2 kilometres for an installation which includes Part B combustion, incineration (but not crematoria), iron and steel, and non-ferrous metal activities, or
- 1 kilometre for Part B mineral activities and cement and lime activities, or
- ½ a kilometre for all other Part B activities 2 kilometres of the installation?

This is not required due to it being a mobile site.

No ☐ Yes ☐

Please give names of the sites

B3.3 Provide an assessment of whether the installation is likely to have a significant effect on such sites and, if it is, provide an assessment of the implications of the installation for that site, for the purposes of the Conservation (Natural Habitats etc) Regulations 1994 (see appendix 2 of Annex XVIII of the General Guidance Manual).

The Mobile Hot Asphalt Recycling Plant is unlikely to have any significant affect on the local environment or any areas of public open spaces under normal operations conditions.

B4 Environmental Statements

B4.1 Has an environmental impact assessment been carried out under The Town and Country Planning (Environmental Impact Assessment)(England & Wales) Regulations 1999/293, or for any other reason with respect to the installation? If there has been no such assessment, have there been any screening opinions or directions?

No **X** Yes ☐

Mobile plant, hence no environment impact assessment has been carried out.

B5 Additional information

Please supply any additional information that you would like us to take account of in considering this application.

Please find attached:

RSL Brochure
Bardon Contracting Risk Assessment for the Mobile Plant
Photos of Site
RSL Air Test Report
RSL Noise Report

C - Fees and Charges, Information Handling, and Declaration

C1 Fees and Charges

The enclosed charging scheme leaflet gives details of how to calculate the application fee. Your application cannot be processed unless the application fee is correct and enclosed.

C1.1 Please state the amount enclosed as an application fee for this installation:

For the local authority

£ 1514 (cheques should be made payable to **Huntingdonshire District Council**)

We will confirm receipt of this fee when we write to you acknowledging your application.

C1.2 Please give any company purchase order number or other reference you wish to be used in relation to this fee.
……N/A……

C2 Annual subsistence charges

If we grant you a permit, you will be required to pay an annual subsistence charge, failure to do so will result in revocation of your permit and you will not be able to operate your installation.

C2.1 Please provide details of the address you wish invoices to be sent to and details of someone we may contact about fees and charges within your finance section.

Alex Good

Aggregate Industries

Bardon Hall, Copt Oak Road

Markfield, Leicestershire Postcode: LE67 9PJ

Telephone:…01530 816691…….

C3 Confidentiality

C3.1 Is there any information in the application that you wish to justify being kept from the public register on the grounds of commercial or industrial confidentiality?

No **X** Yes ☐

Please provide full justification, considering the definition of commercial confidentiality within the EP Regulations.

C3.2 Is there any information in the application that you believe should be kept from the public register on the grounds of national security?

No **X** Yes ☐

Do not write anything about this information on the form. Please provide full details on separate sheets, plus provide a copy of the application form to the Secretary of State/ Welsh Ministers for a direction to exclude information on grounds of national security.

C4 Data Protection

The information you give will be used by the local authority to process your application. It will be placed on the relevant public register and used to monitor compliance with the permit conditions. We may also use and or disclose any of the information you give us in order to:

- consult with the public, public bodies and other organisations,
- carry out statistical analysis, research and development on environmental issues,
- provide public register information to enquirers,
- make sure you keep to the conditions of your permit and deal with any matters relating to your permit
- investigate possible breaches of environmental law and take any resulting action,
- prevent breaches of environmental law,
- offer you documents or services relating to environmental matters,
- respond to requests for information under the Freedom of Information Act 2000 and the Environmental Information Regulations 2004 (if the Data Protection Act allows)
- assess customer service satisfaction and improve our service.

We may pass on the information to agents/ representatives who we ask to do any of these things on our behalf.

It is an offence under regulation 38 of the EP Regulations, for the purpose of obtaining a permit (for yourself or anyone else), to:

- make a false statement which you know to be false or misleading in a material particular,
- recklessly make a statement which is false or misleading in a material particular
- intentionally to make a false entry in any record required to be kept under any environmental permit condition
- with intent to deceive, to forge or use a document issued or required for any purpose under any environmental permit condition.

If you make a false statement

- we may prosecute you, and
- if you are convicted, you are liable to a fine or imprisonment (or both).

C5 Declaration: previous offences (delete whichever is inapplicable)

I/ certify

No offences have been committed in the previous five years which are relevant to my/our competence to operate this installation in accordance with the EP Regulations.

Signature……

Name Alexander R. Good

Position Permitting Manager Date 18/12/08

C6 Declaration

C6.1 Signature of current operator(s)*

I certify that the information in this application is correct. I apply for a permit in respect of the particulars described in this application (including supporting documentation) I have supplied.

Please note that each individual operator must sign the declaration themselves, even if an agent is acting on their behalf.

For the application from:

Installation name: Bardon Contracting Mobile Hot Asphalt Recycling Plant

Signature……

Name: Mr Alexander Robert Good

Position: Permitting Manger Date 18/12/08

Signature……N/A……

Name……N/A……

Position……N/A……Date……

** Where more than one person is defined as the operator, all should sign. Where a company or other body corporate – an authorised person should sign and provide evidence of authority from the board of the company or body corporate.*

AGGREGATE INDUSTRIES	Bardon Contracting IMS – Construction Risk Assessment Operation of Asphalt Recycling Plant	Ref: No.	ARP RA
		Version:	01
		Date:	Nov 08
		Approved by:	Area Manager

Type	Generic ☐ Site Specific ☒	Contract / Location	Dacca Farm Asphalt Recycling

Persons at Risk Operatives ☒ Others working in area ☒ Visitors ☒ Members of the Public ☒

HAZARDS	HARM	RISK FACTOR (in relation to harm)	
		Without Controls	With Controls
Slips & trips	Serious injury	High	Low
Falls from heights	Serious injury	High	Low
Interaction of site traffic	Fatality/Serious injury	High	Low
Striking operatives	Fatality/Serious injury	High	Low
Risk of fire	Fatality/Serious injury/Pollution	High	Low
Operator blind spots	Serious Injury	Medium	Low
Inadequate lighting	Serious injury	High	Low
Working on inclines	Serious injury/obstruction	Medium	Low
Fuel/Oil leaks	Serious injury/Pollution	Medium	Low
Noise	Induced hearing loss/Pollution	Medium	Low
Vibration	HAVS/Pollution	Medium	Low
Interaction with moving parts of plant	Fatality/Serious injury	High	Low

List any additional hazards below

HAZARDS	HARM	RISK FACTOR (in relation to harm)	
		Without Controls	With Controls

ENVIRONMENTAL HAZARDS	HARM	RISK FACTOR (in relation to harm)	
		Without Controls	With Controls
Material spillage	Contamination to land/water	High	Low
Fuel/Oil spills & leaks	Contamination to land/water	High	Low
Noise	Nuisance to local residents	High	Low
Exhaust fumes	Air pollution	High	Low

CONTROL MEASURES

- Ensure all operatives are trained and competent.
- Ensure that plant operator has received manufacturer training and plant commissioning instruction.
- Correct PPE to be worn at all times. Eye protection to be worn when fueling or filling the bulk tank.
- Ensure that fuel interceptor is utilized and checked for correct operation regularly.
- Ensure all equipment is regularly serviced and inspected by a competent person and the daily inspection is recorded on the daily check sheet before use.
- Only trained competent persons to undertake any filling/emptying operation.
- Always ensure that the operator adheres to filling/emptying practices
- Never overload the mixer drum. Do not load more than maximum level.
- Always fill/empty away from water courses, spillage kit and 9kg dry powder fire extinguisher must be present.
- A 9kg dry powder fire extinguisher must be safely mounted on the exterior of the plant and a 2kg dry powder fire extinguisher must be safely mounted near the control panel.
- Always refuel at the designated fueling point
- Ensure that refueling is adequately supervised and that the operative is aware of the emergency procedures.
- Ensure that when boarding & alighting the plant the 3 points of contact method is used.
- Never leave the plant unattended. Never exceed the working temperature
- Ensure Good Housekeeping and constantly monitor
- Observe all speed limits and site speed restrictions and give clear warning to the public.
- Ensure that bulk incoming material is checked for presence of tar bound macadam.
- Ensure that nature and type of incoming bulk material is known, and that waste transfer note has been completed.
- Ensure lockout procedures are adhered to whenever there is a need for routine inspection/maintenance.

Are the control measures adequate? **No**
If No, what additional controls are required?

Refer to separate risk assessments for the following operations:
CRA2 access & egress to site. CRA7 Use of hydraulic tools. CRA 16 Use of tracair's. CRA24 Site security. CRA25 Material distribution. CRA28 Loading/unloading of mobile plant.CRA36 Lone working.

INFORMATION, INSTRUCTION AND TRAINING

TBT 01 Protective Clothing, TBT 07 Slips, Trips & Falls, TBT 12 Reversing Vehicles, TBT 17 Traffic Control, TBT 32 Parking and Security Procedure, TBT 33 Boarding Alighting Vehicles
COSHH 02 Gas/Oil, COSHH 04 Bitumen Emulsion, COSHH 16 Tar/Asphalt Remover

EMERGENCY PROCEDURE

Shutdown plant immediately & contact one of the contracts management team.
IMS - SP 07 Emergency Preparedness

MONITORING

Operators Daily Plant Checks, Health Safety, Environmental inspection/audit report and Inspection of Fixed and Mobile Plant Process Plants (SP28 CPR56 Issue 2.

Risk Analysis

Severity	Rating	Probability	Rating
Fatality	5	Likely	5
Major Injury / Disabling illness	4	Probable	4
Lost Time Injury / illness / damage	3	Possible	3
Minor Injury / Minor damage	2	Remote	2
Insignificant	1	Unlikely	1

Risk Rating	
1 - 10	Low
11 - 15	Medium
16 – 25	High

Risk Rating (with control measures in place)

Hazard	Severity	Probability	Risk Rating
Slips & trips	3	3	9
Falls from heights	4	1-2	8
Interaction of site traffic	5	1-2	10
Strking of operatives	5	1-2	10
Risk of fire	5	1-2	10
Operator blind spots	3	3	9
Inadequate Lighting	3	3	9
Working on inclines	4	1-2	9
Noise	1-2	3	6
Vibration	1-2	1-2	4
Material Spillage	3	3	9
Fuel/Oil Spills & Leaks	3	3	9
Exhaust Fumes	1-2	4	8

Assessed By: R. Scott **Date:** 3.11.08

AIR & EMISSIONS TESTING GROUP

Great Western One
Bristol Street
Swindon
SN1 5ET
Tel: 01793 714 714
Fax: 01793 714 715

Your contact at Scientifics:

Paul Martin
Business Manager
Tel: 01793 714 720
Fax: 01793 714 715
Email: paul.martin@scientifics.com

Stack Emissions Testing Report

Total Particulate Matter
Bitumen Fume

Report Date / Version:	23rd June 2008 / Version 2
Report By: MCERTS Number: MCERTS Level: Technical Endorsements:	Rob Hester MM 06 766 MCERTS Level 1
Report Approved By: MCERTS Number: Business Title: Technical Endorsements: Signature:	Paul Martin MM 04 503 Level 2 - Business Manager TE1, TE2, TE3 & TE4

RSL Group Limited

Balfour Beatty Toutley Depot

Asphalt Recycling Plant

Sampling Date/s:
2nd June 2008

Job Number:
LSW 02155

CONTENTS

EXECUTIVE SUMMARY (Page 1 of 9)

Stack Emissions Monitoring Objectives

RSL Group Limited operates a mobile roadstone reclaimation and recycling from Balfour Beatty Toutley Depot.

Scientifics Limited were commissioned by RSL Group Limited to carry out stack emissions monitoring to determine the release of total particulate matter from the following Plant under Normal operating conditions.

Plant

Asphalt Recycling Plant

Operator

RSL Group Limited
Balfour Beatty Toutley Depot
Old Forest Road
Wokingham
Berkshire
RX41 1XA

Stack Emissions Monitoring

Scientifics Limited - Swindon Laboratory
Great Western One
Bristol Street
Swindon
SN1 5ET
UKAS and MCERTS Number: 1015

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

EXECUTIVE SUMMARY (Page 2 of 9)

Emissions Summary

RSL Group Limited, Balfour Beatty Toutley Depot
Asphalt Recycling Plant
2nd June 2008

Parameter	Units	Result	Uncertainty +/-	Limit	Outcome
Total Particulate Matter	mg/m³	55	12	-	-
Particulate Emission Rate	g/hr	68	15	-	-
Bitumen Fume	mg/m³	2.3	0.5	-	-
Bitumen Fume Emission Rate	g/hr	2.9	0.6	-	-
Moisture	%	11.9	1.2	-	-
Stack Gas Temperature	°C	129	-	-	-
Stack Gas Velocity	m/s	12.3	-	-	-
Gas Volumetric Flow Rate (Actual)	m³/hr	1847	-	-	-
Gas Volumetric Flow Rate (STP, Wet)	m³/hr	1234	-	-	-
Gas Volumetric Flow Rate (STP, Dry)	m³/hr	1087	-	-	-

All results are mean values over one complete batch, with pollutant concentrations expressed at reference conditio

Reference conditions are 273K, 101.3kPa, without correction for water vapour content.

EXECUTIVE SUMMARY (Page 3 of 9)

Monitoring Times

Parameter	Sampling Date	Sampling Times	Sampling Duration
Total Particulate Matter	2nd June 2008	11:45 - 12:05	20 minutes
Bitumen Fume	2nd June 2008	11:45 - 12:05	20 minutes

Process Details

Parameter	Process Details
Process Status	Normal
Capacity and / or Production Rate	-
Continuous or Batch Process	Batch
Feedstock (if applicable)	Old Road Surface
Abatement System	None
Abatement System Running Status	N/A
Fuel (if applicable)	Gas Oil
Plume Appearance	None Visible

EXECUTIVE SUMMARY (Page 4 of 9)

Monitoring Methods

The selection of standard methods employed by Scientifics is determined, wherever possible by the hierarchy of method selection outlined in Environment Agency Technical Guidance Document (Monitoring) M2. i.e. CEN, ISO, BS, US EPA etc.

The table below summarises the monitoring methods, techniques and technical procedures employed, and details any deviations from the aforementioned hierarchy:

Sampling Methods with Subsequent Analysis

Species	Standard Method	Scientifics Technical Procedure	UKAS Lab Number	MCERTS Accredited Method	Limit of Detection (LOD)	MU of Method +/- %	MU +/- %
TPM	BS EN 13284-1	AE 006	1015	Yes	~ 0.1 mg/m³	30%	22% (E)
H_2O	BS EN 14790	AE 004	1015	Yes	0.1%	10%	-
Bitumen	BS EN 13284-1	AE 006	1015	No		30%	22% (E)

where C = Calculated Measurement Uncertainty, E = Estimated Measurement Uncertainty

EXECUTIVE SUMMARY (Page 5 of 9)

Analytical Methods

The following tables list the analytical methods employed together with the custody and archiving details:

Sampling Methods with Subsequent Analysis

Species	Analytical Technique	Analytical Procedure	UKAS Lab Number	UKAS Accredited Analysis	Laboratory	Sample Archive Location	Archive Period
TPM	Gravimetric	AE 006	1015	Yes	Swindon	Swindon	3 months
H_2O	Gravimetric	AE 004	1015	Yes	Swindon	-	-

EXECUTIVE SUMMARY (Page 6 of 9)

Measurement Uncertainty (MU)

Total Particulate Matter & Bitumen Fume

There are 4 ways in which to report measurement uncertainty for total particulate matter. These are listed in the hierarchical table below. The table also indicates which method has been taken to work out the MU for the parameters listed in this report.

MU Reported	**Yes / No**
a) Report a calculated MU	-
b) Report an estimated MU if there are any deviations from the sampling plane validation criteria	-
c) Report an estimated MU if there are any deviations from the specified method	Yes
d) Report the MU specified in the method	-

NOTE: The estimated uncertainty is based upon a calculated MU, coupled with the experience of the Stack Emissions Test house.

EXECUTIVE SUMMARY (Page 7 of 9)

Sampling Location

Sampling Plane Validation Criteria (BS EN 13284-1)	Value	Units	Requirement	Compliance	Method
Lowest Differential Pressure	135	Pa	> 5 Pa	Yes	All
Lowest Gas Velocity	14.77	m/s	-	-	-
Highest Gas Velocity	19.85	m/s	-	-	-
Ratio of Above	1.34	: 1	< 3 : 1	Yes	All
Mean Velocity	16.48	m/s	-	-	-
Angle of flow with regard to duct axis	1	^{o}	< 15^{o}	Yes	All
No local negative flow	-	-	-	Yes	All
Highly homogeneous flow stream / gas velocity	-	-	-	Yes	ISO 10396

Duct Characteristics

	Value	Units
Type	Rectangular	-
Depth	0.26	m
Width	0.16	m
Area	0.04	m^2
Port Depth	60	mm

Sampling Lines & Sample Points

	TPM
Sample Port Size	3 inch BSP
Number Used	1
Orientation	Horizontal
Number Points / Line	1
In Stack / Out Stack Filtration	Out

NOTE: 1 sampling line was used for TPM sampling as only 1 sampling line was available.

Sampling Platform

General Platform Information	
Permanent / Temporary Platform	N/A
Inside / Outside	Outside

Annex A (BS EN 13284-1) Normative requirements	
Minimum Platform Area 5 m^2	No
Platform has 2 levels of handrails (approximately 0.5 m & 1.0 m high)	No
Platform has vertical base boards (approximately 0.25 m high)	No
Platform has removable chains / self closing gates at the top of ladders	No
Handrail / obstructions do not hamper insertion of sampling equipment	No
Depth of Platform = Minimum of 2m or Probe Length + 1m	No

Sampling Location / Platform Improvement Recommendations

All sampling locations should be designed to meet the requirements of the Environment Agency's Technical Guidance Note M1.

EXECUTIVE SUMMARY (Page 8 of 9)

Sampling & Analytical Method Deviations

Sample Duration

The minimum test time of the standard is not met due to the one batch lasting only 20 minutes. However, the aim of the test was to determine the dust result for a single batch and so the test was halted after one batch.

EXECUTIVE SUMMARY (Page 9 of 9)

Conclusion & Discussion

The results of these tests demonstrate that this Plant is being operated with a total particulate matter concentration of 55 mg/m^3 and a bitumen fume concentration of 2.3 mg/m^3.

APPENDICES

CONTENTS

STACK EMISSIONS MONITORING TEAM

Environmental Team Leader	Paul Martin MCERTS Level 2, Technical Endorsements 1, 2, 3 &4 MM 04 503 MSci (Hons) Chemistry
Environmental Technician	Rob Hester MCERTS Level 1 MM 06 766 BSc (Hons) Geography

APPENDIX 2 - Summaries, Calculations, Raw Data and Charts

TOTAL PARTICULATE MATTER SUMMARY

RSL Group Limited, Balfour Beatty Toutley Depot
Asphalt Recycling Plant
2nd June 2008

Test	Sampling Times	Duration min	Concentration mg/m³	Emission Rate g/hr
Particulate Matter	11:45 - 12:05	20	55.5	68.5

Reference conditions are 273K, 101.3kPa, without correction for water vapour content.

Overall Blank Value mg/m³	Daily Emission Limit Value mg/m³	Weighing Uncertainty ± mg
11.2	-	0.37

Acetone Blank Value mg/l	Acceptable Value mg/l
1.0	10

BITUMEN FUME SUMMARY

RSL Group Limited, Balfour Beatty Toutley Depot
Asphalt Recycling Plant
2nd June 2008

Test	Sampling Times	Duration min	Lab Result µg
Bitumen Fume	11:45 - 12:05	20	660

Test	Concentration mg/m³	Emission Rate g/hr	Blank Concentration mg/m³
Bitumen Fume	2.3	2.9	0.12

Reference conditions are 273K, 101.3kPa, without correction for water vapour content.

ISOKINETIC SAMPLING EQUATIONS 1 — Total Particulate Matter & Bitumen Fume

Test	1	Units
Absolute pressure of stack gas, P_s		
Barometric pressure, P_b	747.8	mm Hg
Stack static pressure, P_{static}	3.6	mm H_2O
$P_s = P_b + \frac{(P_{static})}{13.6}$	748.0	mm Hg
Volume of water vapour collected, V_{wstd}		
Impinger volume collected	0	ml
Silica gel weight increase	27	g
Total volume of liquid collected, V_{lc}	27	ml
$V_{wstd} = (0.001246)(V_{lc})$	0.0339	m^3
Volume of gas metered dry, V_{mstd}		
Volume of gas sample through gas meter, V_m	0.2709	m^3
Gas meter correction factor, Y_d	1.0133	-
Average dry gas meter temperature, T_m	21.5	^oC
Average pressure drop across orifice, ΔH	21.5	mm H_2O
$V_{mstd} = \frac{(0.3592)(V_m)(P_b+(\Delta H/13.6))(Y_d)}{T_m + 273}$	0.2509	m^3
Volume of gas metered wet, V_{mstw}		
$V_{mstw} = V_{mstd} + V_{wstd}$	0.2847	m^3
Moisture content, B_{wo}		
$B_{wo} = \frac{V_{wstd}}{V_{mstd} + V_{wstd}}$	0.119	m^3
	11.89	%
Molecular weight of dry gas stream, M_d		
CO_2	0.07	%
O_2	20.8	%
Total	20.9	%
N_2 (100 -Total)	79.1	%
$M_d = 0.44(\%CO_2)+0.32(\%O_2)+0.28(\%N_2)$	28.84	g/gmol
Molecular weight of stack gas (wet), M_s		
$M_s = M_d(1 - B_{wo}) + 18(B_{wo})$	27.55	g/gmol

ISOKINETIC SAMPLING EQUATIONS 2 — Total Particulate Matter & Bitumen Fume

Test	1	Units
Velocity of stack gas, V_s		
Pitot tube velocity constant, K_p	34.97	-
Velocity pressure coefficient, C_p	0.83	-
Average of velocity heads, ΔP_{avg}	9.25	mm H_2O
Average square root of velocity heads, $\sqrt{\Delta P}$	3.04	$\sqrt{}$mm H_2O
Average stack gas temperature, T_s	129	°C
$V_s = \frac{(K_p)(C_p)(\sqrt{\Delta P})(\sqrt{T_s} + 273)}{\sqrt{(M_s)(P_s)}}$	12.33	m/s
Actual flow of stack gas, Q_a		
Area of stack, A_s	0.04	m^3
$Q_a = (60)(A_s)(V_s)$	30.8	m^3/min
Dry total flow of stack gas, Q_{std}		
Conversion factor (K/mm.Hg)	0.3592	-
$Q_{std} = \frac{(Q_a)P_s(0.3592)(1-B_{wo})}{(T_s) +273}$	18.1	m^3/min
Wet total flow of stack gas, Q_{stw}		
Conversion factor (K/mm.Hg)	0.3592	-
$Q_{stw} = \frac{(Q_a)P_s(0.3592)}{(T_s) +273}$	20.6	m^3/min
Percent isokinetic, %I		
Nozzle diameter, D_n	5.83	mm
Nozzle area, A_n	26.70	mm^2
Total sampling time, θ	20	min
$\%I = \frac{(4.6398E6)(T_s+273)(V_{mstd})}{(P_s)(V_s)(A_n)(\theta)(1-B_{wo})}$	107.9	%
Acceptable isokinetic range 95% to 115%	Yes	-

ISOKINETIC SAMPLING EQUATIONS 3 — Total Particulate Matter & Bitumen Fume

Test	1	Units
Particulate Concentration, C		
Mass of particulate collected on filter, M_f	0.0079	g
Mass of particulate collected in probe, M_p	0.0079	g
Mass of total particulate collected, M_n	0.0158	g
$C_{wet} = \frac{M_n}{V_{mstw}}$	55.49	mg/m³
$C_{dry} = \frac{M_n}{V_{mstd}}$	62.98	mg/m³
Particulate Emission Rates, E		
$E = [(C_{wet})(Q_{stw})(60)] / 1000$	68.5	g/hr
Weighing, Conditioning & Filtration Temperatures		
Pre-conditioning temperature	180	°C
Maximum filtration temperature	160	°C
Post-conditioning temperature	160	°C

TOTAL PARTICULATE MATTER QUALITY ASSURANCE CHECKLIST

Leak Test Results	Value	Units
Mean Sampling Rate	13.7	litre/min
Pre-sampling Leak Rate	0.12	litre/min
Post-sampling Leak Rate	0.10	litre/min
Acceptable Leak Rate	0.27	litre/min
Leak Tests Acceptable	Yes	-

Overall Blank Value	Value	Units
Overall Blank Value	11.16	mg/m³
Daily Emission Limit Value	-	mg/m³
Acceptable Blank Value	-	mg/m³
Overall Blank Acceptable	-	-

Isokinetic Criterion Compliance	Value	Units	
Isokinetic Variation	107.9	%	
Acceptable Isokineticity	Yes	-	**Acceptable isokinetic range 95% to 115%**

Total Particulate Matter Filters	Value	Units	
Filter Material	QF	-	**GF = Glass Fibre** **QF = Quartz Fibre**
Filter Size	47	mm	

PRELIMINARY STACK SURVEY

RSL Group Limited, Balfour Beatty Toutley Depot
Asphalt Recycling Plant
2nd June 2008

Time of Survey	10:50 - 11:00
Velocity Measurement Device:	S-Type

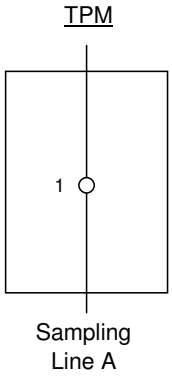
Sampling Line A							
Traverse Point	Distance into duct (m)	ΔPpt mmH_2O	ΔPpt Pa	Temp °C	Velocity m/s	O_2 % Vol	Angle of Swirl °
1	0.01	14.4	141	114	15.09	-	1
2	0.04	13.9	136	114	14.83	-	
3	0.07	16.4	161	114	16.11	-	
4	0.09	15.3	150	114	15.56	-	
5	0.12	16.7	164	114	16.25	-	
6	0.14	13.8	135	114	14.77	-	
7	0.17	24.9	244	114	19.85	-	
8	0.20	22.9	224	114	19.03	-	
9	0.22	19.5	191	114	17.56	-	
10	0.25	15.6	153	114	15.71	-	0
Mean	-	17.3	170	114	16.48	-	

Sampling Line B							
Traverse Point	Distance into duct (m)	ΔPpt mmH_2O	ΔPpt Pa	Temp °C	Velocity m/s	O_2 % Vol	Angle of Swirl °
1	-	-	-	-	-	-	-
2	-	-	-	-	-	-	
3	-	-	-	-	-	-	
4	-	-	-	-	-	-	
5	-	-	-	-	-	-	
6	-	-	-	-	-	-	
7	-	-	-	-	-	-	
8	-	-	-	-	-	-	
9	-	-	-	-	-	-	
10	-	-	-	-	-	-	-
Mean	-	-	-	-	-	-	

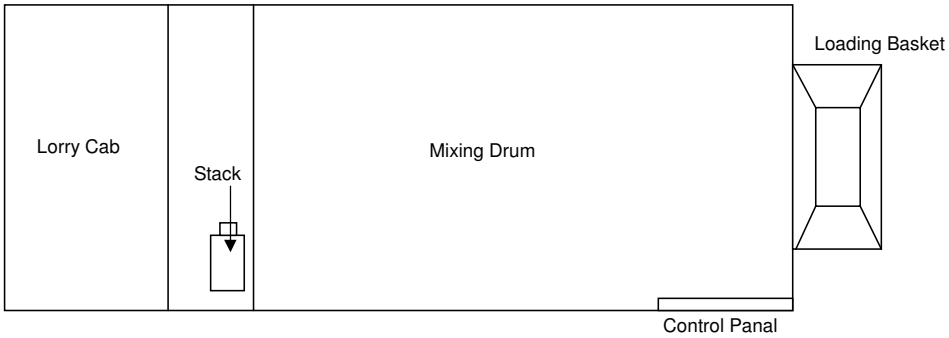
STACK DIAGRAM

	Value	Units
Stack Depth	0.26	m
Stack Width	0.16	m
Area	0.04	m^2

Sampling Point	Distance (% of Depth)	Distance into Stack	Units
1	50	0.13	m



PLANT LAYOUT



CALIBRATEABLE EQUIPMENT CHECKLIST

Extractive Sampling		Instrumental Analyser/s		Miscellaneous	
Equipment	**Equipment I.D.**	**Equipment**	**Equipment I.D.**	**Equipment**	**Equipment I.D.**
Control Box DGM	13-06	Horiba PG-250 Analyser	-	Laboratory Balance	50-10
Box Thermocouples	03-17	Horiba PG-200 Cooler	-	Tape Measure	24-10
Meter In Thermocouple	10-58	JCT JCC P-1 Cooler	-	Stopwatch	-
Meter Out Thermocouple	10-59	Testo 350 Analyser	-	Protractor	LSW100
Control Box Timer	17-11	Testo 339 Cooler	-	Barometer	08-05
Umbilical	03-12	FT-IR	-	Digital Micromanometer	01-08
Oven Box	09-08	FT-IR Oven Box	-	Digital Temperature Meter	03-17
Probe	11-03	Bernath 3006 FID	-	Stack Thermocouple	10-48
S-Pitot	06-01	Signal 3010 MINIFID	-	Drycal	-
L-Pitot	-	Signal 3030 FID	-	Mass Flow Controller	-
Site Balance	14-07	Servomex 570A	-	Mass Flow Control Box	-
Last Impinger Arm	-	JCT Heated Head Filter	-	1m Heated Line	-
Callipers	31-04			5m Heated Line (1)	-
Small DGM	-			5m Heated Line (2)	-
				10m Heated Line (1)	-
				10m Heated Line (2)	-
				15m Heated Line (1)	-
				15m Heated Line (2)	-

NOTE: If the equipment I.D is represented by a dash (-), then this piece of equipment has not been used for this test.

MEASUREMENT UNCERTAINTY BUDGET - TOTAL PARTICULATE MATTER

	Value	Units
Limit value	-	mg/m^3
Measured concentration	55.0	mg/m^3
Reference oxygen	N/A	% by volume

Measured Quantities	Symbol	Value	Units
Sampled Volume	V_m	0.2509	m^3
Sampled Gas Temperature	T_m	295	K
Sampled Gas Pressure	ρ_m	99.7	KPa
Sampled Gas Humidity	H_m	0.0	% by volume
Oxygen Content	$O_{2,m}$	N/A	% by volume
Mass of Particulate	m	15.8	mg
Leak	L	0.73	%
Uncollected Mass	UCM	2.80	mg

NOTE: Sampled Gas Temperature, Pressure and Humidity are at the Dry Gas Meter.

Standard Uncertainty	Symbol	Value	Units	Uncertainty as a %	Uncertainty Required	Uncertainty Met?
Sampled Volume	uV_m	0.0050	m^3	2.0	$\leq$ 2%	Yes
Sampled Gas Temperature	uT_m	3	K	1.0	$\leq$ 1%	Yes
Sampled Gas Pressure	$u\rho_m$	0.9970	KPa	1.0	$\leq$ 1%	Yes
Sampled Gas Humidity	uH_m	0.0000	% by volume	0.0	$\leq$ 1%	Yes
Oxygen Content	$uO_{2,m}$	N/A	% by volume	N/A	$\leq$ 5%	N/A
Mass of Particulate	um	0.3700	mg	N/A	$\leq$ 5% of ELV	N/A
Leak	-	-	-	0.7	$\leq$ 2%	Yes
Uncollected Mass	-	-	-	N/A	$\leq$ 10% of ELV	No

Parameter	Symbol	Value	Units	Uncertainty in Result	Units	Uncertainty as a %	Units
Volume (STP)	V	0.2289	m^3	1.43	mg/m^3	2.61	%
Mass of Particulate	m	15.8	mg	1.29	mg/m^3	2.34	%
Factor for O2 Correction	fc	N/A	-	0.00	mg/m^3	0.00	%
Leak	L	0.23	mg/m^3	0.23	mg/m^3	0.42	%
Uncollected mass	UCM	1.62	mg	5.63	mg/m^3	10.23	%
Combined uncertainty				5.95	mg/m^3	10.82	%
Uncertainty expressed at a 95% confidence level (where k = 2)				**11.91**	**mg/m^3**	**21.65**	**%**

(k is a coverage factor which gives a 95% confidence in the quoted figures)

NOTE: Because there are one or more method deviations from BS EN 13284-1, a calculated MU can not be quoted for the concentration or mass emission of total particulate matter. Instead, this figure may be used to make a best estimate of what the MU might be.

Scientifics Limited
Environmental Division (South)
Swindon Laboratory
Bristol Street
Swindon SN1 5ET

Tel: 01793 714714
Fax: 01793 714715
Email: swindon@scientifics.com

Asphalt Recycling UK Ltd.,
2 Castle Hill,
Burytown Lane,
Blunsdon,
SN26 7DQ

FAO: Mr Mark Gibbs

o/r 85500/1/2/IWD(SWH01742N)

16 June 2008

Dear Mark,

Noise Assessment of Asphalt Recycling Machine

At your request, a noise assessment was undertaken of the above machine the Balfour Beatty depot in Wokingham on the 2nd June 2008.

I enclose a report of the exercise. Should you require any further information, please do not hesitate to contact this laboratory.

Yours sincerely

Ian Douglas
Team Leader – Occupational Hygiene
Direct Line: 01793 714728
Email: ian.douglas@scientifics.com
www.scientifics.com

Report Number: 85500/1/2/IWD (SWH01742N)

Issue Date: 16 June 2008

Copy Number: 1

Noise Assessment of Asphalt Recycling Machine

Author: ……

Ian Douglas

Occupational Hygiene Team Leader

Prepared By:

Scientifics Ltd
Environmental Division
Swindon Laboratory
Bristol Street
Swindon SN1 5ET

Tel: 01793 714714
Fax: 01793 714715

Authorised: ……

Jonathan Harries

Business Manager, Environmental (South)

Prepared For:

Asphalt Recycling UK Ltd.,
2 Castle Hill,
Burytown Lane,
Blunsdon,
SN26 7DQ

Executive Summary

A noise survey was carried out on an asphalt recycling machine whilst in use at the Balfour Beatty Depot in Basingstoke.

A combination of fixed-point measurements and personal noise dosimetry were used to determine noise levels and likely noise exposure whilst operating this machine, revealing that the machine operator is likely to have an $L_{EP,d}$ above the lower action exposure value (LEAV).

At this level the employer should:

- Assess risks (with a view to control) & record assessment
- Provide hearing protection on request
- Maintain equipment & hearing protectors
- Inform, instruct and train employees

Hearing protection should be offered to the operator upon request. The choice of hearing protection should be carefully considered to avoid over protection of staff, which can lead to difficulties with communication and hearing of warning signals. Users may become more isolated from their environment, leading to safety risks and may even have a tendency to remove the hearing protection.

Contents

1 Introduction

1.1 Mr. Mark Gibbs of Asphalt Recycling UK Ltd. requested that *Scientifics* undertake a noise assessment of the mobile asphalt recycling machine whilst in use at the Balfour Beatty Depot in Basingstoke.

Fig. 1: Asphalt recycling machine

1.2 The machine is currently undergoing various trials and an assessment of the noise exposure of the operator is required. Air monitoring was also carried out at the same time, this will be reported separately (Report Ref: 85500/1/2/IWD (SWH01742A)).

1.3 The machine recycles used asphalt material removed from the reconstruction or rehabilitation of aggregate resulting from the processing of inorganic material previously used in construction.

1.4 The used material is loaded into the rear of the machine by use of a JCB. When capacity has been reached the plant mixes and heats the material using integral gas burners. If necessary, extra bitumen is added to the mixture at this point.

Fig. 2: Used material being loaded into recycling machine

Fig. 3: View of rear of plant showing internal gas burners

1.5 This mixing/heating process takes approximately 30 minutes. Upon completion the processed material is ready for use and is deposited via a hopper at the rear of the machine. In this case the material was not used for resurfacing.

Fig. 4: Recycled material being deposited

1.6 Ian Douglas of Scientifics' Environmental Division undertook the noise monitoring on the 2nd June 2008.

2 Objectives

2.1 To determine potential noise exposure levels of staff operating the machine.

2.2 To measure the personal noise exposures of employees and identify any risk of hearing damage.

2.3 To provide recommendations as appropriate.

3 Background Information

3.1 General

3.1.1 Noise is generally considered as unwanted sound - it may be too loud, intrusive or simply occur at the wrong time. It can cause annoyance, interfere with work efficiency, induce stress, disturb concentration, adversely affect communication, mask warning signals, or damage hearing. However, it must be noted that some 'wanted' sound, such as loud music, may still cause damage to hearing.

3.1.2 Noise is one of the most common industrial health hazards, with more than one million workers exposed to noise levels above 90dB(A), and around two million workers exposed to noise levels in excess of 85dB(A).

3.2 Noise induced hearing loss

3.2.1 Noise induced hearing loss is a form of deafness that occurs gradually, and depends directly on the degree of noise exposure. The main attribute of noise determining hearing loss is sound-pressure level, although frequency is also important.

3.2.2 Permanent hearing loss is generally first noticeable around 4kHz - high-pitched speech, before it spreads to other frequencies (3-6kHz). In most cases, both ears are equally affected. The change in the hearing threshold level is known as Hearing Threshold Loss (HTL), or permanent threshold shift.

3.2.3 Various factors may adversely affect hearing, such as increasing age, external injury, blast injury, severe electric shock, pressure changes, obstructions, and infections. Exposure to high levels of some chemicals may also cause permanent hearing loss.

3.2.4 Exposure to high levels of noise may cause other disorders, which affect the ability to work:

- Tinnitus: this is a continual ringing in the ear, causing disruption to sleep and affecting speech.
- Dizziness/loss of balance: it may be particularly dangerous to participate in certain occupations, such as work on or near potentially-hazardous machines, work at heights, work in moving environments (such as at sea), diving, etc.
- Barometric problems: this may result in inability to work in compressed air, or in certain industries, such as flying or diving.
- Ear discharge: this usually occurs due to a bacterial or fungal infection and may affect the ability to use hearing protectors or telephones.

3.3 Other hazards associated with noise

3.3.1 Noise can be a safety hazard as verbal communication may be distorted, leading to errors and misunderstanding. Audible alarms and other warnings may be overlooked.

3.3.2 High levels of noise may also cause stress.

3.4 Factors that affect hearing damage

3.4.1 The level of hearing damage due to noise varies with the following factors:

- Intensity. For every 3dB(A) increase, the perceived loudness doubles and so does the noise energy transmitted to the ear. For every 10dB(A) increase, there is a ten-fold increase in the loudness of a noise, hence 85dB(A) is ten times louder than 75dB(A)
- Frequency. Humans can hear frequencies between 16 and 20,000Hz. Speech frequencies range from 250 to 4,000Hz
- Duration. Longer exposure results in greater hearing damage.

4 Legislation & Guidance

4.1 The exposure of employees to noise is covered by *The Control of Noise at Work Regulations 2005*, which became law in the United Kingdom on the 6th April 2006. They place a general duty on employers to reduce the risk of hearing damage of their employees from exposure to noise to the lowest level reasonably practicable. It is the requirement of these Regulations that where employees are likely to be exposed to noise at or above the limits specified in the Regulations, a competent person must make an assessment of their exposure.

4.2 For the purpose of these regulations the exposure limit values and exposure action values in respect of the daily noise exposure levels and peak sound pressure are fixed at:

- Lower exposure action value: $L_{EX,8h}$ = **80dB(A)**
- Upper exposure action value: $L_{EX,8h}$ = **85dB(A)**
- Exposure limit value: $L_{EX,8h}$ = **87dB(A)**

These exposure action/limit values are based on the levels of noise exposure and the length of time the exposure occurs, normalised for an 8-hour day.

4.3 When applying the above exposure *limit* values, assessment of the noise exposure levels shall take account of the attenuation provided by the hearing protection worn by employees, whereas, the exposure action values shall not take account of protection worn by employees.

4.4 For activities where daily noise exposure varies markedly from one working day to another, for the purposes of applying the noise exposure limit values and the exposure action values, use a weekly exposure level in place of a daily noise exposure level to assess the noise level to which workers are exposed, provided that:

- The weekly noise exposure level as shown by adequate monitoring, does not exceed the exposure limit value of 87 dB(A) and…
- Appropriate measures are taken in order to reduce the risk associated with these activities to a minimum.

4.5 Employers Duties:

- At the lower exposure action level:
  - Assess risks (with a view to control) & record assessment
  - Provide hearing protection on request
  - Maintain equipment & hearing protectors
  - Inform, instruct and train employees

- At the upper exposure action level:
  - Develop & implement programme of control measures (technical and organisational)
  - Designate hearing protection zones
  - Provide hearing protection and ensure it's worn
  - Provide health surveillance
  - Ensure exposure limit values not exceeded

- At the exposure limit value: forthwith,
  - reduce exposure to below the exposure limit value,
  - identify the reason for the limit value being exceeded, and modify the control measures implemented (technical and organisational)

5 Monitoring Equipment

5.1 Sound Level Meter

Monitoring was undertaken using a Brüel & Kjær (B&K) Type 2231 Precision Sound Level Meter (serial no. 1506657) and microphone, which was loaded with the BZ7115 Logging Statistical Analysis Module.

The 2231 instrument was set to 'fast' response, 'A' weighting with the microphone set to 'frontal'. This instrument was calibrated by ACSL to type 1 specifications on the 9th January 2008.

5.2 Personal Dosemeters

A Brüel & Kjær Type 4436 personal dosemeter was used in the completion of the exercise. These instruments calculate the Sound Pressure Level (SPL) and L_{eq} every second from a sampling rate of 16 times a second. Information was downloaded to a PC for graphical presentation and data interpretation. For this exercise the instruments were programmed to use the dosemeter's internal microphone with a 'fast' time weighting.

5.3 Calibrators

In addition to the formal calibration, all instruments were subject to a field calibration check before & after measurements by use of a B&K Type 4231 Acoustical Calibrator (serial number 1558527) which emits a noise level of 94 dB at 1kHz. This calibrator was also calibrated by ACSL on the on the 9th January 2008.

6 Measurements Taken

6.1 Fixed-point measurements were used to determine noise levels and exposure in the vicinity of the recycling plant when in use and was carried out to coincide with typical activities.

6.2 Fixed-point measurements were taken with the B&K Type 2231 Sound Level Meter, which was used to take short term Leq.

6.3 In addition, a personal dosemeter was used to assess the likely daily noise exposure of the machine operative. In the case of the personal dosimetry, the subject was working at various locations. The microphone was located on the collar of the subject, close to the ear.

Subject/ Location	Activity
Michael Johnson	Recycling Plant Operative

Table 1: Summary of dosimetry subjects, 2/6/08.

7 Results

7.1 Fixed Point Noise Measurements

Fixed-point noise measurements were carried out using a *Brüel & Kjær* 2231 meter. Measurements were taken at various locations around the recycling machine. The results are summarised in Table no. 2 below.

Measurement Point	Notes/noise sources	L_{Aeq} (dB)
1	On raised platform at rear of machine	76.0
2	Adjacent to machine control panel	71.1
3	Adjacent to machine control panel – burners operating	83.1
4	Rear of machine with burners operating (approx. 2m from machine)	81.5
5	Approximately 5m from rear of machine with burners operating	77.5
6	Approximately 10m from rear of machine with burners operating	75.5
7	Approximately 15m from rear of machine with burners operating	72.0

Table 2: Results of fixed point noise measurements, 2/6/08.

Above 85dB(A) *Above 80dB(A)* *Below 80dB(A)*

7.2 Personal Dosimetry Using Dosemeters

Activities were assessed by fitting a Personal Dosemeters to the operator. By monitoring activities for a representative period of the shift, a good estimate of the personal daily exposure, $L_{ep}d$, can be gained. Full details are recorded in Appendix 1. A summary of the results is tabulated below in table 3.

Subject	Activity	Measured L_{Aeq}
Michael Johnson	Recycling Plant Operative	83.4

Table 3: Summary of dosimetry results, 2/6/08

8 Assessment of Exposure and Recommendations

8.1 All fixed-point measurements obtained in the vicinity of the asphalt recycling machine were found to be below 85dB (A).

8.2 The dominant noise source associated with the machine appears to be the burners and fixed point measurements taken at the control panel and behind the machine when the burners are operating were above 80dB (A).

8.3 Personal dosimetry on Michael Johnson, the machine operator, revealed an LAeq of 83.4 dB(A). The measurements indicate that the Lower Exposure Action Value of 80 dB is exceeded.

8.4 At the lower exposure action value employers should:

- Assess risks (with a view to control) & record assessment
- Provide hearing protection on request
- Maintain equipment & hearing protectors
- Inform, instruct and train employees

8.5 It should be noted that the noise monitoring was only carried out for a few hours and that some noise exposure was as a result of noise sources other than the recycling equipment, i.e. the movement of the JCB when loading the machine and other general vehicle movements within the yard.

8.6 Spot measurements taken adjacent to the machine however would indicate that the upper exposure action value is unlikely to be exceeded even if working adjacent to the machine for the entire shift.

8.7 Clear signage is attached to the rear of the machine indicating that “ear protection should be worn” (see fig. 3). Under the Regulations this sign could be replaced with one stating “hearing protection is advisory” if required.

8.8 The regulations warn against over protection. Protectors that reduce the level at the ear below 70dB should be avoided, since this over protection may cause difficulties with communication and hearing warning signals. Users may become more isolated from their environment, leading to safety risks and may even have a tendency to remove the hearing protection.

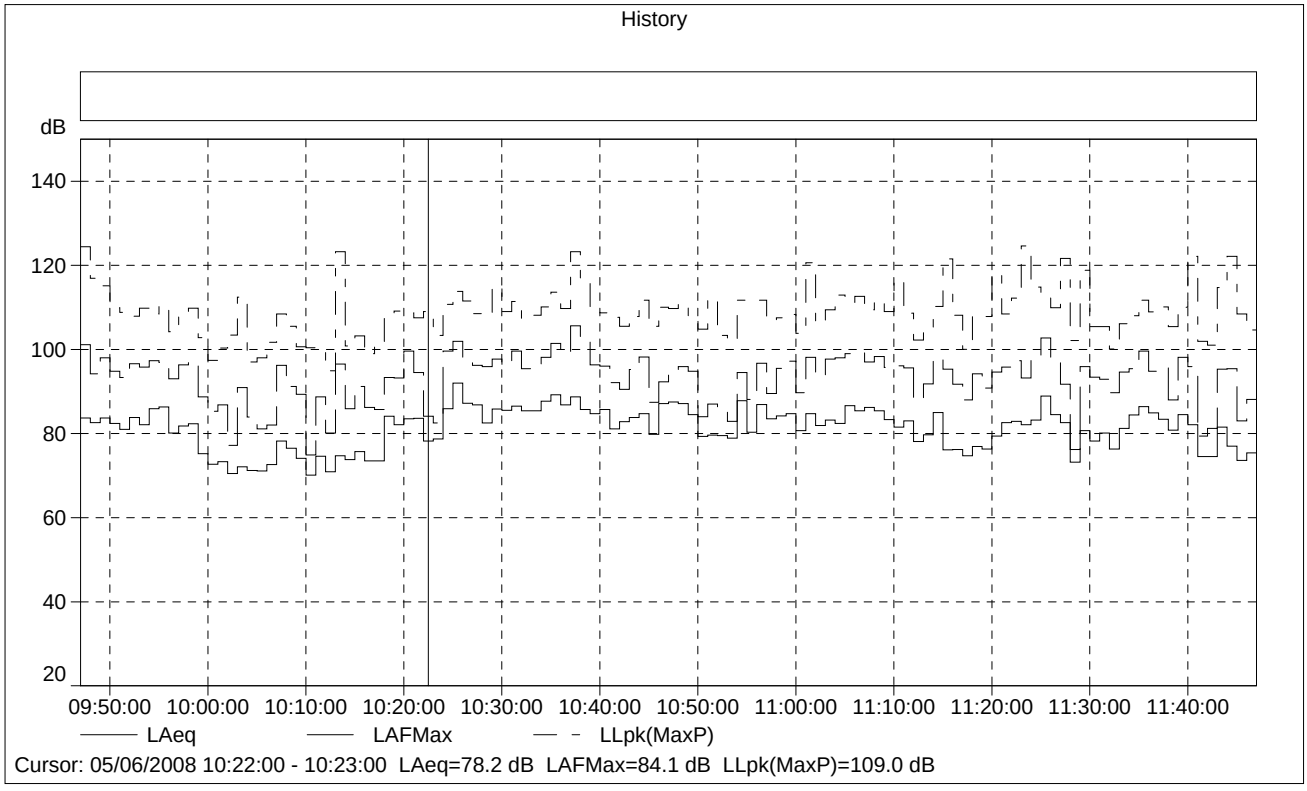
APPENDIX 1: Personal Dosimetry Data and graphs

Michael Johnson

Instrument:		Noise Dose Meter Type 4436
Application:		Dose Measurement
Start Time:		05/06/2008 09:47:00
End Time:		05/06/2008 11:47:00
Elapsed and Run Time:	2:00:00	2:00:00
Bandwidth:		Broad band
Log Rate		60 sec.
Range:		20-150 dB

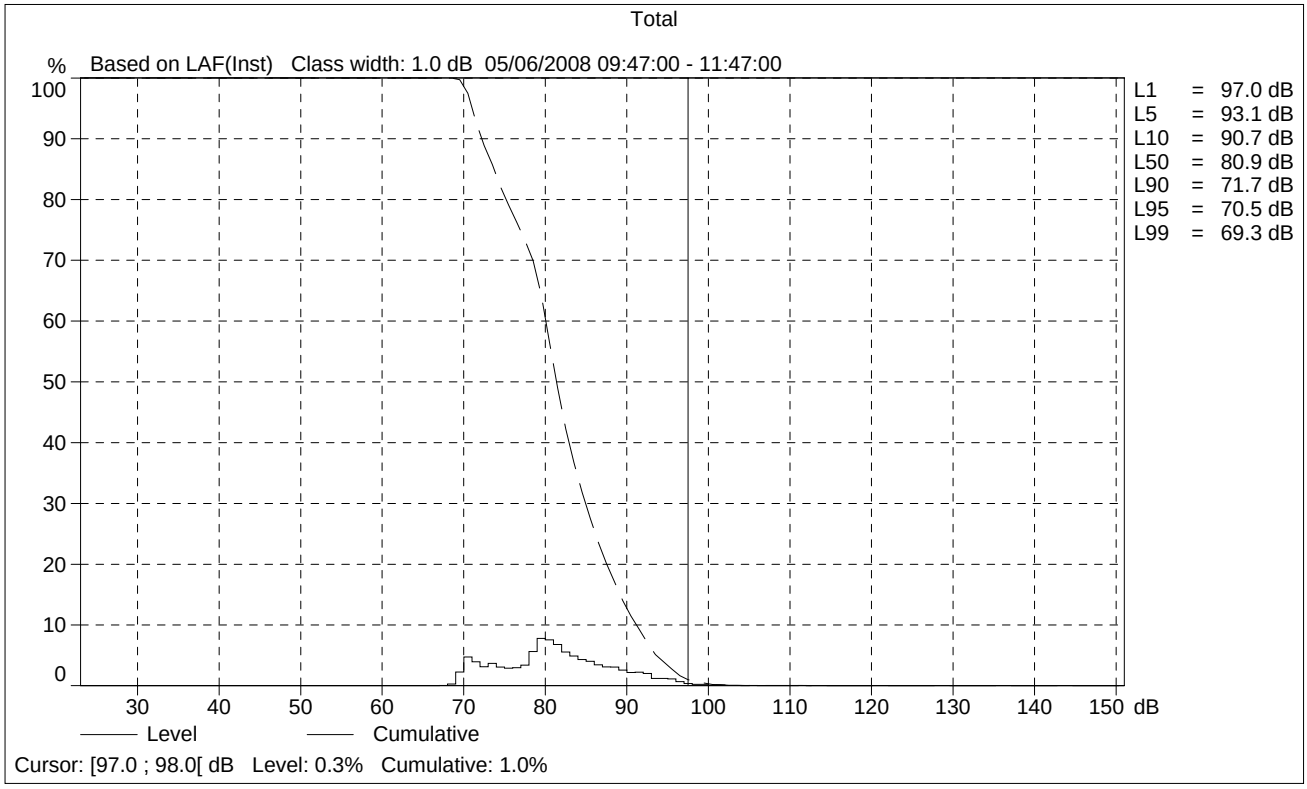
	Time	Frequency
RMS	Fast	A
Peak		L

4436 ID Number:		0
Setup Number:		11
Microphone:		Internal
Exchange Rate		3
Threshold:		0.0 dB
8 Hour 100% Level:		85.0 dB
Calibration Adjustment:		2.7 dB
Calibration Time:		
Instrument Serial Number:		
Microphone Serial Number:		

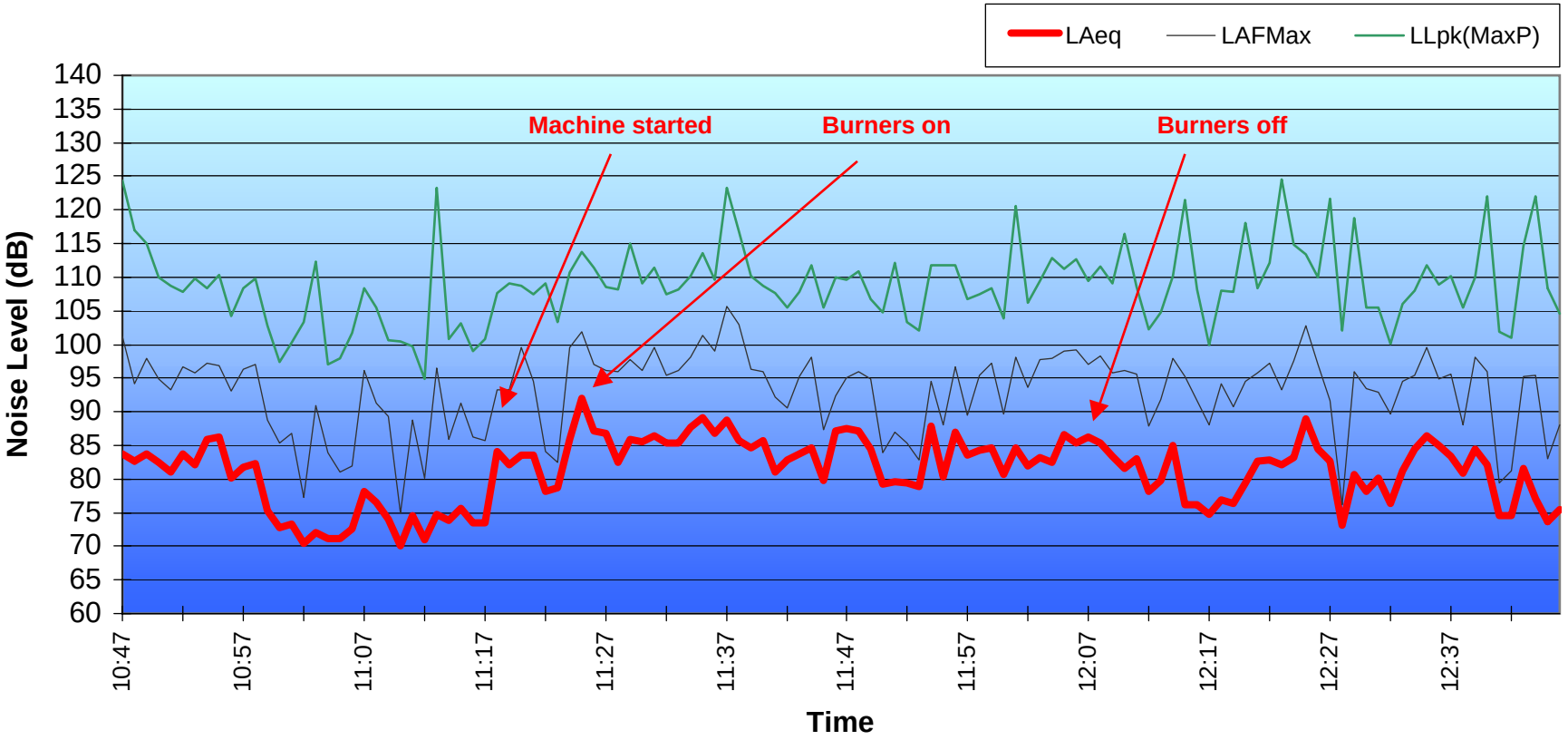


Total

	Start time	End time	Elapsed time	Overload [%]	LAeq [dB]	LAFMax [dB]
Value				0.0	83.4	111.3
Time	09:47:00	11:47:00	2:00:00			
Date	05/06/2008	05/06/2008				



NOISE DOSIMETRY: Asphalt Recycling Ltd
Michael Johnson : Recycling machine operator
2nd June 2008



APPENDIX 2: Background Information, Noise at work

Introduction

Noise is generally considered as unwanted sound - it may be too loud, intrusive or simply occur at the wrong time. It can cause annoyance, interfere with work efficiency, induce stress, disturb concentration, adversely affect communication, mask warning signals, or damage hearing. However, it must be noted that some 'wanted' sound, such as loud music, might still cause damage to hearing.

Noise is one of the most common industrial health hazards, with more than one million workers exposed to noise levels above 90dB(A), and around two million workers exposed to noise levels in excess of 85dB(A).

Noise-induced hearing loss

This is a form of deafness that occurs gradually, and depends directly on the degree of noise exposure. The main attribute of noise determining hearing loss is sound-pressure level, although frequency is also important.

Permanent hearing loss is generally first noticeable around 4kHz - high-pitched speech, before it spreads to other frequencies (3-6kHz). In most cases, both ears are equally affected. The change in the hearing threshold level is known as Hearing Threshold Loss (HTL), or permanent threshold shift.

Various factors may adversely affect hearing, such as increasing age, external injury, blast injury, severe electric shock, pressure changes, obstructions, and infections. Exposure to high levels of chemicals may also cause permanent hearing loss.

Exposure to high levels of noise may cause other disorders, which affect the ability to work:

- Tinnitus: this is a continual ringing in the ear, causing disruption to sleep and affecting speech.
- Dizziness/loss of balance: it may be particularly dangerous to participate in certain occupations, such as work on or near potentially-hazardous machines, work at heights, work in moving environments (such as at sea), diving, etc.
- Barometric problems: this may result in inability to work in compressed air, or in certain industries, such as flying or diving.
- Ear discharge: this usually occurs due to a bacterial or fungal infection and may affect the ability to use hearing protectors or telephones.

Other hazards associated with noise

Noise can be a safety hazard as verbal communication may be distorted, leading to errors and misunderstanding. Audible alarms and other warnings may be overlooked.

High levels of noise may also cause stress.

Factors that affect hearing damage

The level of hearing damage due to noise varies with the following factors:

- Intensity. For every 3dB(A) increase, the perceived loudness doubles and so does the noise energy transmitted to the ear. For every 10dB(A) increase, there is a ten-fold increase in the loudness of a noise, hence 85dB(A) is ten times louder than 75dB(A)
- Frequency. Humans can hear frequencies between 16 and 20,000Hz. Speech frequencies range from 250 to 4,000Hz
- Duration. Longer exposure results in greater hearing damage.

Control of Noise at Work Regulations 2005

In late 2000, the EU's Employment and Social Policy Council proposed a Directive which would:

- repeal Directive 86/188/EEC on risks to workers from noise exposure at work
- require that noise be eliminated at source, or reduced to a minimum
  assess, and if necessary, measure noise at a threshold level of 80dBa L_{Aeq} (8 hours) and 112 Pascals peak
- provide information and training to workers exposed at, or above, this level
- make hearing protection and health surveillance available to workers exposed at, or above, this level
- require that hearing protection be used at or above 85dBa L_{Aeq} (8 hours) and 200 Pascals peak
- provide a programme of control measures to reduce exposure to below this level, including the use of access control and safety signs

In addition to these traditional noise hazards, the proposal also cover assessment of ototoxic substances; for example, quinine, salicyclates, anti-inflammatory drugs, chemotherapeutic agents, many intravenous antibiotics and diuretics. These regulations came into force in April 2006.

Lower Exposure Action Value: 80dB(A)

If this sound-pressure level may be reached in the workplace, the risk must be assessed by a competent person, and a record kept until the next assessment is carried out. A 'competent person' would be (for example), a technician holding the Institute of Acoustics certificate of competence.

The assessment should identify who is exposed to noise above the action value, and should provide employers with sufficient information to enable them to take effective action to reduce noise levels.

Employees must be informed, instructed and trained on any risks and precautions or preventive measures. Employers must make available any noise-reduction equipment provided by a machinery supplier. Employees must know how they may obtain ear protectors, and suitable hearing protection must be made available to employees, on request. All ear protectors must be maintained and repaired.

If an employee believes his/her hearing is being affected they should be advised to seek medical advice.

Upper Exposure Action Value: 85dB(A) and above

Where the daily, personal noise exposure is likely to equal or exceed 85dB(A), a risk assessment must be carried out by a competent person and records kept until the next assessment is undertaken.

Employees must be provided with adequate information, instruction and training about risks to hearing, what they should do to minimise the risks, and how they may obtain ear protectors.

Steps must be taken to reduce exposure, other than providing hearing protection. Where noise reaches this level, or the peak action level, signs must be posted, so far as is reasonably practicable, to restrict entry. So far as is reasonably practicable, employers must ensure that only personnel wearing hearing protection must be allowed to enter such areas.

Employees working in areas where noise levels exceed 85dB(A) must be provided with hearing protection, and employers must ensure that they are worn. All ear protectors must be maintained and repaired.

Wherever reasonably practicable, noise exposure must be reduced. The control hierarchy is:

1. Control of the noise at source, for example by removing the machine or substituting a quieter one.
2. Isolation by noise barriers, or use of enclosures.
3. Use of personal protective equipment.

Noise measurement in general

Noise is measured in decibels (dB) and noise level is measured on a scale from 0 to 140dB. The decibel scale is a scale of comparison and there are three commonly used noise level scales, all having dB as their unit of measurement:

- Sound intensity.
- Sound power.
- Sound pressure.

Instrumentation

There are various instruments on the market for measuring noise.

Sound-level meter

This instrument may be used in most work environments. A sound-level meter will generally measure in the range 10-130dB and may be connected to octave and one-third-octave band filters to analyse the frequency characteristics of the noise concerned. Sound-level meters are available with a variety of functions and levels of accuracy - it is important to be selective about this, as it has a bearing on the expense and usefulness of the data produced.

The microphone is the most sensitive part of the instrument, and should be protected against impacts, moisture and dust, as well as air movement - which can cause spurious responses. The instrument should be held at least one metre away from the user, or any surface to prevent errors due to reflections.

Sound-level meters cannot be used to measure impulsive sounds as their response time is too slow. However, impulse meters are available.

Sound meters must be regularly calibrated against a known standard, and routinely checked with a local calibration device before and after every use - including after a battery change.

Octave band analysers

These may be used to examine the frequency characteristics of noise, and the data may be printed via a computer or plotted manually. Third-octave band analysers provide detailed analysis, and electronic analysers can give very specific data on sound energy at particular frequencies.

Noise dosemeter (dosimeter)

Dosemeters are electronic sound-level meters with in-built clocks and data-storage facilities. In effect, they measure the total sound energy impacting on the microphone, and so to the worker under observation.

The individual worker may carry personal noise dosemeters, where they will directly measure the daily noise-exposure level. The microphone should be placed within one metre of the employee's head, ideally clipped onto the lapel or brim of a safety helmet. This ensures that the dosemeter receives the same sound pressure as the employee's ear, ensuring representative measurements.

Noise measurement: practical details

Do you have a noise problem?

If anyone has to shout to be heard by someone two or less metres away there is likely to be a noise problem. Even if the risks to hearing are relatively low, employers must still reduce the risk to the lowest level reasonably practicable. Do not overlook mobile equipment, such as mechanical sweepers and grass cutting equipment.

Sound levels should be measured when conditions are at their noisiest, and different approaches should be taken dependent on whether the operation involves a single worker, several workers or mobile employees. If an operator works at a fixed location relative to the noise source, measurements should be taken:

- Without the person present, with the microphone at approximately head height at the person's normal working position, or...
- with the microphone at the side of, or above, the person's head, and within 1m of the person's head. The microphone should be placed on the side of the head that receives the highest sound level.

If several people work at the same site and experience roughly the same sound level, measurements should be taken at four or more positions, which represent the positions of the employees. The microphone should be placed about 1.5m above the floor and the sound levels should be averaged for the area. The highest and lowest sound levels in the area should not differ by more than 10dB(A): if they do, the areas should be treated separately. In certain situations, separate measurements may be required for noisy and quiet days, such as where periodic operations generate high sound levels.

If an employee moves around during the day, and is exposed to a variety of sound pressure levels, the equivalent continuous sound level should be measured using a portable magnetic-tape recorder, or dosemeter. Alternatively, the exposure from each job may be determined and the equivalent continuous sound level may be calculated by combining the various exposures - but this requires greater care.

Measuring sound levels accurately and representatively is a skilful operation, and should be carried out by a qualified technician.

The problem of background noise

The total noise environment is made up of various sources. If the background noise is more than 10dB below the plant noise, the recorded level will solely be due to the plant. If the background noise and plant noise levels are the same, the total level measured will be 3dB greater than the background.

Background noise can never be 'turned off' and so noise emissions must be measured by determining the sound pressure level with the plant switched on and off.

Industrial noise control

Once the risks have been assessed, a number of noise control techniques are available. Both the source of noise and transmission pathway need to be considered. Personal protective equipment should never be considered as the primary control measure as it heavily relies on the wearer correctly donning the protector, and wearing it at all relevant times.

The best control strategy is to substitute a quieter process or machine. This may include changing the:

- Process: for example, welding may be used instead of milling, squeeze riveting instead of percussion riveting, etc.
- Machine: for example, manual turning lathes may be replaced with automatic machines which are computer controlled.
- Activity: for example, compressed-air tools may be replaced with quieter hydraulic alternatives.

If it is not possible to adopt the above changes, the following measures may be of use:

- Avoid impacts, or cushion them by providing buffers, rubber/plastic surface coatings, etc.
- Balance rotating parts.
- Enclose the machine. This introduces a barrier to noise transmission (machinery, generators, compressors, pumps, engines, transformers, quiet work stations, etc). The machinist should not enter the enclosure.
- Enclose the operator. The comfort of the operator should be considered, and the enclosure should provide adequate ventilation and temperature control. If this is not practicable, it may be practicable to provide a noise refuge for use when the operator is not actually operating the machine - this may be of particular use where an operator moves around the plant.
- Fit silencers (mufflers) to exhaust systems. These only work on sources where the movement of air or gas is a factor (fans, blowers, compressed air, combustion noise, exhaust gases, etc). However, their effectiveness is limited to a fairly small frequency range and the silencer must be selected following frequency analysis. There are two types of silencer - absorption or expansion chamber silencers. Absorption silencers achieve attenuation by a lining of absorbent material, whilst in expansion chamber silencers, the attenuation is achieved by the acoustic mismatch between the volume of the chamber and inlet/outlet pipe. Alternately, exhaust systems may be discharged into areas remote from workers, provided they do not create a hazard or nuisance to the public.
- Impact sound may be reduced by modifying the motion of the contacting surfaces. For example, the surface shape may be altered or softer surfaces, such as resilient pads, provided.
- Improve maintenance regimes.
- Machines and processes may be set apart, and it is important that the correct size and location, in relation to the noise source and sound frequency, be selected. Where areas are divided into noisy and quiet sections, the division should be as complete as possible, and this may involve extending the partitions to the walls, ceiling or roof. The walls and ceiling may also require the attachment of sound-absorbing material to prevent increases in sound levels due to reflections.
- Match air supply pressure to the needs of the equipment and operation.
- Match fans, fan casings and compressors to the job.
- Place noisy machines and processes in separate rooms.
- Purchase quiet machines or processes for new work.
- Re-arrange the job so that part of it may be carried out in a quiet area.
- Reduce the duration of exposure by rotating jobs.
- Run machines at slower running speeds
- Suitable and sufficient inspection and maintenance by competent personnel.
- Use low-noise air nozzles, pneumatic ejector and cleaning guns designed on good aerodynamic principles.
- Vibration damping; energy is dissipated in a resilient material, reducing that available for noise generation (panels, chutes, fan ducts, machinery guards, ducting etc). Vibration isolation ensures movement is not transmitted to surfaces which then radiate noise (fans, power presses, engines, pumps, guillotines, ventilation equipment etc).

  If an enclosure is built, consideration should be given to the following:

- Absorbent linings should never be made of flammable materials. If liquid fuels, cutting oils, solvents or other flammable liquids are present, it may be preferable not to use any sound-absorbent lining but to construct the enclosure from a material with increased sound-insulating properties. If water sprays are used, the internal lining should be water resistant, and in dusty environments, the lining surfaces should be regularly cleaned.
- Doors. All enclosures must have doors/access areas, fitted with efficient seals.
- Enclosures should be ventilated to discharge heat generated by machinery. If forced ventilation is used, consideration must be given to the noise generated by the fans, blowers, etc.
- Windows: large windows are generally not needed, although vision windows may be required to check processes. If small, windows may be constructed of single sections of shatterproof plate glass or plastic. Larger areas may need to be double glazed.
- Other apertures, such as cable holes, leads, etc should be led through oversized holes and then packed with sound-resistant and vibration-decoupling grommets or glands.

When purchasing new machines, the specification should stipulate low noise generation. Suppliers and manufacturers must provide details of the potential noise to be produced but it must be noted that the levels quoted are those generated under test conditions and when installed, the noise levels may be greater. Reasons for the increases include reflections from walls, floor and ceilings, difference mounting and loading conditions, and the additive effect of noise from adjacent machines.

Personal protection

Personal protective equipment (PPE) should only be used when all other options have been exhausted, as a temporary measure whilst other controls are being adopted, or during an emergency. They should never be chosen in preference to another control measure.

Employers should ensure that all hearing protection affords adequate protection and it should be compatible with all other forms of PPE used.

When purchasing ear protectors the supplier should provide test data showing the attenuation of sound provided. The data should describe the average attenuation and that provided when the protectors are worn by different people of different shape and size.

Hearing protectors only provide adequate protection if they fit, are worn correctly, and are used whenever the employee is exposed to high noise levels.

There are several types of hearing protectors on the market, and hundreds of makes and models. The type chosen should depend on the level of protection required, comfort, and whether the protection needs to be compatible with other forms of PPE, such as hard hats. Employees may have different head shapes, long hair, thick spectacle frames, jewellery, etc which may adversely affect the seal to the head.

Types of ear protection

The types of ear protection available are:

- Disposable ear plugs. These fit into the ear canal, and may be attached to a cord or neck band to prevent them being lost. They are made of compressible material and will fit into most ears. As they are discarded after each use they are more hygienic than permanent re-usable ear plugs.
- Permanent re-usable ear plugs. These work in the same way as disposable ear plugs, but are made of rubber or plastic. They come in various sizes and in order to work, the correct size must be fitted. Certain workers may require different sizes for each ear. Universal fitting plugs are available but the protection afforded is not as good as properly fitted individual-sized plugs. All such plugs should be regularly washed.

- Canal caps supported by head band/semi-inserts. These are pre-moulded ear caps attached to a head band, which presses them against the entrance of the ear canal. One size of cap fits most people. Over long periods of time these may be uncomfortable as the pressure on the ear canals may be too harsh, however they are light and can be worn around the neck when not in use.
- Ear muffs. Hard plastic cups that fit over and surround the ears, sealed to the head with cushion seals, with their inner surfaces covered with a sound-absorbent material. A head band is used to hold and press the muff to the head. One size will fit most people, they are easy to wear, and they can be adapted to allow the passage of low-intensity signals without attenuation. Some muffs are marked 'left' and 'right' ear, and the wearer should be informed of which way to don the muff.

Points to look out for

The key problems associated with hearing protectors are:

- The hazard remains, and if the protectors are damaged or lost, etc, the worker is exposed
- Removal of the protectors for a short period at high noise levels may exceed the daily noise limit.
- They affect direct verbal communication.

The effectiveness of hearing protection may be inadequate if they are not fitted or worn correctly, they are not properly maintained, or they are not worn at all because they are uncomfortable or inconvenient to wear.

Before commencing work, an employee should examine the hearing protection to check:

- Condition of the seals.
- Tension of headbands.
- Overall condition and cleanliness of the protector.
- Resilience and softness of earplugs - if disposables are used, a new pair should be used daily and the old pair should be discarded.

Hearing protectors should be replaced if they are damaged; the seals are torn or hardened, or the lining is exposed; if the earplugs are not soft and resilient; or if head bands have lost their tension.

Earplugs should be issued on an individual basis and if ear muffs are to be shared they should be cleaned between usage. Earplugs should not be inserted using dirty hands. Muffs and plugs should be stored in a clean safe place.

Before any ear protection is issued, the user should be questioned about any ear problems, such as earache or ear infections, and those who experience, or have experienced, associated issues should be referred to a doctor for treatment.

Adding or subtracting decibels

Because decibels are logarithmic units, sound power levels and sound pressure levels can not be added or subtracted in the normal manner. Two plus two does not make four in acoustics!

When two identical levels are added, the result is an increase in level of 3dB.

The table below gives an approximate means of adding noise levels using the familiar rules of arithmetic:

Difference of levels to be added	***Add this to the higher dB level***
0 or 1dB	3dB
2-3dB	2dB
4-9dB	1dB
10 or more dB	0dB

For example, if the background noise is 45dB(A), and :

- A fan operates at 35dB(A), the difference is 10dB(A) so 0dB(A) is added to the background - the fan makes no audible contribution to the background noise.
- A compressor emits 46dB(A), the difference is 1dB(A) and the new ambient sound level is 49dB(A).
- A passing powerboat reads at 75dB(A), the difference is 30dB(A) and the ambient sound level becomes 75dB(A) - the powerboat dominates the background level.

The table overleaf gives an approximate means of subtracting noise levels using the familiar rules of arithmetic:

Difference of levels to be subtracted	***The difference is the higher level, minus.***
More than 10dB	0dB
6-9dB	1dB
4-5dB	2dB
3dB	3dB
2dB	5dB (approx)
1dB	7dB (approx)

Measuring fluctuating noise levels

As noise is rarely steady, the equivalent continuous sound level (Leq) is usually adopted. This is the steady level that would have emitted the same 'A'-weighted sound energy over the same time as the actual noise.

APPENDIX 3: Glossary of Noise Terms

A – weighting	A weighting of the audible frequencies designed to reflect the response of the human ear to noise. The ear is more sensitive to noise at frequencies in the middle of the audible range than it is to either very high or very low frequencies. Noise measurements are often A-weighted (using a dedicated filter) to compensate for the sensitivity of the ear.
Attenuation	Noise reduction, measured in decibels.
Calibration	A check of the function of a sound level meter by comparing the meter reading with a known sound pressure level.
Daily personal noise exposure ($L_{EP,d}$)	A measure of the average noise energy a person is exposed to during a working day. The $L_{EP,d}$ is directly related to the risk of hearing damage.
Decibel (dB)	The units of sound level and noise exposure measurement.
Dosemeter	Instrument designed to continuously measure noise exposure. Usually worn on the person during their normal daily work operations. Useful for measuring a highly mobile person's noise exposure.
Earmuff	Ear protection consisting of a cup enclosing the outer ear.
Earplug	Ear protection in the form of a plug which is inserted into the entrance to the ear canal.
Ear protection zone	An area where a person is likely to be exposed to the second action level or above or to the peak action level or above, which has to be demarcated with a suitable sign to conform with regulation 9(1).
Equivalent continuous sound pressure level L_{Aeq})	A measure of the average sound pressure level during a period of time, in A-weighted decibels.
Frequency (Hz)	The pitch of the sound, measured in Hertz.
Frequency analysis	Analysis of a sound into its frequency components.
Integrating sound level meter	A sound level meter which can accumulate the total sound energy over a specified period and computes an average (in dB (A)). Used for measuring a fluctuating sound level.
Impulsive noise	Any type of single or repeated noise of short duration, e.g. the noise from an explosion or the noise of a power press.
Insulation	A material which reduces sound passing through its thickness.
$L_{AF90,5min}$	The A-weighted noise level exceeded for 90 % of a 5-minute measurement period (with the instrument set to 'Fast' time weighting), also defined as the background noise level in BS4142.

$L_{AF\ max.}$	Maximum value of the A-weighted sound pressure level, measured using the fast (F) time weighting (in dB (A)).
Noise assessment	The determination of the noise exposure of a person or group of people.
Noise exposure	A measure of the total sound energy a person is exposed to. It is dependent on both the sound pressure level to which the person is exposed and the time over which the exposure occurs.
Noise spectrum	A noise represented by its frequency components.
Noise survey	A survey of noise levels at specified locations in a work area before making a full noise assessment.
Nuisance noise	Noise which is usually not damaging but is a cause of annoyance.
Octave-bands	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit. The width of the octave-bands increases at higher frequencies.
1/3 Octave-band	Single octave-bands divided into three parts.
Octave-band centre frequency	The frequency at the centre of an octave-band.
Pa	Pascal, unit of measurement of sound pressure.
Peak sound pressure level	The maximum value reached by the sound pressure at any instant during a measurement period (in dB, usually with either C or linear frequency weighting).
Sound exposure level (SEL, SEL_A, $SEL_{C,}$ L_{AE})	A measure of the sound energy in a short duration event, such as an explosion. The SEL is defined as: 'The sound pressure level (in dB) which, if it lasted for 1 second, would produce the same energy as the actual noise event'.
Sound intensity	A measure of the flow of sound energy.
Sound level meter (SLM)	Instrument for measuring various noise parameters.
Sound power level	A measure of the total acoustic power produced by a noise source.
Sound pressure level (SPL)	The basic measure of noise loudness, expressed in decibels, usually measured with an appropriate frequency weighting (e.g. the A-weighed SPL in dB (A)).

Distribution List

Report No. : 85500/1/2WD(SWH01742N)
Title : Noise Assessment: Asphalt Recycling Machine

Copy No.	Recipient
1	Asphalt Recycling UK Ltd.
2	Swindon Laboratory

Authorised for distribution to the above list.

Ian Douglas
Team Leader – Occupational Hygiene

CONFIDENTIALITY

The information contained in this report shall not be disclosed outside *Scientifics* without the permission of the client.

In addition to those named on the distribution list above, the information contained in this report will be restricted to:

Category of Restriction	
	Scientifics Ltd (Unrestricted)
	Environmental Division
✓	Distribution List Only

The Recycling Plant: The black funnel is where the old road planings are inserted into the drum mixer. The planings are then reheated and broken up.

Picture of the control panel

Picture showing how the material is extracting from the plant.

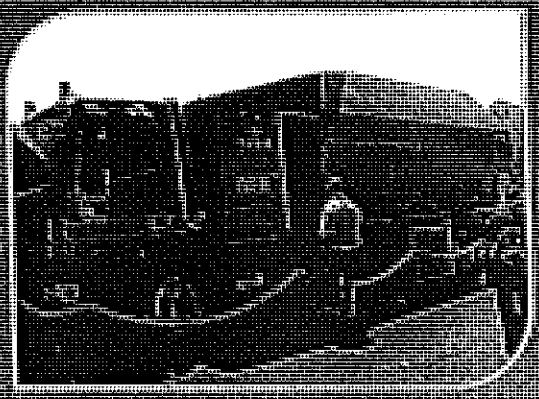
The bin that the recycled material is collected.

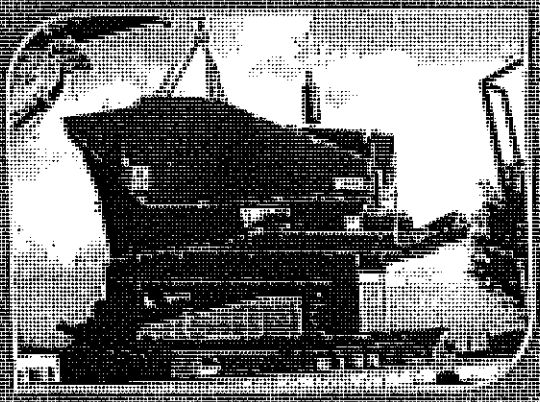
RSL

PLANT MANUFACTURING AND SOLUTIONS IN RECYCLING

SPECIALIST IN MANUFACTURE & MAINTENANCE OF:

- Recycling Plant Including Hot Asphalt Recyclers & Patchers
- Road Maintenance Plant
- Crushers & Screens
- Plant Refurbishment
- Quarry Equipment
- Plant Site Engineering
- Plant Spares





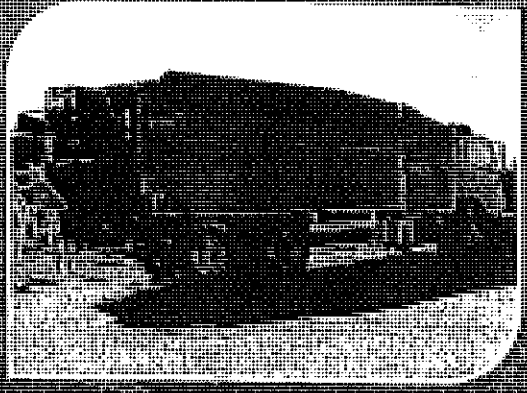
Mobile Asphalt Recycling Plant & Complete Crushing & Screening Solutions

www.rslplant.com

MOBILE ASPHALT RECYCLING PLANT

Designed to recycle 100% break out, millings or unused new asphalt

The plant can also be used to produce virgin hot asphalt for emergency road repairs or weekend work.



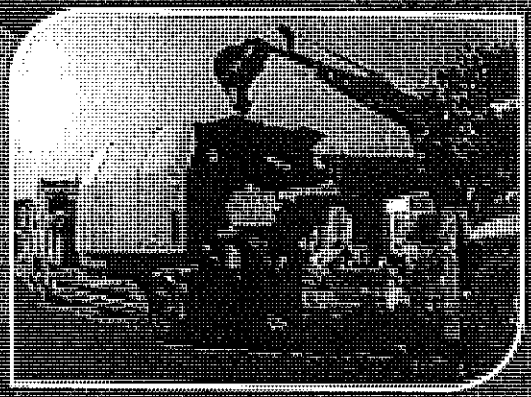
Productivity and Operations

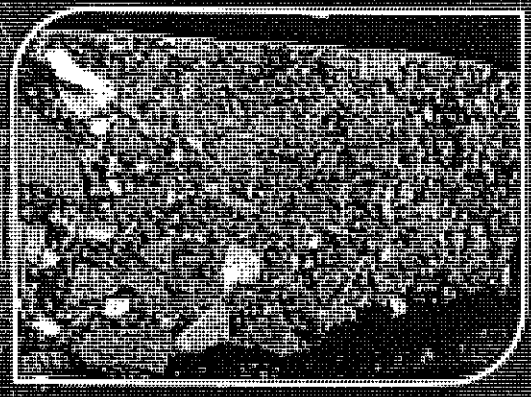
Machine Loading

Additives

Unloading

Health & Safety





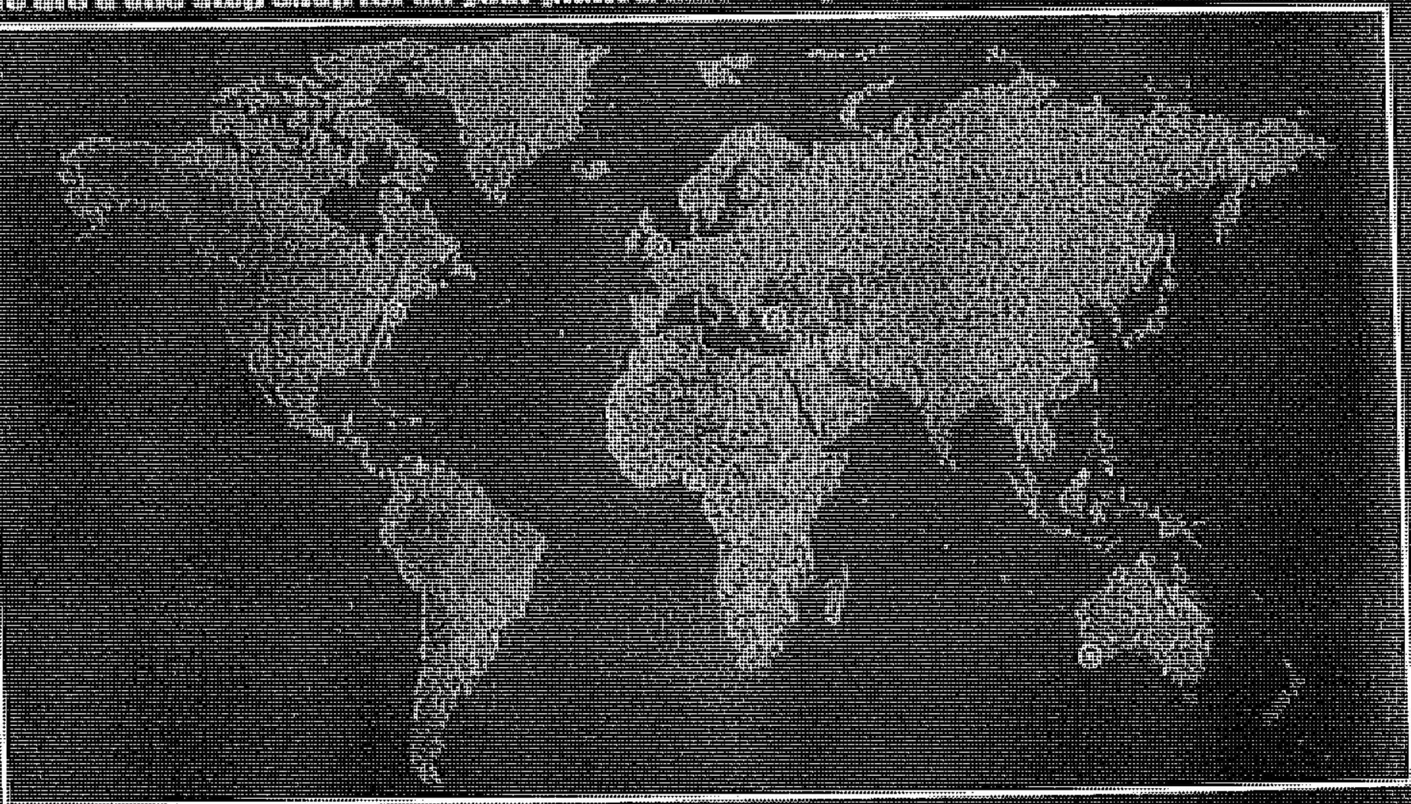
www.rslplant.com

Our customer base has grown to include all of the major quarrying groups in the UK and over seas, with regular sales on a repeat order basis.

International sales range from individual units to the supply of all the necessary components for a complete quarry. We supply small locally owned companies, large privately owned companies and government organisations. We have quarry plant and asphalt recycling units operating in Europe, Asia, USA, China, Africa and many other countries around the world.

RSL will source refurbish and arrange shipment of any kind of machinery or custom build to your requirements.

We are a one stop shop for all your plant & machinery requirements.



Associated Recycling Solutions Ltd
Unit 1
[illegible]

Ozfleck Industries Pty Ltd
[illegible]
Australia

Ama Plants & Asphalt Recycling
[illegible]
Abuja
Nigeria

Ivedik Organize Sanayi Bolgesi
[illegible]
Ankara
Turkey

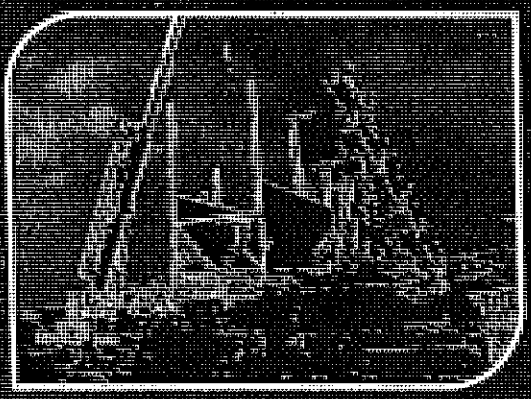
Pavement Group.com
[illegible]
United States of America

CC Akanomo & Sons Ltd
[illegible]
Abuja
Nigeria

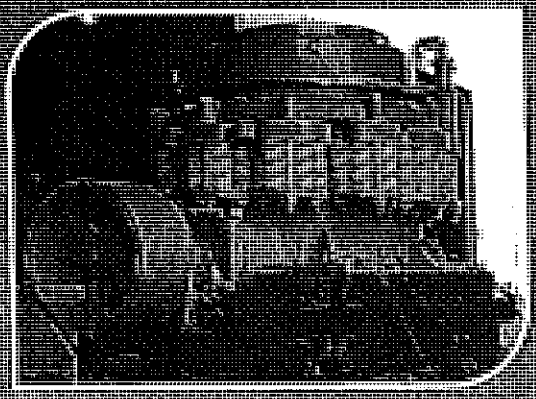
OUR EXPERTISE

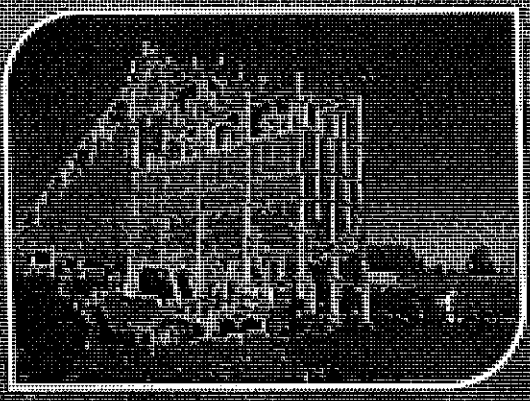
RSL's team of highly qualified and experienced engineers are committed to delivering, both on time and to a high standard.

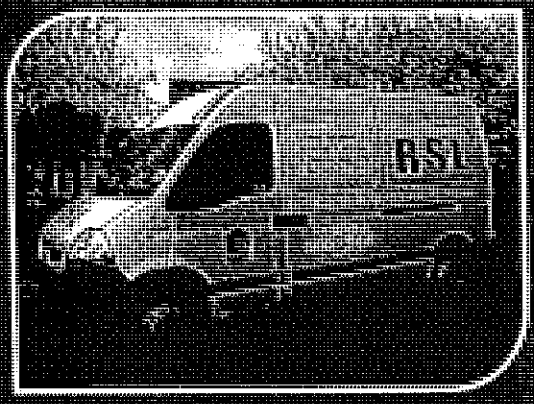
We offer a single source to our clients' from consultancy through to complex engineering solutions.



QUARRY PLANT & MACHINERY







Standard valves are always used wherever possible.

- Restored to pristine condition
- Renovated to an immaculate standard
- Designed to your specification
- New and refurbished machines
- RSL manufacture all manner of crushing and screening plant with the capacity of processing from 10 to 500 ton per hour