APPLICATION FOR LA-APC AUTHORISATION TO OPERATE

A PG 6/23 METAL COATING PROCESS

FOR

BOC LIMITED

AT

BRUNEL ROAD
HADLEIGH ROAD INDUSTRIAL ESTATE
IPSWICH
SUFFOLK
IP2 0EX

433062

clive.bentley@ipswich.gov.uk

CB/EPA.AP2

Clive Bentley

433112

Mr T Grocott
Halcyon
By email
On behalf of BOC,
Hadleigh Rd Industrial Est
Ipswich

C M Palk BSC DMS MCIEH
Group Manager
(Environmental Services)

14 March 2003

Dear Mr Grocott

ENVIRONMENTAL PROTECTION ACT 1990, PART 1
APPLICATION FOR AUTHORISATION, COATING PROCESS
BOC, Hadliegh Rd Industrial Estate, IPSWICH

Please find enclosed:-

(a) An application form.
(b) Explanatory notes for this form.
(c) An explanation about public information.
(d) A list of prescribed substances.

Would you please complete the application form and return four copies of it to me (along with four copies of all plans, maps or other attachments).

You must also submit an application fee currently £1,303 (although this is revised for each financial year) and you must place an advert in one or more local newspapers as described in the explanation on public information enclosed.

As you may know, under the Environmental Protection Act 1990, Local Authorities have responsibility to control air pollution from a particular list of "prescribed" industrial or trade processes within their areas. It is an offence to operate any such process unless authorised, otherwise you may face a fine and/or imprisonment. A list of prescribed processes is to be found in The Environmental Protection (Prescribed Processes and Substances) Regulations 1991 (SI No.472):1991. This can be obtained from HMSO.

Before filling in the application, I would strongly advise you to read the Process Guidance Note relevant to your process.

Secretary of State's Guidance – Coating of Metal PG 6/23 (97)

Detailed information on the application is contained in General Guidance Note 3 "Applications", and I recommend reading this also. Comprehensive guidance to Part 1 of the Act can be found in General Guidance Note 1. These Guidance Notes (and others) are published by HMSO. The telephone numbers for HMSO Publications Centre are 0171 873 9090 (orders) or 0171 873 0011 (enquiries).

The general principle of the Act is to use "Best Available Techniques, not entailing excessive cost" (BATNEEC) to prevent or minimise emissions of prescribed substances to air and for rendering harmless any other substances which might cause harm if released into any environmental medium. (Section 7(2) Environmental Protection Act 1990).
This principle should be borne in mind when making your application.

Once Ipswich Borough Council has received your application, we will inform you as to whether it has been "duly made" (contains all standard required information) within 14 days. We may require additional information following this under Para 1(3), Schedule 1 to the Act, and you may of course include any extra information that you feel is appropriate. (It is important to include any proposals for interim upgrading or planned process variation, for example).

If, once an authorisation has been granted, you wish to make any change to the process plant or operating techniques, you must inform us so that the conditions of the authorisation can be varied.

If you feel that any conditions on an Authorisation, or decisions regarding it are unreasonable you may appeal to The Secretary of State. Information on how to make an appeal is contained in General Guidance Note 5 "Appeals" from HMSO.

If you have any queries on the above or would like to discuss any matter relating to your application, please do not hesitate to contact me on 01473 433112.

Yours sincerely

Clive Bentley
Senior Environmental Health Assistant
Pollution Services

IPSWICH BOROUGH COUNCIL

APPLICATION FOR AUTHORISATION TO CARRY OUT PRESCRIBED PROCESS WITHIN THE CONTROL OF IPSWICH BOROUGH COUNCIL, UNDER SECTION 6 OF THE ENVIRONMENTAL PROTECTION ACT 1990 (LOCAL AUTHORITY AIR POLLUTION CONTROL)

YOU SHOULD READ THE ENCLOSED EXPLANATORY NOTES BEFORE COMPLETING THIS FORM

SECTION 1 Details of Operator and Location of Process

(a) Name, address and telephone number of the applicant:-

BOC LIMITED, BRUNEL ROAD, HADLEIGH ROAD IND. ESTATE,

IPSWICH, SUFFOLK, IP2 0EX

(b) Address of registered or principal office, if the applicant is a body corporate:-

The BOC Group, Chertsey Road,

Windlesham, Surrey, GU 20 6HJ

(c) Address for correspondence, if different from that in (a) above:-

AS ABOVE – 1 (c). *

(d) Address of the premises where the process will be carried out:-

As Above - 1 (c)

(e) Details of maps and plans attached:-

SEE ENCLOSED FOLDER

SECTION 2

Description of Process and of the Proposed Techniques to Prevent or Minimise Emissions to Air of Prescribed Substances and to Render Harmless Emissions to Air of all Substances

This should include a description (with drawings, where appropriate) of physical characteristics of the process, height and location of stacks or vents and abatement technology. Also, details should be given of how the process is to be operated. (See separate explanatory notes for more detail).

REFER TO FOLDER

(Continue on a separate sheet if necessary)

SECTION 3

Details of the Source, Nature and Amount of Current and/or Anticipated Air Emissions from the Process

(Include non-prescribed substances, as well as prescribed substances)

Refer to folder

(Continue on a separate sheet if necessary)

SECTION 4

Details/Proposals for Monitoring, Sampling and Measurement of Air Emissions

Applicants should propose the type and frequency of monitoring they expect to carry out, in order to meet the requirements of the EPA.

Refer To Folder

(Continue on a separate sheet if necessary)

SECTION 5

Assessment of the Likely Environmental Consequences of any Emissions to Air

Applicants should aim to show that their process achieves BATNEEC. The assessment should be limited to considering the effects of air emissions on the environment. (See separate explanatory notes for more detail.)

REFER TO FOLDER

(Continue on a separate sheet if necessary)

Name of Newspaper in which it is proposed to advertise the application:-

..........Ipswich Evening Star, East Anglian Daily News..........

Fee enclosed:- (cheques made payable to Ipswich Borough Council)

£ ......1303.00.................

I hereby certify that all the information contained in this application is, to the best of my knowledge, correct.

SIGNATURE: ....[signature]..........

NAME IN BLOCK CAPITALS: ....JOHN MORGAN..........

CAPACITY IN WHICH SIGNING: ....PRODUCTION MANAGER..........

DATE: ....11/8/2003..........

IPSWICH BOROUGH COUNCIL

Environmental Protection Act 1990

The Environmental Protection (Prescribed Processes and Substances)
Regulations 1991, SI 472
Schedule 4 Regulation 6(1)

Release into the Air: PRESCRIBED SUBSTANCES

Oxides of sulphur and other sulphur compounds
Oxides of nitrogen and other nitrogen compounds
Oxides of carbon
Organic compounds and partial oxidation products
Metals, metalloids and their compounds
Asbestos (suspended particulate matter and fibres), glass fibres and mineral fibres
Halogens and their compounds
Phosphorous and its compounds
Particulate matter

IPSWICH BOROUGH COUNCIL

AIR POLLUTION CONTROL UNDER THE ENVIRONMENTAL PROTECTION ACT

EXPLANATORY NOTES FOR THE APPLICATION FORM ENCLOSED

SECTION 1

The purpose of supplying maps or plans is to allow Ipswich Borough Council, the Health and Safety Executive, English Nature and the general public to see the area of land which the process will occupy. If a process takes part on only part of the premises, the applicant is requested to submit a clearly labelled site plan, showing the location of that process.

SECTION 2

Ipswich Borough Council needs to know the precise nature of the process from receipt of raw materials to the dispatch of wastes and finished products. This section should include details of the physical characteristics of the plant and descriptions of how the process is to be operated, ie:-

Fuel and raw materials used;
Storage of raw materials and waste;
Maximum production capacities;
Levels of process maintenance;
Extent of staff supervision;
Work force qualifications and training;
Height and location of stacks and vents (including calculations to determine heights);
Location of abatement equipment (including reasons for selecting the particular type used);
Contingency arrangements for process breakdowns.

For more complex processes, a set of process diagrams and a plan of the plant should normally form part of the application.

The description should identify all potential sources of emissions to air and proposed techniques for achieving BATNEEC and other objectives contained in Section 7(2) of the Act.

SECTION 3

These details may be contained within the general process description. Ipswich Borough Council needs to be made aware of all significant contained and uncontained emission sources from the process applied for.

SECTION 4

In identifying the main sources of emissions from the process, the applicant should also put forward proposals as to which emissions should be monitored, sampled and measured, and how and when this should be done.

SECTION 5

An appraisal of the environmental benefits and disadvantages of adopting different approaches to controlling emissions will be central to Ipswich Borough Council's decisions regarding the application. If the process complies fully with the relevant process guidance note, it will be unnecessary to give a detailed assessment, as this compliance is generally deemed sufficient to meet this requirement.

It will be particularly important to include a justification of the process' likely environmental impact if it is to be carried out in an environmentally sensitive area: for example, if the area already has high air pollution levels or if it is near a designated site of Special Scientific Interest, or in the Town Centre. It will also be important to include detail if there are a number of alternative means of minimising emissions to air, each having different environmental impact, or where the application differs significantly from the relevant process guidance note.

Applications must be signed by a person authorised to sign on behalf of the Company, and dated.

IPSWICH BOROUGH COUNCIL – LAPC

Explanation about Public Information

The Act and subordinate regulations require that copies of all applications are sent to the Health & Safety Executive and English Nature. These bodies are "statutory consultees". They also require that, once the applicant has been advised that an application has been duly made (this will normally be within 14 days of submission of an application), the applicant must advertise the application in a local newspaper. Information which must be included in an advertisement is as follows:

- name of the applicant
- address of premises where the process is or will be carried on
- brief description of the nature of the process
- address(es) of the places(s) where the application may be inspected (at the Civic Centre, Room 409) together with a statement that members of the public have a right to inspect the registers free of charge
- statement to the effect that written representations concerning the application may be made to Ipswich Borough Council, Pollution Services within 28 days following the publication of the notice
- address to which representations should be sent (Ipswich Borough Council, Pollution Services, Room 409, Civic Centre, Civic Drive, Ipswich IP1 2EE).

If there is some aspect of the application which the applicant believes should not be held on the public register for reasons of national security or commercial confidentiality, the applicant should, in the first instance, discuss this with the appropriate officer in Pollution Services.

Proof of advertisement must be forwarded to the Council within ten days of the advertisement appearing in the press.

Public Register

The regulations require that local authorities hold certain information relating to authorised processes in a public register. (Commercially confidential or information which would be contrary to the interests of national security would not be included). Examples of information included are:

Applications, representations, legal notices, authorisations, appeals, court cases/conviction details, monitoring data, reports, directions from Secretary of State.

APPLICATION SUMMARY.

The Environmental Protection Act (1990) places duties, via regulations, upon the operators of specified processes.

The processes operated by **BOC LIMITED** are encompassed in Section 6 of the Environmental Protection (Prescribed Process and Substances) Regulations 1991.

These processes encompass the use of coating technologies used in the painting of compressed gas cylinders, which will be detailed in the above regulations for authorisation and control by Ipswich Borough Council, Pollution Services, Civic Centre, Civic Drive, Ipswich, IP1 2EE.

This authorisation application is made in accordance with those provisions detailed by Guidance Note PG 6/23 (1997) and the Environmental Protection Act 1990, S.I. 472.

The assessment of these processes and their environmental effects are detailed within this application.

COMMERCIAL CONFIDENTIALITY.

For the purpose of the provisions of this application it is the intent of **BOC LIMITED** to request the information contained herein not to be encompassed initially by Commercial Confidentiality.

However, should more specific data or information be required to support this application, **BOC LIMITED** reserves the right to revoke this and reassess the Commercial Confidentiality clause proviso.

COMPANY PROFILE, POLICY AND STRATEGIES.

BOC Limited is part of the BOC Group, which has an international portfolio of companies.

The Group, reporting into three business segments, Gases & Related products, Health Care and Vacuum Technology & Supply Chain Solutions, recognises that people and customers being its most important assets is committed to the highest standards of safety and environmental practice.

At the Brunel Road premises, the BOC Limited facility encompasses a dedicated Paint Shop, within which compressed gas cylinders are primed and top coated and a Test Shop facility in which the manual coating of cylinders is undertaken.

With the operation of the painting processes the site encompasses a dedicated storage area, waste control systems, day storage and distribution. The process is fully supported by internal Q.C. systems and operational instructions for all activities.

It is the activities that are undertaken by the use of Volatile Organic Compounds (VOCs) (solvents) in excess of 5 tonnes/annum as used in coatings and thinners that are encompassed under the Environmental Protection Act 1990 (SI 472).

ENVIRONMENTAL POLICY.

The Company currently operates their own specific Environmental policy, a copy of this is included within this application.

ENVIRONMENTAL ORGANISATION.

Specific environmental responsibilities are already defined at all levels within the sites Management structure.

WASTE MANAGEMENT AND MINIMISATION.

The Waste Management function is directly encompassed with the company's organisational structures for the disposal of all wastes, including "Special Wastes".

The site operates a fully documented procedure for the disposal of waste, as defined under the Control of Pollution Regulations I and II 1980. Full documentation is maintained in accordance with Section 17 protocols and the Special Waste Regulations 1996 in accordance with Section 62 protocols.

Wastes generated from site activities are dealt with via approved and licensed Waste Contractors. Environmental auditing of the waste contractors forms part of the Company's "Cradle to Grave" monitoring initiative.

All wastes which may contain traces or residues of paints will be stored on site in a dedicated, storage compound prior to disposal via an approved contractor. This facility will contain skips and 205 lt. drums of materials including rags, cardboard, paper etc.

POLLUTION CONTROL INITIATIVES.

In accordance with Pollution Prevention and Control initiatives, as part of the precept of resource minimisation, the Company and Group have established ongoing procedures to comply with this aspect of regulation.

This includes routine environmental audit, as part of an integrated SHEQ audit.

EMERGENCY RESPONSE TEAM.

Site management have an on site Emergency Response Team, on hand to deal with incidents. The team act in accordance with specific procedures to ensure minimisation or elimination of escape of production materials and wastes.

SPILLAGE AND CONTAINMENT.

Site management have specific spillage and containment procedures to deal with potential incidents.

ENERGY MINIMISATION INITIATIVES.

In accordance with the precept of energy minimisation, the Company has already addressed initiatives to reduce inputs in this area.

BOC Gases Europe

Environmental Protection Policy

BOC Gases Europe must regard the protection of the environment as a fundamental principle of its business philosophy. We will take a responsible attitude to the management of our environmental care programmes. Our aim is to achieve sustainable development of our business without compromising the continued protection of the environment.

BOC Gases Europe fully adheres to The BOC Group Environmental Protection policy. Within our sphere of operations, this policy will be implemented by comprehensive Environmental Action Plans for each area of our business activity.

Objectives

These plans will embrace all aspects of our environmental protection philosophy. Viewed together, they will ensure that we:

- Identify the best practicable environmental options for all processes and activities and establish operating standards which embody these options.
- Set achievable and realistic goals to maintain a high standard of environmental protection performance, taking compliance with legislation as a minimum requirement.
- Conduct regular reviews of all aspects of our operations to ensure that those standards are being maintained and that we meet our goals.
- Identify the necessary resources and training requirements for sustaining continued improvement in environmental protection.
- Include environmental protection performance information in internal and external reports.
- Encourage full and effective consultation on environmental protection matters at all levels, and ensure effective liaison with other BOC Group companies which interface with our operations.
- Develop an awareness and sense of shared responsibility for environmental protection amongst our employees.
- Assess and minimise the environmental impact of all our products, processes and services.

Organisation and Arrangements

The responsibility for ensuring implementation of this policy lies with the Business Unit Heads. Each area of our business is required, under the leadership of the relevant Executive Board Member, to implement a comprehensive Environmental Action Plan. Day to day implementation of this plan will be developed through line management.

Nigel Hunton
Managing Director,
PGS Europe

Jim Ford
Managing Director,
I&SP Europe

I give my full support to the above policy which shall be fully implemented on this site

BOC GASES

VVP-01-15-EUR 18/04/02

APPLICATION INDEX.

CONTENTS.

SECTION 1.

PROCESS DESCRIPTION

1. PROCESS DESCRIPTION.

The proposed coating process to be operated at BOC Limited' Brunel Road premises is defined as the painting of compressed gas cylinders and associated components. The site will produce finished compressed gas cylinders used in a broad spectrum of end user applications.

The process is currently operated at other BOC Limited site's within the UK, and achieves compliance with regional environmental standards. The process operated at Brunel Road will directly parallel these operations.

The site will operate the process from 6am on a Monday morning to 6am on a Saturday morning for about 48 weeks per annum. There may be some limited weekend working as required at times.

All activities encompassed within the coating process are supported by specific equipment specifications, process controls, planned maintenance, quality assurance and product verification procedures.

The coating processes, both primer and topcoat based, have dedicated cycle times at all stages, defined operating efficiency targets, planned preventative maintenance programs, and in built, breakdown criteria.

The building in which the coating process takes place will be maintained at ambient temperature during production hours.

All equipment used in the coating process will conform to; -

BOC's Electrical and Mechanical specifications.

IEE Regulations (16^{th} Edition)

The Health and Safety at Work Act 1974, and relevant Regulations under the Act.

1.2. PROCESS DETAILS.

The Paint Shop at BOC Limited, Ipswich is a purpose built, fully dedicated facility. Its location is defined in the site map (refer to section 2).

The shot blast, spray booths, spray equipment, associated pump, motors, fans, delivery systems, storage facilities and ultrasound test facility were specifically designed to meet BOC Limited's criteria.

All engineering works, technical specifications, commissioning data etc are maintained on-site and managed via the Test Shop Manager.

The Paint Shop facility was designed to achieve and subsequently maintain compliance with statutory environmental provisions and specifically those encompassed within Process Guidance Note PG 6/23 (1997).

The extraction systems associated with the facility were designed to achieve "adequate" dispersion as defined in PG 6/23, with the height of release being approximately 8m above ground level.

The extraction systems were engineered to comply provisions of mean efflux velocity, as defined in BS 3405, to exceed 15m/sec.

1.2.1. PAINT SHOP.

A process schematic is included at the end of this section of the application.

Essentially the process can be summarised as follows.

Compressed gas cylinders are delivered either on pallets, or individually, to the Paint Shop and are stored on the floor area proximal to the process area. The first stage of the process encompasses the "de-valving" of incoming gas cylinders, whereby the cylinder valve assembly is removed.

Each cylinder is then inspected by an operator, using high-intensity light sources, for its internal and external condition. The cylinder condition is undertaken against defined control visual standards.

Each passed and approved cylinder (rejected cylinders are withdrawn from any subsequent operations) is then transferred manually form the inspection area to a lifting enclosure and then fitted with a screw threaded adaptor piece. This piece is mated and screwed into the cylinder valve by the operator using a dedicated tool to secure the two together

Each cylinder, in turn, is transferred into a caged lifting enclosure and raised, using a Reid Cylinder Lifter unit, such that the adaptor piece's other end can be locked on to the facility's overhead conveyor's indexing headpieces. The conveyor has 60 indexing pieces, each located at approx. 0.76 m pitch.

The conveyor is non continuous, each subsequent operation taking place over a computer controlled period of operation, each pitch moves through each station, stops and then starts according to the programmed cycle period.

A Lister Lubricants Chain Oiler, model DP1/55/58, is used to maintain the conveyor

The next stage encompasses the automated shot blasting of each cylinder. This process is undertaken to remove any existing paint and to "key" the cylinder surface for subsequent coating. Surface key provides the mechanical aspect for coating adhesion and is critical to achieving a surface profile consistent with performance requirements for the service aspects of the cylinders use.

The shot blasting process is undertaken in a dedicated, purpose built facility. The shot blasting takes place in a "sealed" enclosure, with entry and exits doors operating as each conveyorised cylinder passes through the unit. The facility has a "zero loss" of grits to atmosphere. Grits are continually recycled as long as they are fit for purpose. The plant has 2 off dedicated local exhaust ventilation systems (DV-1 and DV-2), encompassing a cyclone system with bag filter unit to abate total particulate matter releases.

The grits used in the process are based on steel alloy based materials.

"Fines" produced in the shot blasting process are collected from the abatement unit on a scheduled basis and disposed of via an authorised Waste Contractor.

The shot blast unit's electronic systems record Total Hours and Shot Hours, these are displayed visually via a Hengestler unit. The shot blast unit is fitted with emergency shut down capability, The pre-programmed process cycle is typically as follows; -

PROCESS OPERATION	UNITS	PERIOD
CONVEYOR STATIC TIME	SECONDS	100
SHOT BLASTING	SECONDS	100
PRIMER COAT FIXED GUN SPRAY GUN PERIOD	SECONDS	12
PRIMER COAT RECIPROCATING SPRAY GUN PERIOD	SECONDS	70
TOPCOAT FIXED SPRAY GUN PERIOD	SECONDS	12
TOP COAT RECIPROCATION SPRAY GUN PERIOD	SECONDS	90
TOP COAT FIXED RIM SPRAY GUN PERIOD	SECONDS	12

This programme is operated via a process specific "InView" software package.

The process permits the coating of approx. 180 cylinders per shift to be processed.

The actual coating process encompasses the following; -

(i) Spray painting of cylinders in a dedicated Primer Spray Booth.

The Primer Spray Booth is an RDM Industrial Services type 2M unit, serial number SOP/32372, and was commissioned on 16.06.99. The booth maintains RegSpec inspection status. It is an open fronted type and has a laminar airflow and water wash extraction system.

The booth is floor mounted with a washing chamber section sitting on a tank situated at the back and protruding forward into and up to a reciprocator.

The protruding section has a flooded, water flowing floor sloping to the rear of the booth, with a water wash screen incorporated at the rear. The exhaust washing system is of the water wash venturi type incorporated within the booth-washing chamber.

The wash water is automatically dosed with an approved denaturant.

Paint laden air is drawn towards the rear of the spray booth up through the washing chamber where the air is water washed before release to atmosphere.

The spray booth face aperture encompasses 3 off conveyor pitches.

A single exhaust fan extracts the booth. The fan produces a face velocity of 1.1 m/sec with a motor rating of 17.1 .KW. The booth extraction is via a 0.55 m. dia. circular duct, without additional abatement.

The plant has the capability of coating cylinders up to 220 diameter x 560 mm length.

Primer paint is applied using a single AID pneumatic reciprocator unit fitted with Binks BBR, air assisted spray gun for the main cylinder body and a single fixed Binks BBR spray gun for the cylinder head. Paint to these guns is pre-treated to achieve sufficient atomisation.

Spray guns, nozzles, end caps and needles are cleaned once per shift, or as required.

The reciprocator is fixed. Whilst in the booth the incoming and outgoing conveyor points, stations 1 and 3) remain idle whilst the middle station (station 2) is rotated throughout the painting cycle.

Paint is supplied to the spray guns, from bunded 20 – 30 lt. steel drums, using standard diaphragm pumps. Paint application is controlled by electronic systems. In addition, a simple paint heater system has been included as part of the paint application process. Just prior to spraying, the paint in the lines for both primer and topcoat applications is 'warmed'. This initiative has been introduced to improve viscosity levels as well as reducing the volume of paint solvents.

A signal from the main control panel initiates a pneumatic timer sequence to spray for a predetermined period of time. The reciprocator travels full stroke with its spray gun operating and ceasing at the specific points selected by manually adjustable pneumatic switches mounted on a slide rail in the back of the reciprocator.

(ii) Transfer of coated cylinders through the Flash Off Enclosure.

Primer coated cylinders pass through a ventilated Flash Off Enclosure giving a flash off period of 8 - 10 minutes. The coating is air-drying.

(iii) Ultrasonics test station.

The conveyor than passes each cylinder through a dedicated, enclosed, Dapco ultrasonics non-destructive testing facility. As each cylinder enters the facility it is contacted by a dedicated fixture that maintains two wheels per each of its two drive spindles. A second fixture then moves to contact the cylinder.

The drive wheels are started; the cylinder is rotated and tested using a dedicated programme of ultrasonics. Water rolls down the cylinder during the test, and is collected and recycled.

A dedicated RTS300 unit controls continuous monitoring of the ultrasonics test procedure and results.

Water residues are removed from tested cylinders via a dedicated air drying station. Air supplied from a Compare Broomwade Cyclon unit is blown, via 4 off tubes to a single box blower unit. Cylinders are rotated during this process

Once tested cylinders then pass to the topcoat spray booth.

(iv) Spray painting of primed cylinders in a dedicated Top Coat Spray Booth.

The Top Coat Spray Booth is an RDM Industrial Services type 4M unit, serial number SOP32372, and was commissioned on 16.06.99. It is an open fronted type and has a laminar airflow and water wash extraction system.

The booth is floor mounted with a washing chamber section sitting on a tank situated at the back and protruding forward into and up to a reciprocator. The protruding section has a flooded, water flowing floor sloping to the rear of the booth, with a water wash screen incorporated at the rear. The exhaust washing system is of the water wash venturi type incorporated within the booth-washing chamber.

The washing water is automatically dosed with an approved denaturant.

The booth maintains RegSpec inspection and approval.

Paint laden air is drawn towards the rear of the spray booth up through the washing chamber where the air is scrubbed before release to atmosphere.

The spray booth encompasses 5 conveyor pitches. The spray booth aperture encompasses a 220 x 560 mm profile.

3 off exhaust fans operate; 2 x 0.60 m. dia. ducts extract the spray booth and 1 x 0.6 m. dia. duct extracts its flash off enclosure.

The spray booth fans produce a face velocity of 1.4 m/sec at a motor rating of 17.1.KW.

All three ducts have a mean efflux velocity > 15 m/sec as per PG 6/23 provisions.

Topcoat paint is applied at the first pitch location, using a single AID pneumatic reciprocator unit fitted with Binks BBR spray gun with a second Binks BBR spray gun located on a fixed frame. This frame-mounted spray gun is used to apply paint to the neck area of the cylinder.

A third BBR spray gun is installed at pitch 5 to apply the "rim" colour band identification paint. The application encompasses the use of a simple "mask" to give "clean" colour band edge lines.

Paint is supplied to the spray guns, from bunded 20 – 30 lt. drums, using standard diaphragm pumps, supplied with suction kit, back pressure relief valve and hoses.

Paint application is controlled by electronic PLC systems. A signal from the main control panel will initiate a pneumatic timer sequence to spray for a predetermined period of time. The reciprocator travels full stroke in each direction with the spray gun operating and ceasing at the specific points selected by manually adjustable pneumatic switches mounted on a slide rail in the back of the reciprocator.

Only pitches 1 and 5 rotate in the spray booth.

The Paint Shop operators utilise a dedicated solvent wash unit in which gun cleaning is undertaken and drum crushing unit for the disposal of empty drums.

(v) Transfer of top coated cylinders through the Flash Off Enclosure.

Top coated cylinders will pass through a ventilated Flash Off Enclosure giving a flash off period of 8 - 10 minutes.

(vii) The Pindenter and Off load Area.

Conveyorised cylinders then pass to the Pindenter.

The cylinder is "clamped" in situ at a defined index station and a Telysis Pindender unit applies a unique identification code by indentation. Once the indent has been completed the cylinder is "unclamped" and passes to the final inspection and off load enclosure.

A second, dedicated, cylinder lifter unit is used to remove each cylinder and its threaded adaptor from the conveyor-indexing piece. The unhitched cylinder is then lowered to floor level. The operator removes the cylinder adaptor and stores it for use again on the loading side of the process area.

A visual internal and external inspection of each cylinder, using high-intensity light sources, is repeated for each cylinder by the operator.

A dedicated Symbol unit is used to electronically record each cylinder's unique code, size, last gas filled etc.

The operator then fits an internal, fixed dip tube, where required using a driven, shaft tool, and then manually fits a plastic collar and then filled with a purge as appropriate.

Each cylinder is then manually "touched up" by brush application to repair any minor blemishes. Paint used in the touch up process is maintained in small 20 lt, bunded containers.

The tested inspected and coated cylinders are then manually transferred to storage pallets for removal from the Paint Shop.

In addition to the extraction system in the spray booths and flash off enclosure general ventilation is provided within the Paint Shop to maintain a safe working environment for the operators, and maintain EPA compliant releases.

The coating processes; primer and top coat, have appropriate controls such that;

- Equipment can be operated safely in automatic and manual modes at all times.
- The display of process parameters is achieved at all times.
- Remote displays will inform the operators of the system condition during normal working hours.

1.2.2. TEST SHOP.

Test Shop coating operations are small (120 small cylinders) in comparison to the Paint Shop capability and only encompass manual, brush application procedures.

The process is as follows; -

Cylinders are brought to the test shop and de-valved by the operator using dedicated tooling and equipment. The operator then inspects each cylinder, internally and externally, using high-intensity light sources for any defects.

Defective cylinders are withdrawn from any further processing.

Each cylinder is pressure tested. This encompasses filling with water, testing to a predefined pressure on dedicated test rigs. Test data is recorded on Symbol instrumentation as in the Paint Shop.

Once tested each cylinder is emptied of water and dried.

The facility maintains two dedicated cylinder drier units, one for steel cylinders only and a "mixed-usage" aluminium and steel drier unit.

Tested cylinders are fitted with an internal dip tube, where required, plastic identification collar and guard collar, where required.

The valve assembly is refitted by the operator, to a defined torque loading using a set rig.

Operators apply paint to the cylinder as required using brushes. The paints used in this section are maintained in small containers in which the can is generally kept.

The cylinders move only by manual handling, there is no conveyorisation within the area.

1.3 RAW MATERIALS

1.3.1 THE PRIMER PAINT TECHNOLOGY

The primer technology is based on pigmented air-drying resin technologies. The coating has the following properties;-

Density	approx. 1.20 - 1.45
Working temp. range	between 20 and 50 C
VOC content	590 grams/litre
% solids by volume	31 +/- 2.

Primer will be supplied to the site in 25 lt. steel drums. The primer will be stored in dedicated storage container and when required fully dedicated transfer lines and systems are used under supervision, and after on site Q.A. / Q.C. testing of the supplied product.

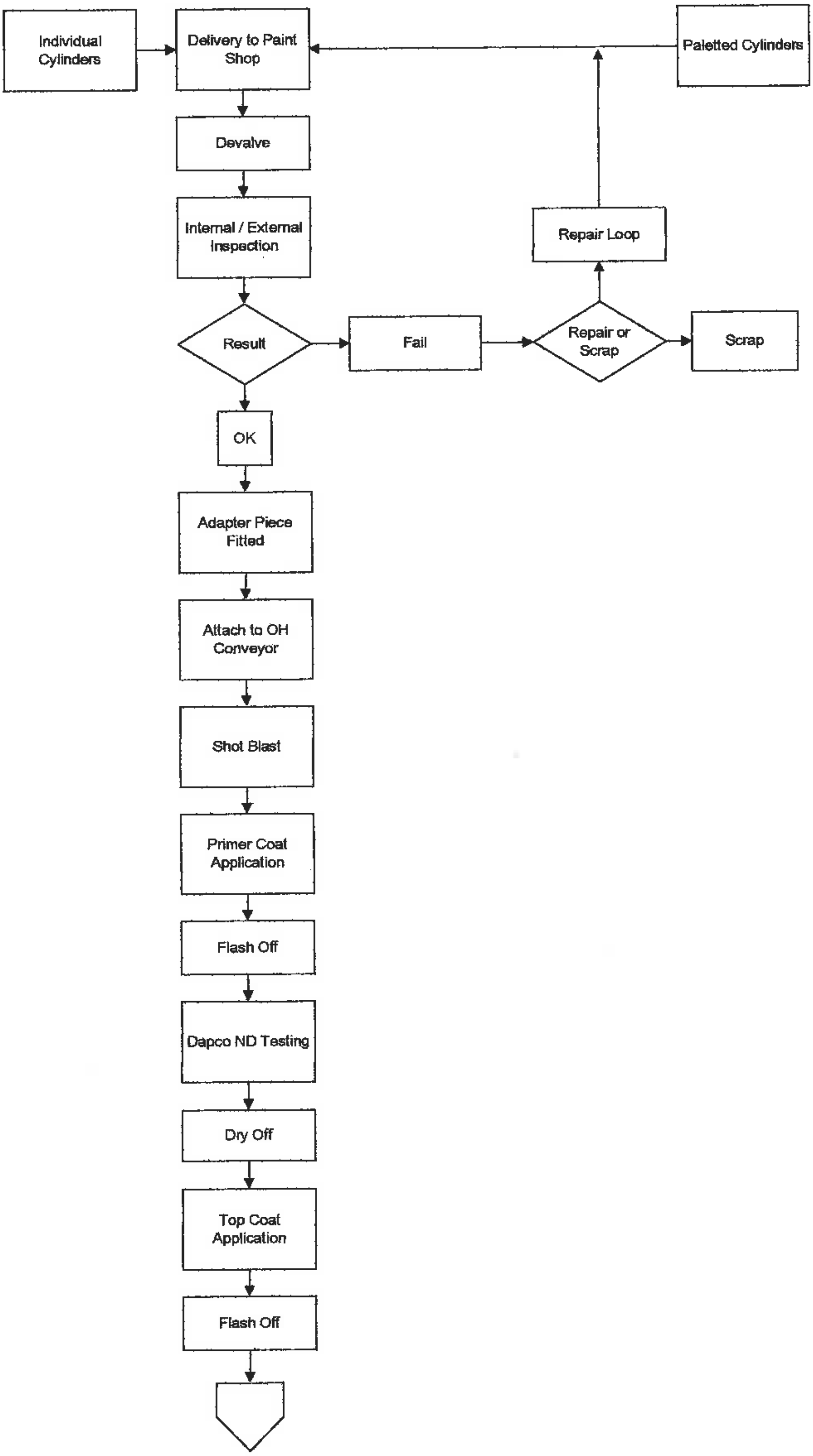
1.3.2. THE TOPCOAT PAINT TECHNOLOGY.

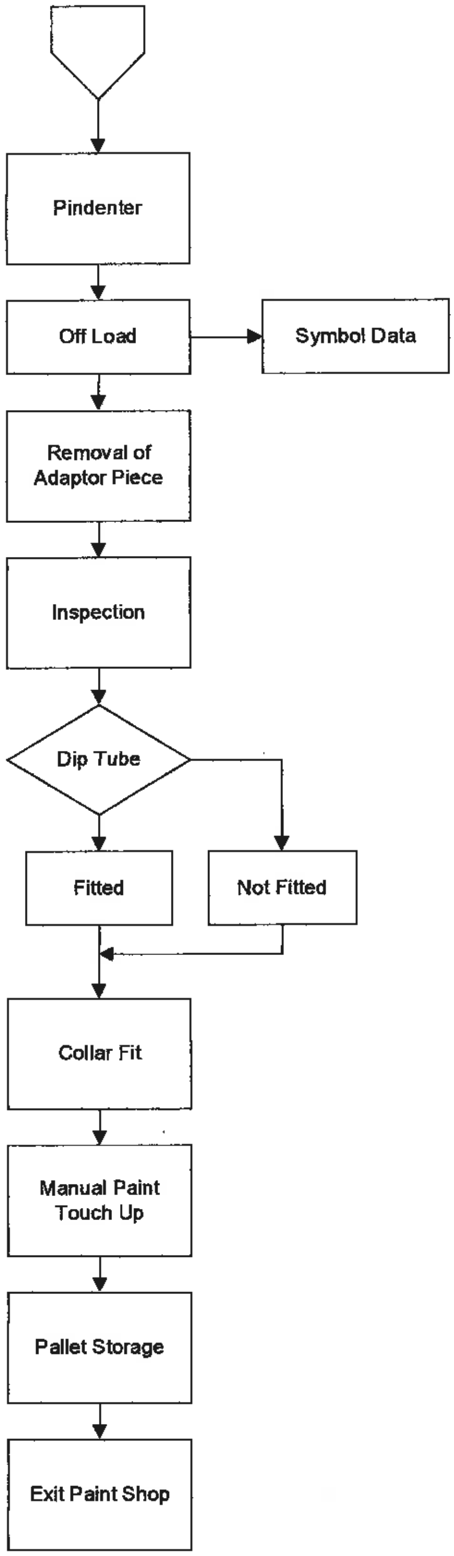
The topcoat is based on a conventional air-drying resin technology.

The topcoat component has the following properties;-

Density	1.30 - 1.45
Working temp. range	20 - 50 C
VOC content	520 grams/litre.
% solids by valve	47%

Paint Shop


Individual Cylinders
Delivery to Paint Shop
Paletted Cylinders
Devalve
Internal / External Inspection
Repair Loop
Result
Fail
Repair or Scrap
Scrap
OK
Adapter Piece Fitted
Attach to OH Conveyor
Shot Blast
Primer Coat Application
Flash Off
Dapco ND Testing
Dry Off
Top Coat Application
Flash Off


Pindenter
Off Load
Symbol Data
Removal of Adaptor Piece
Inspection
Dip Tube
Fitted
Not Fitted
Collar Fit
Manual Paint Touch Up
Pallet Storage
Exit Paint Shop

SECTION 2

SITE/PROCESS LOCATION

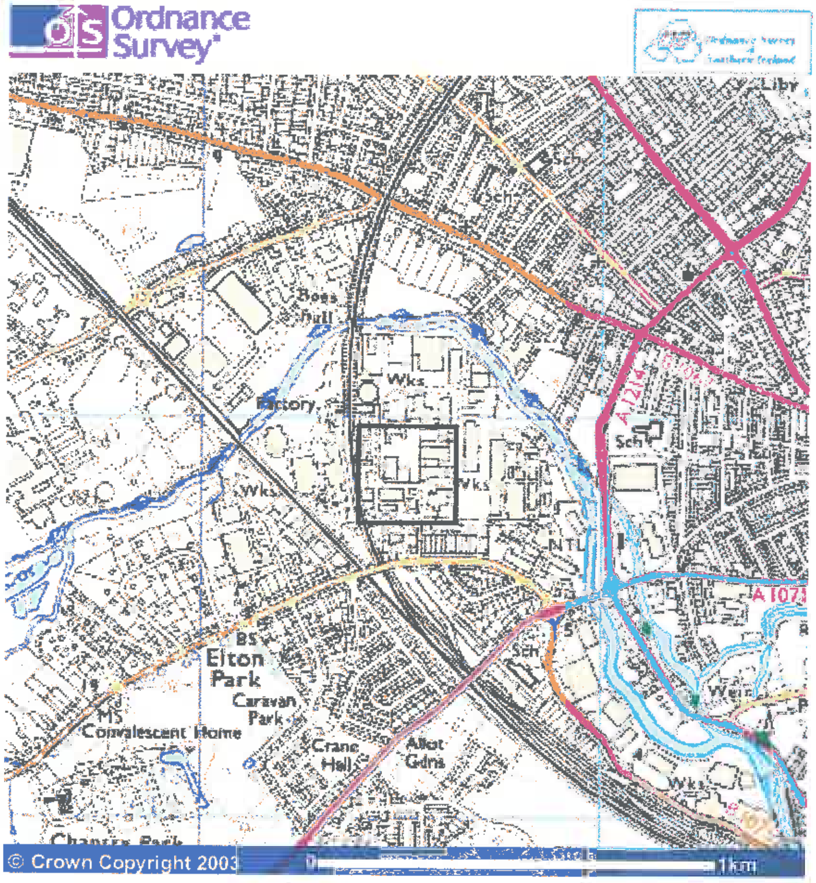
INDEX

SITE LOCATION

The facility is located in an industrialised area located at Brunel Road, Hadleigh Road Industrial Estate, Ipswich O.S. grid reference 614588 244796.

The location has an extended history of industrial activities.

A section of the current OS map is included herein.



The immediate neighbourhood by the site is that of industrial premises on the north, west, east and south. The BOC site is near to a railway line.

The BOC Limited facility has no additional tenants or subtenants nor any other permanent third party businesses.

The facility includes Car Park, Sales Centre, cylinder filling Paint Spray Booths, Material Stores, Loading Bays, Test Shops, Maintenance and Reception and Office facilities.

There is no discharge of any process materials to storm nor foul sewer.

ORDNANCE SURVEY

SITE MAP.

PLOT SCALE: 1:1250
PLOT DATE 09/09/92

▭ EXTENT OF CONROL

↔. ACCESS / EGRESS POINTS

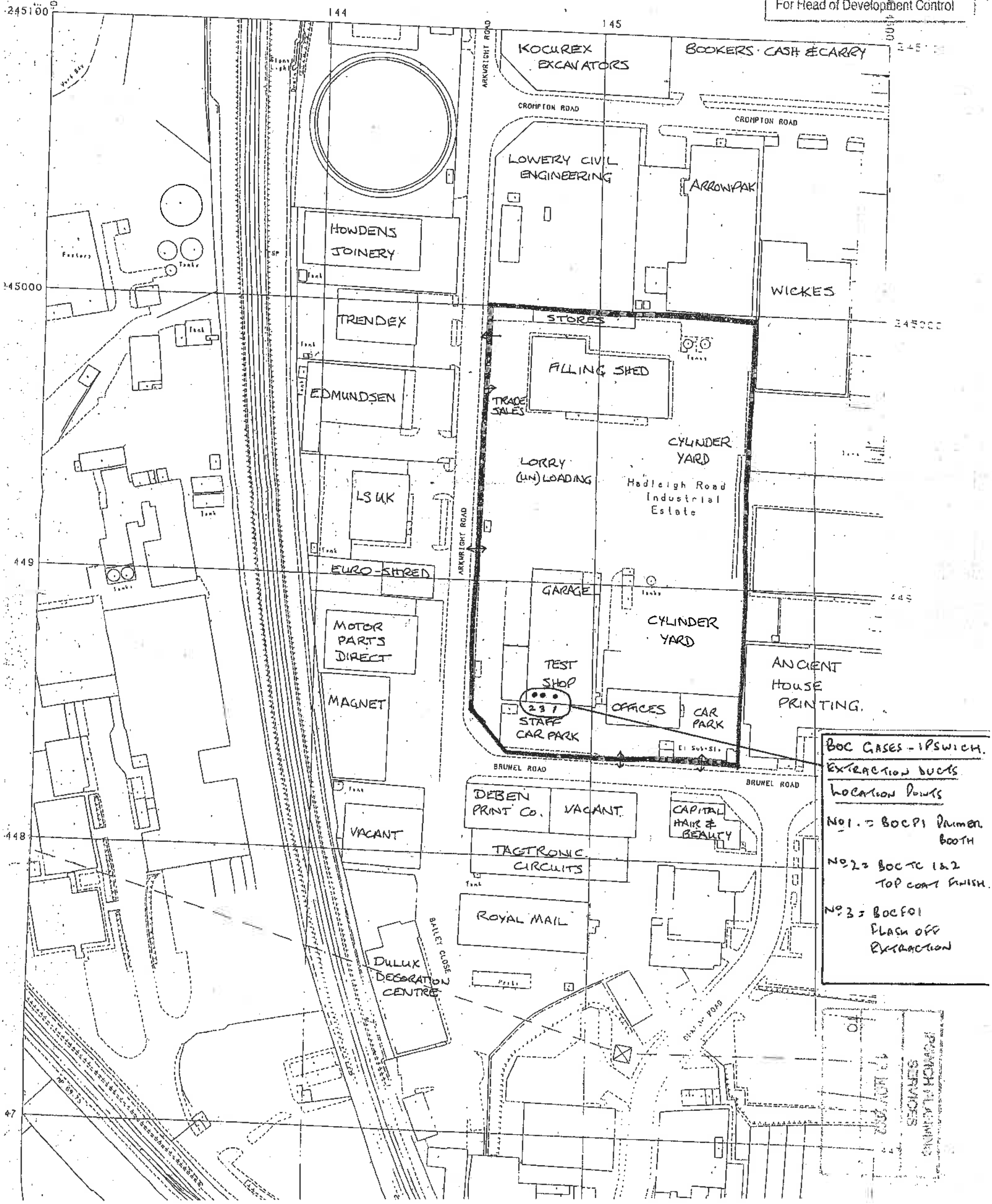
IPSWICH BOROUGH COUNCIL

IP/02/01180/1/SC

THIS IS THE PLAN REFERRED TO IN THE APPROVAL/~~REFUSAL~~ NOTICE DATED - 8 AUG 2003

Signed:

For Head of Development Control



SECTION 3

DIRECT EMISSION SOURCES.

EXISTING EXTRACTION SYSTEMS STATUS.

As defined in process guidance note PG 6/23 (1997), clauses and conditions are specifically detailed to encompass the following aspects of the site's extraction systems with regard to:-

(i) Local topography

(ii) Effective stack / chimney height

(iii) Minimum stack / chimney height

(iv) Chimney vent restrictors

(v) Minimum point of exit mean velocity

The VOCs (solvents) releases sourced from site activities will be discharged to atmosphere via dedicated LEV systems. The plant and equipment associated with the process are considered to represent Best Available Techniques (BAT) in terms of minimisation of environmental significance.

The extraction fans will draw process air through specially designed and dedicated particulate filter and vents directly to atmosphere. The filtration system has a design specification for the capture of 98% of particulate releases. Filters will be changed on a scheduled basis or as when required. The filter media is fine mesh interwoven fabric based with a high efficiency capability.

Operators will receive formal training in the correct operation of their spray equipment and the paint booths and the relevance of environmental conformance. This relevance will encompass normal, abnormal and catastrophic operational scenarios.

The significance of dark or black smoke will be addressed by formal procedure and by use of Ringlemann Shade Cards.

Abatement equipment, where required, will meet; -

(i) All work place COSHH exposure limit provisions.

(ii) All PG 6/23 emission limit provisions.

(ii) D1 calculation provisions.

A D1 calculation is included herein as appendix 3.

SECTION 4

LISTED SUBSTANCES.

4. LISTED SUBSTANCES.

The coating process operations utilise only a limited range of chemical components.

These are specifically formulated by a number of specialist manufacturing companies to provide highly specific application and performance standards.

The principle coating technology formulations are based on complex, organic resin systems. As such the company maintains extensive, updated, Health & Safety data files, C.O.S.H.H., Risk Assessment, Application data sheets and EPA data provided by the Suppliers.

An overview of the basic generic formulation types is included within this section of the report.

Stock inventories are maintained in documented formats within the Production and Purchasing functions.

The following products and chemicals are directly related to those processes defined within Process Guidance Note PG 6/23 (1997).

A dedicated purchasing schedule will be used to maintain a six monthly interval submission of these products and chemicals.

Based on inventory mass calculation figures, the estimated annual VOC usage is approximately 10 tonnes per annum

At any one time site management anticipate 6 x 205 lt. barrels of topcoat and 6 x 205 lt. barrels of primer to be maintained on site in the dedicated Empteezee storage facility. Most of the paint used on site will be sourced from 25 – 50 lt. capacity drum stock

All of these products are specifically formulated by dedicated resin and chemical suppliers and manufacturers to optimise the process characteristics and quality standard demanded by supplier and in-house QA / QC systems.

There will be no use of any chlorinated hydrocarbon solvents within the coating process.

The coatings used on site are formulated with 4 basic components;

1. Pigmentation and extenders

2. Resins and plasticisers

3. Solvents

4. Additives

Pigmentation encompasses titanium dioxide, red and yellow iron oxides, carbon black and synthetic colourants including phthallocyanines and quinacridones.

Extenders encompass barium sulphate, mica and china clays, zinc phosphite and various inorganic carbonates. These components make no contributions to the VOC inventory.

Resins encompass organic polymers of relatively high molecular weight and low volatility and low vapour pressure. The resins are supported by relatively low molecular weight components fuel as film formers, plasticisers, flexibilisers, aminoplasts and rheology modifiers. All of these components have relatively low molecular weight and low volatility. As such these components make virtually no contribution to the VOC inventory.

Solvents used in the formulations are relatively low molecular weight and high volatility and are specifically catagorised as volatile organic compounds (VOCs) by reference to their vapour pressure.

Solvents included in the formulations used at the BOC Ipswich facility include xylenes, toluol, butanol, butanone, light and heavy aromatic naphthas, aliphatic hydrocarbons and various esters and alcohols.

All of these compounds and species are typical of current paint formulations. These are the main components of the sites VOC inventory.

These additives encompass trace amounts of bentonite clays, silicons, anti oxidants, stabilisers and flow promotors. These tend to be very dilute solutions added to the base formulations in solvent carriers.

As such, whilst these additives may contain volatile organic compounds they make little contribution to the sites VOC inventory.

In summary, the listed substances used in the sites paints are encompassed within the current definitions of volatile organic compounds. As each paint used on site is specific in its formulation and as the producers Technical Data Sheets can only give descriptive quantitative and qualitative data, the general approach is not to list each and every solvent individually but to quote VOC in grams / litre. This is defined in Process Guidance Note PG 6/23.

All of the main solvents used in the sites paints are classified as Class II VOCs as defined in PG 6/23.

SECTION 5

FUTURE PROPOSALS FOR ACHIEVING E.P.A. COMPLIANCE

SECTION 5 FUTURE PROPOSALS

Site management are targeting the following initiatives and actions to achieve and maintain compliance with the provisions of the Environmental Protection Act 1990.

These include specifics with regard to; -

(1) Establishment of proposals for future Monitoring Schedules.

(2) Proposals for future Preventative Maintenance Schedules.

(3) Proposals for future Process Related Developments - Chemical Products.

(4) Proposals for future Process Related Developments - Plant/Equipment.

(5) Proposals for future "Environmental" Training.

5.1. PROPOSALS FOR FUTURE MONITORING SCHEDULES

It is the continued intent of **BOC LIMITED** to comply with all monitoring procedures, continuous and non-continuous, as defined in Guidance note PG 6/23.

These procedures will include the following objectives: -

(i) Annual monitoring of specified analytes defined in guidance note PG 6/23.

(ii) Implementations of visual and olfactory assessment based upon weekly scheduling including colour assessment of emission discharges to atmosphere.

(iii) Documents reporting via log books, electronic data.

(iv) Maintenance and annual submission to the local authority of organic chemical inventories as defined in guidance note PG 6/23.

(v) Implementation of reporting procedures to encompass exceeding of agreed and or defined authorisation discharge limits relevant to atmospheric emissions.

(vi) Implementation of scheduled reassessment and review for monitoring procedures as defined in guidance note PG 6/23.

(vii) Implementation of appropriate procedures via an audit to assess compliance with the objectives of the proposals defined in this section.

5.2. PROPOSALS FOR FUTURE PREVENTATIVE MAINTENANCE PROCEDURES

These procedures will include the following objectives: -

(i) Continuation of existing site based preventative maintenance plan schedules.

(ii) Continuation of preventative maintenance schedules to assess the compliance of all exhaust/extraction equipment and duct work to achieve compliance with the provision of guidance note PG 6/23, and also with the provision of the Control of Substances Hazardous to Health (COSHH) Regulations 2002.

This work will be scheduled via a specified subcontractor.

These schedules will incorporate existing records and documentation relating to LEV (Local Exhaust Ventilation) data.

(iii) Documented reporting via appropriate data/results logs.

(iv) Continuation of procedures via audit to assess compliance with the objectives of the proposals defined in this section.

(v) Continued assessment of the plant maintenance programs.

(vi) Continued assessment of specialised sub-contract maintenance of the premises' process related plant and ancillary systems.

5.3 PROPOSALS FOR FUTURE PROCESS RELATED DEVELOPMENTS-CHEMICAL PRODUCTS

Ongoing initiatives include:-

(i) Assessment of alternative process technologies.

Options under discussion include:-

(a) high efficiency coatings usage.

(b) usage, where possible, of low VOC compliant coatings.

(c) usage of low odour coatings.

5.4. PROPOSALS FOR FUTURE PROCESS RELATED DEVELOPMENTS - PLANT.

(i) It is the continued intent of site management to give full consideration to the application of BAT when developing proposals relating to plant and equipment.

(ii) It is the continued intent of site management to give full consideration to the implementation of BPEO when developing proposals relating to plant and equipment.

(iii) Modification of extraction ducts to comply with EPA exit velocity and geometry as detailed in PG 6/23.

5.5. PROPOSALS FOR FUTURE "ENVIRONMENTAL" TRAINING

It is the continued intent of site management to comply with the provisions of Guidance note PG 6/23 in providing relevant Training of the work force.

Ongoing initiatives will include the following objectives:-

(i) Implementation of "EPA Awareness" training procedures of employees as to the implications of Environmental legislation.

(ii) Implementation of training procedures relating to improved work place practices with regard to reducing emissions to atmosphere.

(iii) Implementation of clauses (i) and (ii) will be reflected in Training Records.

(iv) Training documentation is in due process of compilation, this to be circulated to the work force at the earliest opportunity.

SECTION 6

EMISSION MONITORING
(See Appendix 3 for report)

AND

ENVIRONMENTAL APPRAISAL

6.1. EMISSION MONITORING.

A specific study of emissions sourced from the spray plant's activities will be implemented in line with the provisions of PG 6/23.

This programme will encompass; -

Measurement of particulates using method BS 3405.

Measurement of mean efflux velocity using method BS 3405.

Measurement of VOC as C using US EPA method 25.

Monitoring will be undertaken by an STA member specialist company.

Monitoring will be undertaken by trained and competent personnel.

The date, procedures and personnel who undertake the monitoring will be formally notified to Local Authority in accordance with PG 6/23 provisions.

All reports and data provided by the consultancy will be sent to Local Authority personnel within 8 weeks of receipt by site management.

6.2. ASSESSMENT OF THE ENVIRONMENTAL CONSEQUENCES OF RELEASES TO THE ATMOSPHERE.

The requirements of the Environmental Protection Act 1990 (EPA) are that a critical assessment of the environmental consequences of potential releases should be made, and these can be summarised as follows:-

The site maintains ongoing Technical and H & S Data Sheets on all products used in on line process operations in defined locations.

The principle components of site-sourced emissions, detailed in PG 6/23, are detailed below with specific reference to their potential impact in the event of potential release to the atmosphere.

The Environmental Consequences of releases to the atmosphere by those analytes defined in Guidance Note PG 6/23 have been addressed in specific detail.

The main components of the primer and topcoat coating process releases will be paint based overspray and volatile organic compounds including aromatic and aliphatic hydrocarbons.

The principle solvents encompassed within the site's coating processes include butan-1-ol, butan-2-ol, xylenes, 2-methoxy-1-methylethyl acetate, 4-hydroxy-4-methylpentan-2-one, ethyl benzene and trace amounts of various alcohols, esters, ketones and aromatic hydrocarbon cuts.

Pigmentation may include titanium dioxide, barium sulphate, mica, iron oxides, carbon and bead blacks and lead chromate molybdate suphate red and minor extenders and fillers.

Colourants include phthallocyanine blue, quinacridone synthetics and various organic lakes.

Cobalt carboxylate and 2-butanone oxime are used as additives.

There are no significant thermal processes operated within the site's metal coating process. The environmental contribution of oxides of carbon, nitrogen and sulphur were considered as trivial.

Operating the process is not anticipated to have adverse effects on any local populous, flora or fauna, SSSI, ANOB, built heritage, sensitive receptor, surface or ground water, nor be a contributor to contamination of any surrounding land. (The site does acknowledge however the location is in a protected groundwater zone).

The relative risk and hazards presented at the site are considered to be of limited consequences due to :-

(i) the extremely low levels of total particulate and VOC emissions discharged to atmosphere.

(ii) the current systems, procedures and practices operated on site.

(iii) the high level of awareness of management of the implications of environment legislation and its significance.

(iv) the commitment to future development to reduce environmental emissions, by addressing new technology and application options.

SECTION 7

E.P.A. ADVERTISEMENT

In accordance with provisions of the Environmental Protection (Application, Appeals and Registers) Regulations 1991 with due regard, the following single insertion advertisement will be submitted by **BOC LIMITED**, in 2 local newspapers.

ENVIRONMENTAL PROTECTION ACT 1990 PART 1.

NOTIFICATION OF APPLICATION UNDER SECTION 6.

BOC LIMITED

has applied for authorisation from Ipswich Borough Council to operate a

Metal Coating Process

at

Brunel Road
Hadleigh Road Industrial Estate
Ipswich
Suffolk
IP2 0EX

A copy of this application is available for public inspection, free of charge, during office hours at;-

Ipswich Borough Council,
Pollution Services
Room 409
Civic Centre,
Civic Drive
Ipswich
IP1 2EE

Written representations about this application may be sent to the Pollution Services at the above address.

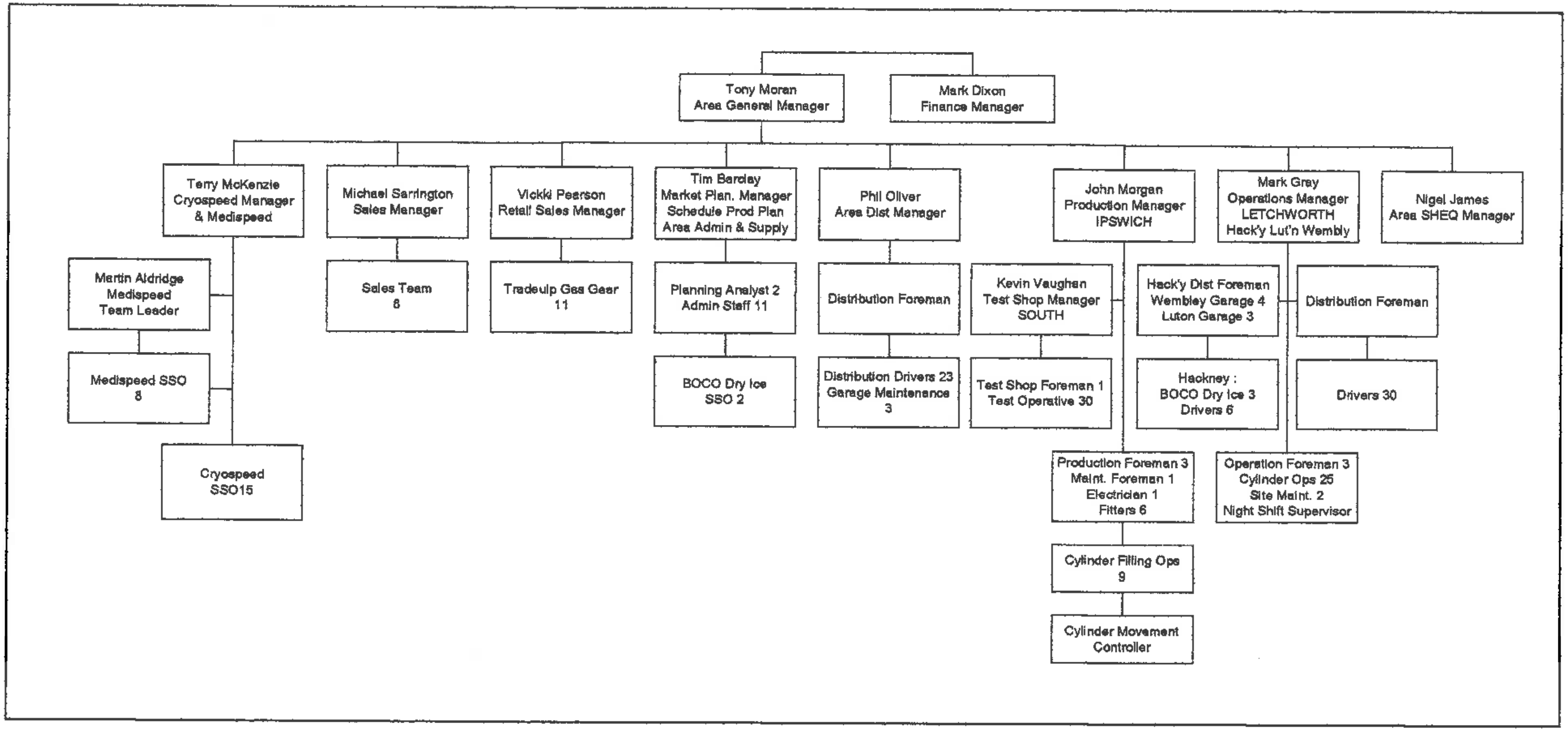
SECTION 8

APPLICATION FEES

In accordance with the provisional detailed by the Environmental Protection (Applications, Appeals and Registers) Regulations 1991, the fee of £1,303.00 is contained herein.

APPENDIX 1

ORGANISATION CHART


Tony Moran
Area General Manager
Mark Dixon
Finance Manager
Terry McKenzie
Cryospeed Manager
& Medispeed
Martin Aldridge
Medispeed
Team Leader
Medispeed SSO
8
Cryospeed
SSO15
Michael Sarrington
Sales Manager
Sales Team
8
Vickki Pearson
Retail Sales Manager
Tradeuip Gas Gear
11
Tim Barclay
Market Plan. Manager
Schedule Prod Plan
Area Admin & Supply
Planning Analyst 2
Admin Staff 11
BOCO Dry Ice
SSO 2
Phil Oliver
Area Dist Manager
Distribution Foreman
Distribution Drivers 23
Garage Maintenance
3
John Morgan
Production Manager
IPSWICH
Kevin Vaughan
Test Shop Manager
SOUTH
Test Shop Foreman 1
Test Operative 30
Production Foreman 3
Maint. Foreman 1
Electrician 1
Fitters 6
Cylinder Filling Ops
9
Cylinder Movement
Controller
Mark Grey
Operations Manager
LETCHWORTH
Hack'y Lut'n Wembly
Hack'y Dist Foreman
Wembley Garage 4
Luton Garage 3
Hackney :
BOCO Dry Ice 3
Drivers 6
Distribution Foreman
Drivers 30
Operation Foreman 3
Cylinder Ops 25
Site Maint. 2
Night Shift Supervisor
Nigel James
Area SHEQ Manager

APPENDIX 2

COATING TECHNICAL DATA SHEETS.

AMERON
INTERNATIONAL

Tractol 816

Primer Undercoat

Product Finishes

Product Data

- **Fast air drying primer**
- **Good anti corrosion protection**
- **Recoatable with all 1 pack Ameron finishes**

Typical Uses:

Designed as a single pack air drying primer for agricultural and construction equipment

Recommended Systems:

Directly onto shot blasted or phosphated pretreated steel, or etched non ferrous surfaces followed by overcoating with Tractol range of finishes.

Approvals and Certificates:

Safety:
Improper use and handling can be hazardous to health and cause fire or explosion, safety precautions included with application instructions must be observed during all storage, handling, use and drying periods. This product is flammable. Keep away from heat and open flame. Keep container closed. Use with adequate ventilation. Avoid prolonged and repeated contact with skin. If used in confined areas, observe the following precautions to prevent hazards of fire or explosion or damage to health:

1. circulate adequate fresh air continuously during application and drying;
2. use fresh air masks and explosion proof equipment;
3. Prohibit all flames, sparks, welding and smoking.

Do not empty into drains. Take precautionary measures against static discharges. For specific information on hazardous ingredients, required ventilation, and possible consequences of contact, exposure and safety measures see Material Safety Data Sheet.

Physical Data

Finish	Slight Sheen
Colour	Light & dark grey, black, white, yellow, red
Substrate	Steel
Components	Single pack
Curing mechanism	Air Drying
Volume solids	31 ± 2%
VOC	590 gms per litre
Dry film thickness	35 microns
Number of coats	1
Calculated coverage	8.8m²/litre at 35 mics dft
Application methods	Brush or conventional spray
Potlife	n/a
Drying times at 20°C	
dry to touch	30 min
dry to handle	2 hrs
dry to recoat	1 hr
Thinner	T002
Specific gravity	1.15-1.32
Flash points (Closed Cup)	23°C
Packaging	1, 5,20 litres
Shipping weight (typically)	1.3-1.4 kilo per 1 ltr can 6.3-7.0 kilo per 5 ltr can 24.0-27.4 kilo per 20 ltr can
Shelf life	12 months

Notes:

1. Potlife and drying times are dependent on temperature and ventilation.
2. Maximum interval for topcoating depends on coating system to be used. Consult your Ameron representative for specific recommendations.
3. Volume Solids is measured in accordance with ASTM D2697 modified. Slight variations of up to 3% may occur due to colour and testing variances.

Ameron Coatings. Bankside. Hull HU5 1SQ
Tel: 01482 341441, Fax 01482 449 165
E mail: sales@ameron-coatings.co.uk

AMERON INTERNATIONAL

Tractol 816

Primer Undercoat

Product Finishes

Surface Preparation

Steel; Remove all loose rust, dirt, oil and grease or other contaminants from the surface. For optimum results apply over steel shot blasted to Sa 2.5 Swedish Standard 05-5900 1967 or to phosphated pretreated steell.
Non Ferrous; Apply over etched aluminium or galvanising using Ameron T708.

Where the existing coating system is unknown or based on conventional binders a test patch is recommended.

Environmental Conditions:
Air temperature: 5 to 50°C
Surface temperature: 5 to 60°
The surface temperature must be at least 3°C above the dew point to prevent moisture condensation. For most epoxy type coatings the minimum temperature for satisfactory cure is 10°C. Please consult Ameron for detailed information.

Application Equipment:
The product may be applied by brush or spray. The following equipment is listed as a partial guide and suitable equipment from other manufacturers may be used. Adjustments of pressure and change of tip size may be needed to achieve the proper spray characteristics.
AIRLESS SPRAY – Standard airless spray equipment, such as Graco Bulldog Hydra or larger with a 0.32 mm (0.013 inch) fluid tip or larger.
CONVENTIONAL SPRAY – Industrial equipment such as De Vilbiss MBC or JGA or Binks 18 or 62 spray gun. A moisture and oil trap in the main air supply line, a pressure material pot with mechanical agitator and separate regulators for air and fluid pressure are recommended.
MIXER - Use power mixer powered by an air motor or an explosion proof electric motor.

Application Procedure:
If required, use Ameron T002 Thinners. For equipment cleaning use Ameron T002. Flush equipment with recommended cleaner before use.

1. Before use, stir to an even consistency with a power mixer.
2. For conventional spray, thin only as needed for workability with no more than 10 vol % of recommended thinner. Thinning is normally not needed for airless spray. Stir during application to maintain uniformity of material. Apply a wet coat in even parallel passes. Overlap each pass 50% to avoid bare areas, pinholes or holidays. Give special attention to corners, welds, rough areas, edges.
   Apply recommended dry film thickness per coat, using a wet film gauge to check application consistency. Applying additional thickness will retard drying and overcoating times and may detract from performance.
4. Small damaged or bare areas and random pinholes or holidays can be touched up by brush.
5. Clean all equipment with recommended cleaner immediately after use or at least at the end of each working day or shift

Drying Times:
Maximum recoating/topcoating time intervals are dependent on temperature, degree of weathering, type of topcoat, and service conditions of the complete coating system. Consult your Ameron representative for specific recommendations. Drying times are dependent on temperature, ventilation and film thickness.

Warranty: Ameron warrants its products to be free from defects in material and workmanship. Ameron's sole obligations and Buyer's exclusive remedy in connection with the products shall be limited, at Ameron's option, to either replacement of products not conforming to this warranty or credit to Buyer's account in the invoiced amount of the nonconforming products. Any claim under this warranty must be made by Buyer to Ameron in writing within five (5) days of Buyer's discovery of the claimed defect, but in no event later than the expiration of the applicable shelf life, or one year from the delivery date, whichever is earlier. Buyer's failure to notify Ameron of such nonconformance as required herein shall bar Buyer from recovery under this warranty.
Ameron makes no other warranties concerning the product. No other warranties, whether express, implied, or statutory, such as warranties of merchantability or fitness for a particular purpose, shall apply. In no event shall Ameron be liable for consequential or incidental damages.
Any recommendation or suggestion relating to the use of the products made by Ameron, whether in its technical literature, or response to specific enquiry, or otherwise, is based on data believed to be reliable. However, the products and information are intended for use by Buyer's having requisite skill and know-how in the industry, and therefore it is Buyer to satisfy itself of the suitability of the products for its own particular use and it shall be deemed that Buyer has done so, as its sole discretion and risk. Variation in environment changes in procedures of use, or extrapolation of data may cause unsatisfactory results.
Limitation of Liability: Ameron's liability on any claim of any kind, including claims based upon Ameron's negligence or strict liability, for any loss or damage arising out of, connected with, or resulting from the use of the products, shall in no case exceed the purchase price allocable to the products or part thereof which give rise to the claim. In no event shall Ameron be liable for consequential or incidental damages.
Conditions of Sale All our transactions are subject to our Standard Terms and Conditions of Sale.

Ameron Coatings, Bankside, Hull HU5 1SQ
Tel: 01482 341441, Fax 01482 449 165
E mail: sales@ameron-coatings.co.uk

AMERON
INTERNATIONAL

Tractol 340

VQD Machinery Enamel

Product Finishes

Product Data

- Very Quick Drying
- Oil Resistant
- High Gloss

Typical Uses:

Designed for agricultural, construction equipment or small machinery components where rapid drying is required.

Recommended Systems:

Apply on any Ameron Primers/Primer Surfacers such as Tekaloid 708, Tractol 837and Tractol 816.

Approvals and Certificates:

Safety:
Improper use and handling can be hazardous to health and cause fire or explosion, safety precautions included with application instructions must be observed during all storage, handling, use and drying periods. This product is flammable. Keep away from heat and open flame. Keep container closed. Use with adequate ventilation. Avoid prolonged and repeated contact with skin. If used in confined areas, observe the following precautions to prevent hazards of fire or explosion or damage to health:

1. circulate adequate fresh air continuously during application and drying;
2. use fresh air masks and explosion proof equipment;
3. Prohibit all flames, sparks, welding and smoking.

Do not empty into drains. Take precautionary measures against static discharges. For specific information on hazardous ingredients, required ventilation, and possible consequences of contact, exposure and safety measures see Material Safety Data Sheet.

Physical Data

Finish	High Gloss
Colour	Full range made to order
Substrate	Prepared steel or aluminium
Components	Single
Curing mechanism	Air drying
Volume solids	40 ± 3%
VOC	520 gms per litre
Dry film thickness	25-30 microns
Number of coats	1-2
Calculated coverage	16m² at 25 microns dft
Application methods	Conventional, air assisted or Hot Spray, or Dip
Potlife	n/a
Drying times at 20°C	
dry to touch	20 mins
dry to handle	20 mins
dry to recoat	within 6 hours or after 7 days
Thinner	T002
Specific gravity	0.97-1.15
Flash points (Closed Cup)	23°C
Packaging	5 ltr in 5 ltr can
Shipping weight (typically)	5.2-6.2 kilo
Shelf life	12 months

Notes:

Potlife and drying times are dependent on temperature and ventillation..

2. Maximum interval for topcoating depends on coating system to be used. Consult your Ameron representative for specific recommendations.
3. Volume Solids is measured in accordance with ASTM D2697 modified. Slight variations of up to 3% may occur due to colour and testing variances.

Ameron Coatings. Bankside. Hull HU5 1SQ
Tel: 01482 341441, Fax 01482 449 165
E mail: sales@ameron-coatings.co.uk

AMERON
INTERNATIONAL

Tractol 340

VQD Machinery Enamel

Product Finishes

Surface Preparation

Remove all loose rust, dirt, oil and grease or other contaminants from the surface. Apply over suitably primed surfaces. All Ameron single pack primers such as Tractol 816, Tractol 837.
For Aluminium prime with Tekaloid 708.

Where the existing coating system is unknown or based on conventional binders a test patch is recommended

Environmental Conditions:
Air temperature: 5 to 50°C
Surface temperature: 5 to 60°
The surface temperature must be at least 3°C above the dew point to prevent moisture condensation. For most epoxy type coatings the minimum temperature for satisfactory cure is 10°C. Please consult Ameron for detailed information.

Application Equipment:
The product may be applied by brush, roller, or airless spray. The following equipment is listed as a partial guide and suitable equipment from other manufacturers may be used. Adjustments of pressure and change of tip size may be needed to achieve the proper spray characteristics.
AIRLESS SPRAY – Standard airless spray equipment, such as Graco Bulldog Hydra or larger with a 0.32 mm (0.013 inch) fluid tip or larger.
CONVENTIONAL SPRAY – Industrial equipment such as De Vilbiss MBC or JGA or Binks 18 or 62 spray gun. A moisture and oil trap in the main air supply line, a pressure material pot with mechanical agitator and separate regulators for air and fluid pressure are recommended.
MIXER - Use power mixer powered by an air motor or an explosion proof electric motor.

Application Procedure:
If required, use Ameron T002 Thinners. For equipment cleaning use Ameron T002 . Flush equipment with recommended cleaner before use. .

Before use, stir to an even consistency with a power mixer.
For conventional spray, thin only as needed for workability with no more than 10 vol % of recommended thinner. Thinning is normally not needed for airless spray. Stir during application to maintain uniformity of material. Apply a wet coat in even parallel passes. Overlap each pass 50% to avoid bare areas, pinholes or holidays. Give special attention to corners, welds, rough areas, edges
Apply recommended dry film thickness per coat, using a wet film gauge to check application consistency. Applying additional thickness will retard drying and overcoating times and may detract from performance.
Small damaged or bare areas and random pinholes or holidays can be touched up by brush.
5 Clean all equipment with recommended cleaner immediately after use or at least at the end of each working day or shift.

Drying Times:
Maximum recoating/topcoating time intervals are dependent on temperature, degree of weathering, type of topcoat, and service conditions of the complete coating system. Consult your Ameron representative for specific recommendations. Drying times are dependent on temperature, ventilation and film thickness.

Ameron Coatings. Bank de, Hull HU5 1SQ
Tel: 01482 341441, Fax 1482 449 165
E mail· sales@ameron-c

APPENDIX 3

HE 03/3947 – D1 CALCULATION

HE 03/3953 – LA-APC PART B COMPLIANCE MONITORING OF THE PAINTSHOP RLEASES

HE 03/3947

D1 Calculation of Minimum Stack Heights for the 4 off Paint Shop Spray Booth Stacks' Releases

for

BOC Limited

Brunel Road
Hadleigh Road Industrial Estate
Ipswich
Suffolk
IP2 0EX

Study Period; - 29th. March 2003

ISSUE STATUS	HE 03/3947	
ISSUE 02	CHECKED: J.A.GROWCOTT	APPROVED : T.GROWCOTT
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SECTION

BOC LIMITED
BRUNEL ROAD
HADLEIGH ROAD INDUSTRIAL ESTATE
IPSWICH
SUFFOLK
IP2 0EX

24.06.2003.

F.a.o. Mr K Vaughan

REPORT REF: - HE 03/3947

D1 STACK HEIGHT CALCULATIONS FOR THE 4 OFF PAINT SHOP SPRAY BOOTH STACKS' RELEASES

1.1. Introduction.

The 4 off Paint Shop Spray Booths' local exhaust ventilation systems (LEV) currently operate under the definition of a LA-APC part B authorised "metal coating process" and as such are encompassed under the provisions of the Environmental Protection Act S.I. 472 (1990), and the operational clauses defined in Process Guidance Note PG 6/23 (1997).

Process Guidance Note PG 6/23 provisions requires a site operator to determine minimum stack heights for releases sourced from the process operations, based on H.M.I.P. note D1, in this instance releases produced from the spraying operations extracted by the 4 LEV systems.

From LA-APC defined monitoring it is clear that releases have to meet the requirements of compliance in which the extraction meets; -

(i) the minimum mean efflux velocity criteria of 15 m/sec.

(ii) the extraction provides adequate dispersal of process-sourced releases.

(iii) the maximum consents for emissions are not breached.

For PG 6/23 (1997) the following maximum discharge consents are as follows; -

(a)	Total Particulate Matter	50 mg/m^3
(b)	Volatile Organic Compounds (VOC as C)	50 mg/m^3
(c)	Total di-isocyanate (as –NCO)	0.1 mg/m^3

1.2. Introduction of the D1 calculation.

The first edition of the 1956 Clean Air Act Memorandum, "Chimney Heights" was published in 1963.

Minor revisions were subsequently added in 1967 and 1981.

The note however was not initially designed to address releases sourced from the wide variety of combustion systems that are in use today, and as a result, was systematically revised by Warren Spring Laboratory. The revised note was published by their personnel in 1992.

The current version is published by her Majesty's Inspectorate of Pollution (H.M.I.P.), as Technical Guidance Note D1 (Dispersion).

There are three main stages in the calculation of minimum stack height as follows; -

(i) Calculating Pollution Index (as per section 4).

(ii) Calculating the Discharge Stack Height (as per section 5).

(iii) Other Considerations (as per section 6).

The following calculations use the D1 format.

2. Site Process and Data.

The site's 4 off Spray Booth releases to atmosphere under consideration will be authorised via Local Authority personnel under Process Guidance Note 6/23 provisions.

The 4 stacks have an internal diameter of 0.50 m. with a cross sectional area of 0.3848 m^2 and will be operated at a maximum emission discharge temp. of 293 degrees K, with a mean efflux velocity of 15.0 m/sec. minimum and a volume flow of 2.9445 m^3/sec.

i.e. cross sectional area = $\left(\frac{0.50}{2}\right)^2 \times 3.1415926 = 0.1963\ m^2$

volume flow = 0.1963 x 15.0 = 2.9445 m^3/sec.

The process does not encompass any additional stoving or forced drying ovens as sprayed coatings are air drying only. As such there is no requirement to consider stoving-sourced releases of COx nor NOx as per guidance note provisions.

Note that the site does not use and has no future intention of using isocyanate based systems, and as such total di-isocyanate calculations have not been included here. The following calculations are based on the maximum consents defined by Process Guidance Note PG 6/23.

3.1. Calculating the Pollution Index (Pi).

The Pollution index is defined in note D1 as; -

$$Pi = \frac{D}{(Gd - Bc)} \times 1000$$

where -

D	= the discharge rate of the pollutant in g/s.
Gd	= the guideline concentration of the discharged pollutant in mg/m^3.
Gd	for Total Particulate Matter has been taken as 0.3 mg/m3 as per D1 table 1.
Bc	for Total Particulate Matter has been taken as 0.2 mg/m3 as per D1 table 2 for a highly developed large urban area.
Bc	= the background concentration of the pollutant for a particular area, or its polluting equivalent, in mg/m^3.

Gd for VOC has been calculated based on 1/40th. of the current EH 40 occupational exposure standard limit for toluol of 50 mg/m^3 as per D1 provisions.

Bc for VOC has been calculated based on zero.

3.2 Corrected Discharge Rates and Calculated Pollution Index Pi.

Analyte max discharge consent (mg/m^3)	Release Temp. Corrected consent and Discharge Rate g/sec	Corrected Discharge Rate against Background	Pollution Index Pi
Total Particulate Matter (TPM) 50	$\frac{50 \times 273}{293} = 46.58$ mg/m^3 $\frac{2.9452 \times 46.58}{1000} = 0.1371$ g/s	$\frac{0.1371}{0.3 - 0.2} \times 1000 =$	1371
Volatile Organic Compounds (VOC as C) 50	$\frac{50 \times 273}{293} = 46.58$ mg/m^3 $\frac{2.9452 \times 46.58}{1000} = 0.1371$ g/s	$\frac{0.1371}{1.25 - 0} \times 1000 =$	109.7

The highest Pollution Index value for the process is used, Pi = 1371.

4. Calculating the Discharge Stack Height ; (section 5).

There are two stages in this calculation.

(i) Calculating the uncorrected discharge stack height:

Ub based on the discharge buoyancy.

Um based on the discharge momentum.

(ii) Calculation of heat release of each stack - Q.

The first stage involves the calculation of heat release, Q (expressed in Mega Watts).

$$Q = V\left(1 - \frac{283}{Td}\right) / 2.9 \text{ MW}$$

where ;-

V = Total Volume Rate of Gas Discharge in m^3/sec. at discharge conditions.

Td = Temp. of discharging gases in degrees Kelvin.
= 293 K.

For each Spray Booth stack Q = 0.0347 MW.

Ub is calculated for each stack from the formula; -

$Ub = 10^a . Pi^b$

a = - 1.11 - 0.19.log Q a = - 1.3872

b = 0.49 + 0.005.log Q b = 0.4827

log Q = - 1.4592

Pi = 1371

Ub for each stack = 1.3397 m

5. Calculating Um.

The Discharge Momentum (M) for each stack is defined as;-

$$M = \frac{283.V.w}{Td}$$

Where ;-

V = Volume rate of Discharge at stack temp. in m^3/sec.

w = Discharge Velocity in m/sec.

Td = Discharge temp. in degrees K.

$$M = \frac{283 \times 2.9452 \times 15}{293}$$

M for each stack = 42.6702 m^4/sec^2

log M = 1.6301

Um for each stack can then be calculated from the following equation; -

$$\log Um = x + (y.\log Pi + z)^{0.5}$$

where;-

$$x = -3.7 + (\log M)^{0.9}$$

$$y = 5.9 - 0.624.\log M$$

$$z = 4.24 - 9.7.\log M + 1.47(\log M)^2 - 0.07(\log M)^3$$

from the calculations;

x = - 2.148

y = 4.8827

z = - 7.9691

As the calculated value for Um is less than the minimum discharge stack height given in clause 5.3.4. of D1 then the minimum Um value of 1 m. as per D1 is taken.

6. Calculation of Final Stack Height; as per section 5.

For the case of a single dominant building in the area of the point of discharge, which is wider than it is high, the Final Stack Height (C) is defined as follows; -

C = H + 0.6 (U)

where; -

H = Building Height, highest point over more than 1 % = 6.7 m.

U = Uncorrected discharge height (the lesser of Um or Ub) = 1

For a single release the minimum stack height = 7.7 metres.

In respect of multiple points of release, as occurs with the 4 stacks, in accordance with the defined D1 methodology, the stack locations are addressed as to their relative proximity. In the existing configuration the calculation for a "cumulative release" encompasses the summing of the 4 stacks' Pi values (Pi = 5484), and summed M and Q values and a final calculation based upon these summed values.

As such, the calculation is repeated giving a final stack height value of 10.3 m as the release height, this is then rounded up to the nearest metre

i.e. 11 m.

The release height value is then considered in terms of 5U and surrounding buildings (as per D1 clause 6.2.4).

5U = 5 x 1.3397 = 6.6985 m.

As such there are no buildings higher than this within the 5U radius.

7. Significance and Implications of the stack height calculation.

Elevation of the proposed minimum height for release to 11 m. would have significance as follows; -

(i) capital costs in installation and erection.

(ii) potentially adverse visual intrusion into the locality.

(iii) formal requirement of Planning Permissions.

In respect of the 4 stacks' actual release heights and the previous calculations, the actual height of the stack is 8 metres compared to the calculated height of 11 metres.

However consideration should be given to maintaining the existing release height on the basis of; -

(i) the standard D1 protocol is to calculate releases based on the maximum consent limits defined within the relevant process guidance note (PG 6/23).

Actual releases for the site's coating activities are less than these maximum limits and as such a lower value of Pi relates to "real time" releases.

(ii) The standard D1 protocol is to calculate releases based on a mean efflux velocity of 15 m/sec.

Actual release mean efflux velocities have been measured to be in excess of this value, thus "real time" releases will have a greater level of dispersion and dilution compared to the calculated index.

A combination of lower "actual" Pi and higher mean efflux velocity, compared to the D1 calculated values, will result in actual site releases having lesser impact than that calculated from D1 provisions.

The calculations are included herein: *(See following page)*

The final cumulative stack height was calculated at 9 metres.

A copy of this report should be sent to Local Authority for disclosure and discussion.

Tim Growcott
Senior Partner.

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Stack	Dia m	CSA m^2	Velocity m/sec	Mass flow m^3/sec	Analytes	Mg/m^3	G/sec	Pi	Pi summed	M	Ub	Um	H
BOC P1	*0.5*	*0.1963*	*12.26*	*2.4072*	*TPM*	*6.7*	*0.01502*	*150.2*	*233.24*	*1.4549*	*0.5697*	*<D*	*7.041*
					VOC	*38.9*	*0.1038*	*83.04*					
BOC TC1	*0.5*	*0.1963*	*13.73*	*2.6958*	*TPM*	*5.9*	*0.01431*	*143.1*	*243.70*	*1.5532*	*0.5819*	*<D*	*7.049*
					VOC	*46.2*	*0.1145*	*91.60*					
BOC TC2	*0.5*	*0.1963*	*13.89*	*2.7272*	*TPM*	*6.2*	*0.01575*	*157.5*	*250.14*	*1.5633*	*0.5893*	*<D*	*7.053*
					VOC	*45.6*	*0.1158*	*92.64*					
BOC FO1	*0.5*	*0.1963*	*12.89*	*2.5309*	*TPM*	*2.7*	*0.006365*	*63.65*	*87.60*	*1.4984*	*0.3551*	*<D*	*6.913*
					VOC	*12.7*	*0.029948*	*23.95*					

HE 03/3953

Local Authority Air Pollution Control (LA-APC) Part B Compliance Monitoring of the Paint Shop Releases

at

BOC Limited

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Hadleigh Road Industrial Estate
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IP2 0EX

Study Period; - 9th April 2003

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BOC LIMITED
BRUNEL ROAD
HADLEIGH ROAD INDUSTRIAL ESTATE
IPSWICH
IP2 0EX

14.04.2003

F.a.o. Kevin Vaughan

REPORT REF: - HE 03/3952

LOCAL AUTHORITY AIR POLLUTION CONTROL (LA-APC) COMPLIANCE MONITORING OF PAINT SHOP RELEASES

1. Introduction.

This study was undertaken to determine data as detailed by Process Guidance Note PG 6/23 (1997) as part of the site's application towards Local Authority Air Pollution Control (LA-APC) Part B authorisation and its defined release monitoring protocol.

A draft authorisation currently exists awaiting formal application to encompass the site's metal coating processes. Site personnel have a copy of PG 6/23 on site. The "metal coating" process encompasses the primer and top coating of gas cylinders within a dedicated Paint Shop facility and is currently being operated on 2 x 8 hour shifts per day, 5 days per week.

In order to determine compliance status of the Paint Shop releases a Local Authority-Air Pollution Control (LA-APC) monitoring study was undertaken. Under the provisions of the E.P.A. (SI 472), a compliance monitoring study of the Paint Shop spray booths' extraction characteristics will be required to be measured annually.

This provision has been encompassed by use of Halcyon personnel. Halcyon is a member of the Source Testing Association (STA) and Surface Engineering Association (SEA) via the Metal Finishing Association (MFA).

The facility encompasses 2 off conventional water wash spray booths, both RDM Industrial Services units, one used for the application of air-drying primer finishes and the second for the application of air-drying topcoat finishes.

The facility also encompasses its own Safety Kleen solvent wash cabinet.

This report relates to the determination of releases sourced from the 1 off extraction duct associated with the site's RDM 2M Primer Booth and 3 off extraction ducts associated with the RDM 4M Topcoat Spray Booth and its Flash Off enclosure.

(i) BOCP1 identifies the extraction duct associated with the primer booth,

(ii) BOCTC 1 and 2 identifies the extraction duct associated with the top coat spray finishing section and

(iii) BOCFO1 identifies the Flash Off extraction duct. All 4 of these local exhaust ventilation systems are extracted into circular ducts.

Releases are directed to atmosphere without abatement other than by conventional water wash filter media.

All 4 extraction systems were in operation under normal conditions of throughput and operational schedules during the study period. The condition of the booths' water wash filtration media was consistent with having been in use for a reasonable period of operation.

The emissions from these operations were encompassed by the provisions of Process Guidance Note PG 6/23 (1997) and were currently limited to the determination of non-speciated V.O.C's as C., Total Particulate Matter (TPM) and mean efflux velocity.

The report relates to studies undertaken by Mr T Growcott BSc. Hons. MRSC C.Chem MIMF of Halcyon Environmental on the April 9th. 2003.

Monitoring was undertaken over a continuous period per stack to determine the results quoted and in accordance with the following Source Testing Association (STA) codes of practice; -

DOCUMENT	TITLE
M 1054	STA MINIMUM STANDARDS OF TESTING AND REPORTING.
M 1055	STA CODE OF PRACTICE.
TGN007	MINIMUM SPECIFICATION FOR TESTING COATING PROCESSES.
MIG001	MEASUREMENT OF SPECIFIC ORGANIC COMPOUNDS IN SOURCE EMISSIONS.
QGN001	GUIDANCE ON ASSESSING UNCERTAINTY IN STACK EMISSION MONITORING.

All 4 extraction ducts were seen to be free of any significant corrosion and all were in good structural order.

The Paint Shop spray guns were noted to be conventional, air-assisted, high pressure Binks BBR spray guns with compressed air pressures being below the maximum defined in PG 6/23.

Halcyon acknowledges the assistance of site personnel in producing the data and results reported herein.

1.1 Summary.

1.1.1 Mean Efflux Velocities.

The 4 extraction stack velocities effectively achieved and maintained the requirements of PG 6/23 for wet arrestment systems.

1.1.2 Volatile Organic Compounds (V.O.C. as C) and Di-isocyanate Releases.

Volatile Organic Compounds (VOC as C) releases were compliant with PG 6/23 provisions, however the results were only just below the limits of release. (Note: the site does not use isocyanate-based systems, as such no measurement of this component was made).

1.1.3 Total Particulate Releases.

Total Particulate Matter (TPM) releases were compliant with PG 6/23 provisions.

1.1.4 Odour Perception.

Odour from the 4 off spray booth stacks was assessed and determined to be perceived notably only at close proximity.

The odour was sourced from the solvents used during the painting process.

1.1.5 Future Actions.

Site management will need to assess the potential usage of water based and water – borne materials to reduce VOC emissions under the provisions of the forthcoming Solvent Emissions Directive (SED). (Subsequent to this compliance monitoring study it has been identified that this assessment has been completed and identified that the quality of painting would be such that a greater number of paintings per cylinder life would be required).

A copy of the authorisation, when issued, must be displayed on site in a place of prominence.

All records relating to the authorisation must be maintained for a period of not less than 4 years.

For the 2004 study site management need to install 2 off BS 3405 ports and caps in each of the 4 extraction system ducts.

The extraction systems must not be fitted with restrictors nor cowels.

The use of high volume low pressure HVLP spray guns should be considered to meet PG 6/23 provisions and to enable the plant to ensure > 65% transfer efficiency

Tim Growcott
Senior Partner.

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SECTION 2

SAMPLING AND MONITORING PROCEDURES

2 SAMPLING AND MONITORING STRATEGY

2.1 SAMPLING STRATEGY

The sampling strategy adopted was based upon remote sampling using the linear log procedure detailed in BS 3405.

The data was determined at sampling locations on each of the 4 off extraction duct systems using the following instrumentation.

Velocity data was determined using 2 off Solomat Zephyr Electronic micro manometers used in conjunction with 2 off BS 1042 type 2A pitot systems, with in line Casella 1730 thermocouples.

Calibrated Huger Sutronics temperature and pressure measurement devices were also used in these procedures.

Gas flow rates were monitored using conventional AGL instrumentation.

2.2 SAMPLING EQUIPMENT

Sampling was undertaken using calibrated, specific, purpose built, instrumentation using, in this instance, BMS high and low flow pumps used in conjunction with Aquaria and AZTEC sampling heads.

Specialist procedures were involved in the determination of VOC analytes using 2 off portable F.I.D. Signal Instruments PM 3030 instrument and also absorption and trapping media followed by two stage thermal desorption Gas Chromatography and Mass Spectroscopy.

All sampling and monitoring procedures were based on isokinetic sampling strategy to assess process uniformity, with continuous on line assessment of flow rate and dynamic velocity measurements.

All flow rate and velocity measurement instrumentation was calibrated prior to, during and after each sampling run.

All sampling planes and points of determination were corrected in accordance with Ka coefficients as detailed in the ACOP of the Source Testing Association protocols to within 100 % I +/- 10 % variance.

2.2.1 TOTAL PARTICULATE MATTER DETERMINATION

(i) T.P.M. by BS3405 PROCEDURE

The procedure employed was that detailed in BS3405: 1983. Total Particulate Matter was determined using pre weighed 47 mm. dia. mixed cellulose ester (MCA) (0.8 micron pore size) and glass fibre (GFA) filters, obtained from a specialist environmental test house.

Air was extracted from the stacks isokinetically via a purpose built AZTEC stack sampling train, with a 1/1500 venturi nozzle.

Samples were taken at the four points across the stack diameters as detailed in the transaxial survey (0.065, 0.25, 0.75 and 0.935 x dia).

The filter holder was located immediately adjacent to sampling nozzle, but external to each stack.

The filters were submitted to Halcyon personnel for post sampling reweighing. The filters were dried to constant weight using Differential Thermal Analysis techniques to determine the non-volatile, volatile and solvent components of the over spray paint particulate.

From these plots it was possible to estimate a more valid assessment of the over spray components.

2.2.2 V.O.C. DETERMINATION

Both direct reading and post sampling laboratory-based procedures were used to produce the data reported herein.

Direct measurements were determined via a sampling train located adjacent to each stack.

Direct reading measurements were made as detailed in E.P.A. Method 25 using 2 off Signal instruments PM 3030 instruments using dual channel inputs to encompass the 4 stacks.

These instruments sampled stack and duct air at its own predetermined rate, and air was passed through a Flame Ionisation or Photo Ionisation detector within the units. The electrical signal generated in a hydrogen fuelled flame varies with V.O.C. concentration. This variance is measured in the unit and read as methane equivalent by the instrument operator.

BOC 80 and 800 ppm methane in synthetic air calibration gases were used.

A correction coefficient is then applied from the equipment supplier's data tables.

Indirect measurements were made using composite Activated Charcoal, Chromasorb and Tenax adsorption tubes, used in conjunction with low flow pumps.

The tubes were then analysed in laboratory based procedures using Gas Chromatography + Mass Spectroscopy by Halcyon personnel.

2.2.3 WATER CONTENT

Water (moisture) content was determined in accordance with EPA Method 4.

2.2.4 SAMPLING PROTOCOLS.

Calculation of velocity of Flow:

The basic formula for calculating velocity of flow from velocity pressure is:

$$\text{Velocity Pressure (Pv)} = \tfrac{1}{2} \rho V^2$$

Where:

Pv is Velocity Pressure in pascals

ρ is the density of dry air (free of CO_2) at 1013mb, 273K in Kg/m^3.

V is velocity in metres per second.

Dry air contains 78.1% Nitrogen (as N_2), 20.9% Oxygen (as O_2), 0.9% Argon (as Ar) and traces of CO_2 (0.03%), Ne, He, Kr, Xe, H_2, CH_4, N_2O, O3, SO_2, NO_2, NH_3, CO, & I_2.

Atomic Weight of Nitrogen is 14, Oxygen is 16, and Argon is 40. Molecular Weight if Nitrogen (N_2) is 28, Oxygen (O_2) is 32 and Argon (Ar) is 40.

Molar Density of a complex gas mixture, such as air, can be calculated using the proportions of gas present, and the molecular weights of the component gases. Thus using the 3 principle components of dry air:

Molar gas density = 0.781 x 28 (for N_2) + 0.209 x 32 (for O_2) + 0.009 x 40 (for Ar)
= 28.916

When the figures are made more accurate, and all the other trace gases added into the equation, **Molar Gas Density of Air** works out to be **28.9644**. This is normally approximated to 29.

The following calculations can be utilised (in most cases), where molar gas density is in the range of 28-30, (see note on determination of flue gas density).

In some combustion stacks the density can be found to be outside this range, in which case the calculations need to be modified by substituting the actual value into the basic equation, and following the calculation through.

One mole of gas occupies 22.4136 litres at 273 K, 1013mb. (Normally approximated to 22.4). One mole of air occupies the same volume and weighs 28.9644 g. Thus the **Density of Dry Air** at 273 K, 1013 mb works out at 1.292 Kg /m^3. The precise figure is 1.2928 Kg/m^3.

If this figure is entered into the initial equation

$$Pv = \tfrac{1}{2}\,\rho V^2$$

It calculates out to

Velocity (metres per second) = 1.244 $\sqrt{Pv}$ (at 273 K, 1013 mb)

or

Velocity (metres per second) = 1.280 $\sqrt{Pv}$ (at ambient: 289 K, 1013mb)

This equation can be applied at or near standard conditions. Where conditions vary significantly from standard, corrections can be made according to the following formula:

$$V = 1.280 \sqrt{\frac{1013 \times T \times 101300}{Pa \times 289 \times (101300+Ps)} \times Pv}$$

This equation corrects for atmospheric pressure (Pa), expressed in millibars, Temperature expressed in Kelvin (T), and static pressure in the stack (Ps) in pascals.

It multiplies out to give:

$$V = 762.7 \sqrt{\frac{T \times Pv}{Pa\ (101300+Ps)}} \times Pv$$

Where:

V	=	Velocity of Flow on metres per second	(ms^{-1})
T	=	Temperature in Kelvin (Kelvin =° Celsius + 273)	(K)
Pv	=	Velocity Pressure in pascals	(Pa)
Ps	=	Static Pressure in pascals	(Pa)
Pa	=	Atmospheric Pressure in millibars (1 millibars = 100 pascals)	(mb)

To apply this equation, Pv should be entered as the root mean square of all velocity pressure readings. But where the majority of the readings do not vary by more than 25% from the mean figure, the mean provides a satisfactory answer.

The equation gives velocity of flow at temperature T, static pressure Ps, and atmospheric pressure Pa.

Location of Measuring Site:

The measuring site should be located in a region of linear flow. Smooth flow in a duct has a meniscus like profile, with maximum flow in the middle of the stack, which is unaffected by the surface roughness of the exterior walls, and a reduced flow at the edges. Where the flow is turbulent, such as after a fan, a corner, a junction, or a damper, flow measurement is rendered impossible. Similarly before these obstacles air flow is broken up.

The measuring site (both for flow measurement and extractive sampling) should thus be located 5 - 6 diameters downstream of the last point creating turbulence, in a straight run of ductwork. BS 3405 allows 1 diameter for a bend, 2 for a junction and 3 for a fan or damper. It should also be at least two diameters upstream of the next point creating turbulence. BS 3405 allows 1 diameter. There will be places where even the rules of BS 3405 cannot be met, in which case, very considerable care is needed in obtaining readings.

Measurements and Extractive Sampling:

Measurements are taken across the duct at points in the centre of a series of equal areas. In a square duct this is straightforward, but in a circular duct, it implies a series of points near to the edge of the stack, and very few measurements in the middle. These points are calculated by the Log Linear rule for circular ducts, and the Log Tchebycheff rule for rectangular ducts. BS 3405 says that measurements may be taken at a series of 10 points evenly spaced across the duct.

Extractive Sampling points are chosen on the same basis, and BS 3405 says that samples should be collected at 2 points across each of two traverses, in small stacks. Where the stack has an internal area greater than $2.5m^2$, 4 sampling points should be used on each traverse. There are two diagrams from BS 3405 included with this protocol, showing the location of the sampling points, and the preferred BS 4" fitments for the sampling ports.

Measurement of Air Flow in Stacks:

Correct isokinetic sampling is dependent on accurate assessment of air velocity in the duct or flue. Because of the potentially hot, acid conditions found in flues, the instrument of choice for measuring flow is one, which measures differential pressure, and does not insert an instrument with electronic or moving parts into the duct. There are several other types of instrument available for measuring airflow, but these should not, as a general rule, be used in flue stacks.

Pressure in Ducts:

There are 4 factors which effect the perceived pressure in a duct:

1. Movement of air produces a measurable Velocity Pressure (also known as Dynamic pressure).
2. Static Pressure is exerted in all directions, by the compression, expansion, or heating process which is moving the air.
3. Atmospheric (Barometric) Pressure
4. Temperature.

Micro manometer & Pitot Tube:

The pitot tube is the differential pressure probe. It is designed to create minimal turbulence in the flow. The British Standard design has an ellipsoidal nose, which is inserted to face the flow. The tube is very directional and needs to be accurately aligned into the flow, to produce the best result. Unfortunately the pressure bearing on the nose of the instrument is Velocity pressure, but with the addition of static pressure.

To eliminate this problem, the pitot tube is made with a separate tapping to measure static pressure alone. The BS tube is made double, with tappings at right angles to the flow, whereas the American S type pitot consists of two separate tubes 180° opposed. The two types of pitot tube have different response factors (sometimes called the K factor), and this may require the use of a correction factor in calculating flow. The response factor for the BS type is 1.0 and for the S type is 0.85.

The original instrument for measuring air pressure is the U tube manometer. By attaching the two tappings of the pitot tube, one to each side of the manometer, Static pressure is applied to both sides, and its effect is eliminated, allowing a direct reading of Velocity pressure.

The inclined manometer is an improvement on the U tube, because it allows for more accurate readings of pressure. However it does require careful levelling before use, and an electronic micro manometer is more user friendly.

With either type of instrument it is important that it is connected up with the Velocity pressure tapping bearing on the positive side of the instrument.

Calculating & Presentation of Results (Measurements & Corrections):

Particulate sampling is always assessed gravimetrically (by weight). Filter material of all types is pre weighed, exposed in the sampling line and re-weighed.

This procedure may require drying of the filter medium before re-weighing, if the sampling was conducted at a temperature below the dew point. In all circumstances, filters require careful handling to avoid loss particulate, and also loss of original fibrous material. Weight of particulate collected is thus derived from the difference of the two weights and is normally expressed in milligrams (g^{-3}) or micrograms (g^{-6}).

The balance should be calibrated against a traceable standard before and after each batch of filters is weighed / re-weighed.

Volume of gas collected is normally determined either by multiplying sampling flow rate (litres/minute) by time elapsed (minutes) to get a final volume in litres, or by utilising a direct reading from a gas meter.

In both cases, volume calculated is at ambient temperature and pressure and requires correcting to standard conditions. The gas meter or flow meter should be regularly re-calibrated against a traceable standard, and this may impose an extra calibration factor on the results to obtain correct ambient volume.

Schedule A & B processes require presentation of results in milligrams per cubic metre, and / or parts per million, as standardised to the following conditions:

Temperature273K (0° Celsius)	
Barometric Pressure	101.3KPa, (1013mb)
Humidity	Dry
Oxygen	3%, 6%, 8%, 11%, 15%, 18% depending of combustion process

The various calculations and conversions are explained in the subsequent paragraphs.

Determination of Isokinetic Sampling Rate:

To obtain correct samples of particulates, turbulence caused by sampling must be minimised. This is achieved by making the velocity of flow into the sampling probe equal to the velocity flow moving along the duct or stack. This sampling technique is called isokinetic sampling, and its use enables the collection of representative samples, by eliminating the distortion of sample reliability caused by variation in proportion of light particulates collected.

Velocity of flow is determined by the use of pitot tube and micro manometer. This is normally calculated at the stack temperature. The gas volume measuring equipment is normally functioning at about ambient temperature. (Gas moving along the sampling line rapidly cools to ambient).

To calculate isokinetic flow rate, first the gas velocity must be calculated as at ambient. This is done using the standard gas equation. (See Calculation of Results).

$$\frac{\text{Pressure x Volume}}{\text{Temperature}} = \text{Constant}$$

Thus for a stack of uniform width volume is proportional to velocity, hence:

$$\text{Velocity}_{\text{ambient}} = \frac{\text{pressure}_{\text{stack}} \text{ x Velocity}_{\text{stack}} \text{ x Temperature}_{\text{ambient}}}{\text{Temperature}_{\text{stack}} \text{ x Pressure}_{\text{ambient}}}$$

As atmospheric pressure remains equal this item cancels out of the equation.

Sampling rate (litres per minute) is a function of stack velocity (metres per second) and probe tip area (square centimetres), derived from pr^2. The rationale is as below:

$$\text{Metres per second (m/s) x } \frac{100}{60} = \text{centimetres per minute (cm/min)}$$

$$\text{Centimetres per minute (cm/min) x Square centimetres (cm}^2\text{) = Cubic Centimetres per minute (cm}^3\text{/min)}$$

$$\frac{\text{Cubic Centimetres per minute (cm}^3\text{/min)}}{1000} = \text{Litres per minute (l/min)}$$

Thus:

$$\textbf{Sampling Rate (l/min)} = \frac{\textbf{Ambient Stack Flow (m/s) x Tip area (cm}^2\textbf{)}}{\textbf{600}}$$

Determination of Flue Gas Density:

Stack gas density is determined by measuring the concentration of Carbon Dioxide, Carbon monoxide and Oxygen in the stack. This can be done using a combustion analyser, or if more accuracy is required, using an Infra Red Gas Analyser.

The residual dry atmospheric gas is assumed for the purpose of this calculation to be Nitrogen. Nitrogen concentration is calculated as follows:

$$\% N_2 = 100 - (\% CO_2 + \% O_2 + \% CO)$$

The proportion if each gas in the dry mixture can then be utilised to calculate the dry molar gas density as shown previously:

$$\text{Molar Dry Gas Density (Dd)} = (\%CO_2 \times \frac{44}{100}) + (\% O_2 \times \frac{32}{100}) + (\%CO + \%N_2 \times \frac{28}{100})$$

Flue gases however also contain water. The water is condensed out of the sampling line, (to protect the sampling pump), and is weighted.

The volume of gas occupied by the collected condensate water can be calculated from the volume occupied by 1 mole of standard gas (ie. 22.4 litres at 273K, 1013mb).

$$\text{Gas Phase Volume of Water (litres)} = \text{Weight of Water (grams)} \times \frac{22.4}{28}$$

Dry gas volume of the sample, is measured by the gas meter in the sampling line. Total gas volume (wet) collected is therefore the sum of the calculated water volume above and the dry gas volume measured.

Total (Wet) Gas Volume = Dry Gas Volume + Gas phase Water Volume

Using the above relationship, the proportion of dry gas in the total volume collected, (Mole Faction of Dry Gas), can be calculated as follows:

$$\text{Mole Fraction of dry gas (Md)} = \frac{\text{Dry gas volume}}{\text{Total gas volume}}$$

Mole fraction of wet gas can be calculated similarly, or as

Mole fraction of wet gas (Mw) = 1 - Mole fraction of dry gas (Md)

Density of stack gas can then be calculated from the density of dry stack gas calculated above, and the Mole Fractions calculated.

Thus:

Molar Density of dry gas (Dd) x Mole fraction of dry gas (Md) + 18 (1 - Md) = Molar Stack gas density (Ds)

This latter equation is identical in methodology to the earlier equation for deriving molar gas density of dry gas, but now includes an extra derived function for water

$$\text{Molar stack gas density (Ds)} = Md\left(\frac{\%CO2 \times 46}{100} + \frac{\%O2 \times 32}{100} + \frac{\%N2 + \%CO \times 28}{100}\right) + Mw\left(\frac{\%H2O \times 18}{100}\right)$$

In most cases the Molar stack gas density will work out as 29 $\pm$ 1. In this case, the normal equation for stack flow will prove to be satisfactory.

Calculation of Volume Flow:

Volume flow is calculated from flow velocity and internal area of the stack or duct as follows:

Volume flow ($m^3\ min^{-1}$) = Velocity (ms^{-1}) x Internal Area of Duct (m^2) x 60

Internal area of duct is calculated as:

pr^2 for a circular duct,
or base x height for a square duct.

To convert $m^3 min^{-1}$ to cubic feet per minute (cfm) multiply by 35.315

Conversion Factors (mg/m^3 and ppm):

Final results of particulate concentrations in air are always presented as a weight by volume measure (e.g. milligrams per cubic metre).

Gases can be presented as a weight by volume, or as a volume measure (parts per million). Unfortunately, there is no standard methodology within the Process Guidance notes and both types of measure are used, often in the same note. It is thus, important to be able to change between the two methods of calculating gas concentration.

The concept of parts per million is particularly useful, because gas volumes expand and contract with temperature and pressure. Because all gases occupy the same volume, ppm does not change with temperature.

Thus a gas concentration recorded in ppm at high temperature, is still the same at low temperature, and at standard conditions, allowing a direct conversion to mg/m^3 without the worry of changing volumes.

Particulates:

The sampling of stack particulates is undertaken using an Italian (Aquaria) sampling line following the main procedural requirements of BS 3405 EPA Method 17.

Procedure is as follows:

1. Determine correct location of measuring and sampling points.

2. Measurement of stack flow using BS 1042 ellipsoidal nosed pitot tube, with electronic micro manometer and thermometer.

3. Calculation of flow rates, isokinetic sampling rates, sampling locations etc.

4. Sampling over four 15 -30 minute periods, to obtain optimum samples at the point specified by BS 3405.

Samples are collected onto pre-weighed 47mm glass fibre filters, with the whole sampling tip and probe assembly located inside the stack, thereby producing a dry sample.

The sampling line includes a condensation trap, such that gas flow, gas volume, and gas temperature as measured at the pump all relate to dry gas.

Exposed filter samples are re-weighed, to obtain weight of particulate collected.

If required the filter material and particulate sample can be digested, prior to analysis of metals by Atomic absorption spectrophotometry (AA), or Inductively coupled plasma atomic emission spectrophotometry (ICP-AES).

This Introductory protocol is amplified, by a further series of protocols, including diagrams, copies of record sheets, and an explanation of the calculations involved in presenting results of extractive sampling methods.

Temperature and Pressure:

Assuming that stack gases obey the standard Gas Laws, then:

$$\frac{\text{Atmospheric Pressure (mb)} \times \text{Volume (m}^3\text{)}}{\text{Temperature (K)}} = \text{Molar Gas Content}$$

or

$$\frac{PV}{T} = K$$

The Molar Gas Constant equals 8.3143 J K^{-1} mol^{-1}

A more useful expression of the Gas Law is:

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

This can be expressed to find an unknown as

$$V1 = \frac{P_2V_2}{T_2} \times \frac{T_1}{P_1}$$

The correction equation can therefore be expressed as:

$$\textbf{Standardised Volume} = \frac{\textbf{Recorded Pressure}}{\textbf{Std Pressure (1013)}} \times \frac{\textbf{Std Temperature (273)}}{\textbf{Recorded Temperature}} \times \textbf{Recorded Volume}$$

For this correction to work, any unit of pressure can be utilised (inches of water, millimetres of mercury, millibars, KiloPascals etc.) provided that the standard atmosphere is expressed in similar units. Temperature must however be worked in Absolute Units e.g. Kelvin ($K = {}^{o}C + 273.15$) or Rankine (${}^{o}R = {}^{o}F + 459.67$)

All sampling and monitoring procedures were based on isokinetic sampling strategies, to assess process uniformity, with continuous on line assessment of flow rate and dynamic velocity measurements during process operation.

All flow rate and velocity measurement instrumentation was calibrated prior to, during and after each sampling run.

All sampling planes and points of determination were corrected in accordance with isokinetic correction Ka coefficients as detailed in STA protocols.

2.2.5 INITIAL STACK PROFILE STUDY

As per the provisions of BS 3405, a stack/duct profile study was addressed prior to monitoring and sampling.

This study was undertaken at ten points in two transaxial assessments at the sampling points.

Both temperature and velocity profiles were measured for each of the 4 stacks.

The study determined that the temperature variance velocity variances across the two measured planes were within method tolerance specification.

There was no evidence of non linear flow, spiralling or swirling flow, nor of pulsed airflow in any of the plant's extraction systems.

In this assessment the relative ratio of the cross sectional area of the stack and Aztec sampling head were determined.

The filter holder c.s.a., was noted as less than 10% of the stack/duct c.s.a., however, it was decided to maintain the filter body outside of the air streams to minimise sampling errors.

The c.s.a. of the sample line was calculated on a 69 mm. diameter.

SECTION 3

ANALYTICAL METHODS

3. ANALYTICAL METHODS

The following analytical methods were used to determine the data reported herein ;-

	ANALYTE	METHOD REFERENCE
1.	TOTAL PARTICULATE MATTER	BS 3405 (mod.) + D.T.A.
2.	V.O.C.	EPA METHOD 25
3.	V.O.C. as Carbon	EPA METHOD 25 + GC
4.	Water Vapour	EPA Method 4

SECTION 4

EXTRACTION SYSTEM MEAN VELOCITY DATA

4. FLOW DYNAMICS RESULTS

The following parameters were determined for each defined extraction system;-

STACK REF	DURATION OF TEST	MEAN EFFLUX VELOCITY AT T	Tmax:Tmin	Vmax:Vmin
		m/sec		
BOCP1	14.22-- 15.34	12.26	1.022	1.347
BOCTC1	14.27– 15.35	13.73	1.013	1.224
BOCTC2	14.42 – 15.48	13.89	1.028	1.265
BOCFO1	14.32 – 15.41	12.89	1.019	1.302

4.1 FLOW DYNAMICS DATA

These results are reported in accordance with BS 3405 sampling protocol, corrected to standard conditions as detailed in process specific PG 6/23 (1997) note provisions.

The results should be considered to be accurate within the error quoted in BS3405 i.e. +/- 25%.

This is normally considered as an acceptable variance for such studies.

SECTION 5

ANALYTICAL RESULTS

5. ANALYTICAL RESULTS

The following analytical results were determined whilst normal production operations took place over a 2 x 1 hour sampling schedule;-

TABLE 5.1.

STACK REF	TOTAL PARTICULATE MATTER mg/m^3	
	PG 6/23 MAX	DETERMINED
BOCP1	50	6.7
BOCTC1	50	5.9
BOCTC2	50	6.2
BOCFO1	50	2.7

Volatile organic compounds were determined as the mean of 30 off measurements per stack (sampled at approx. 15 per hour over a 2 hour period).

TABLE 5.2.

STACK REF	VOC AS CARBON mg/m^3	
	PG 6/23 MAX	DETERMINED
BOCP1	50	38.9
BOCTC1	50	46.2
BOCTC2	50	45.6
BOCFO1	50	12.7

These results are reported in accordance with the protocol defined by PG 6/23 (1997) guidance note and are expressed at standard reference conditions of 273K and 101.3 kPa, without correction for water vapour.

SIGNAL INSTRUMENTS PM 3030 VOC RELEASE MONITORING PRINTOUT SHEETS

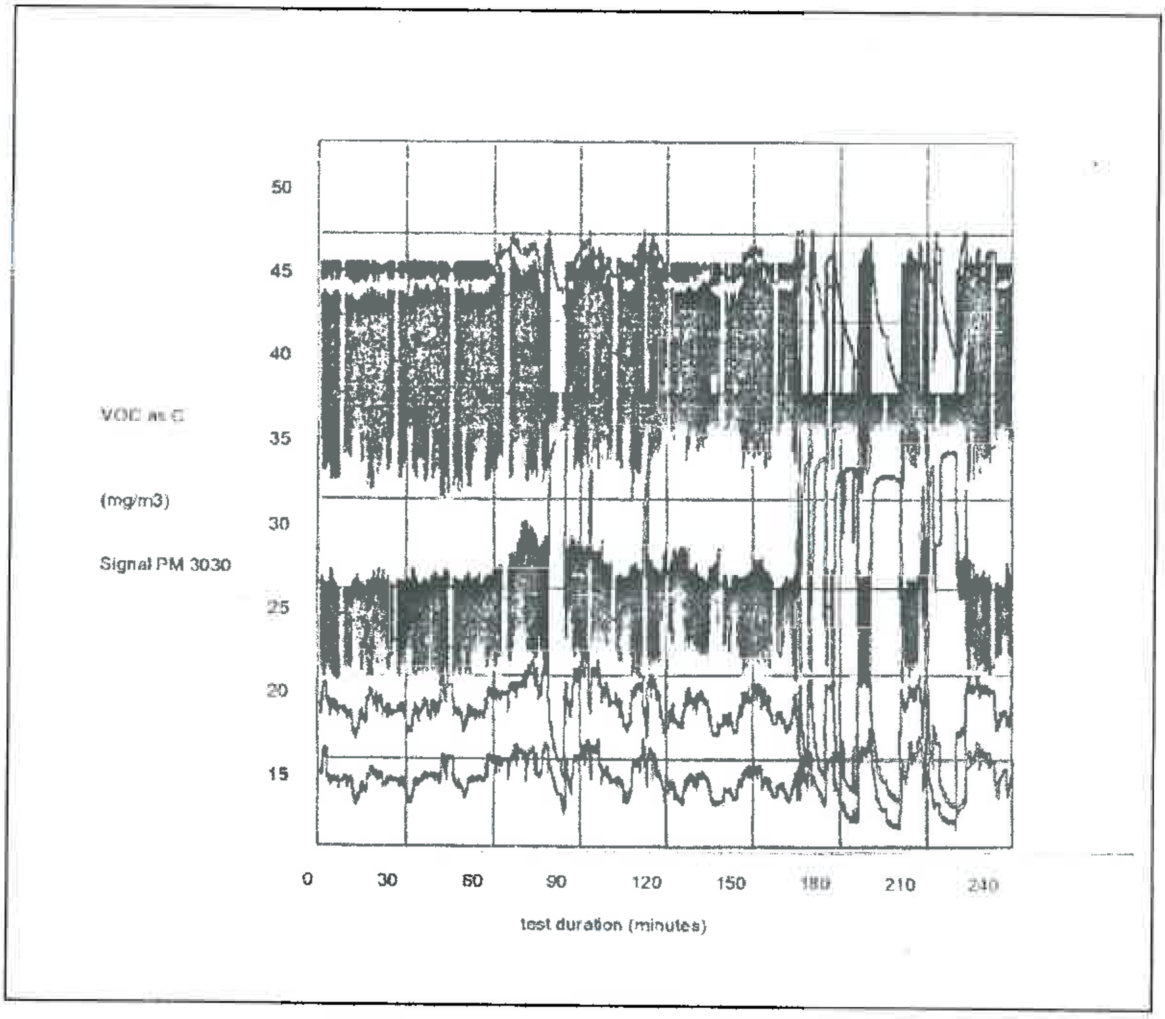
The following printout sheets show the VOC as C monitoring for; -

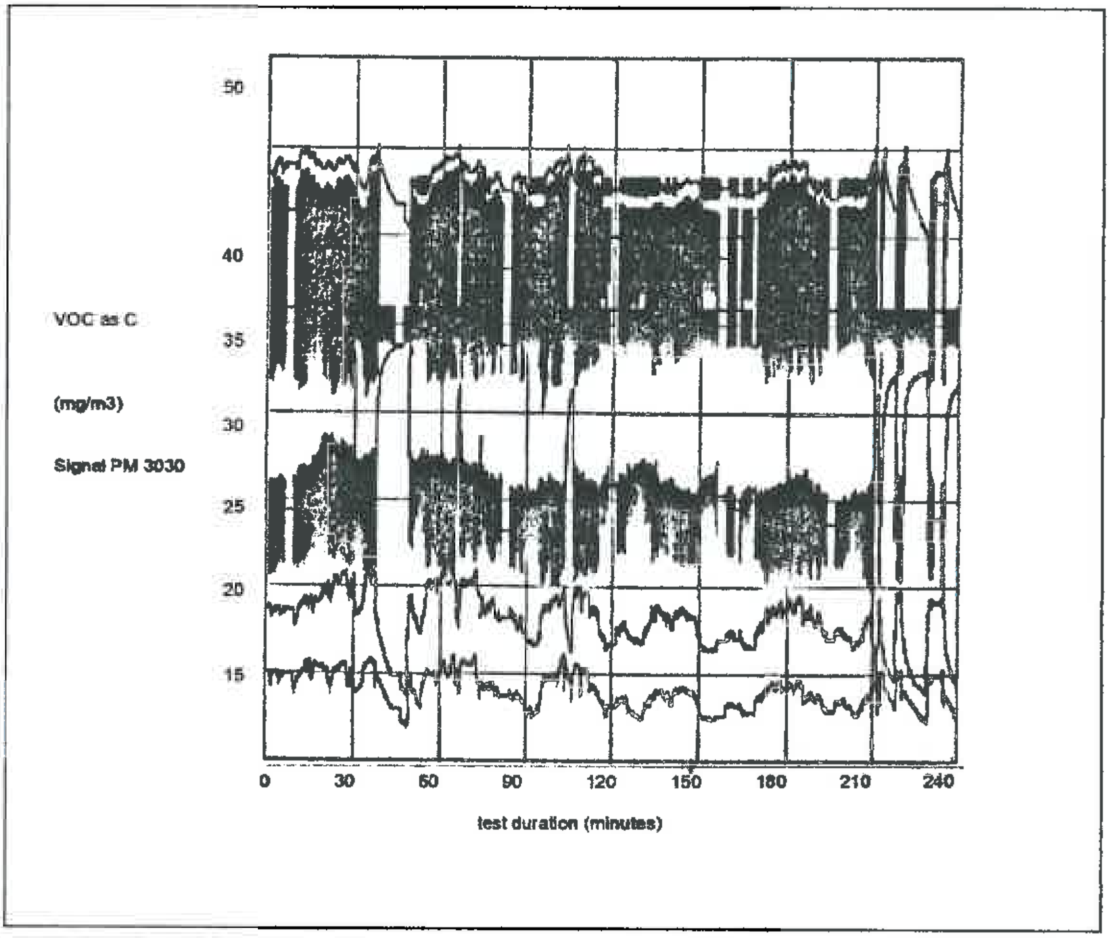
(i) The Primer Booth Stack – BOCP1.

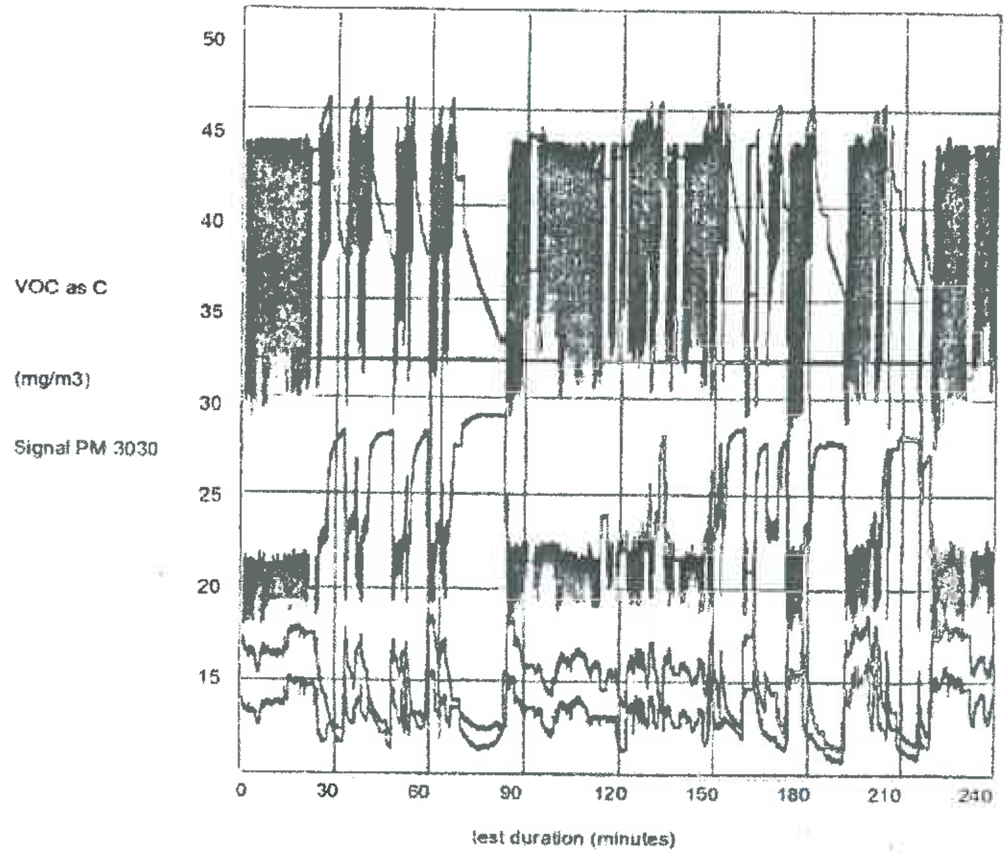
(ii) The Top Coat Booth Stack - BOCTC1.

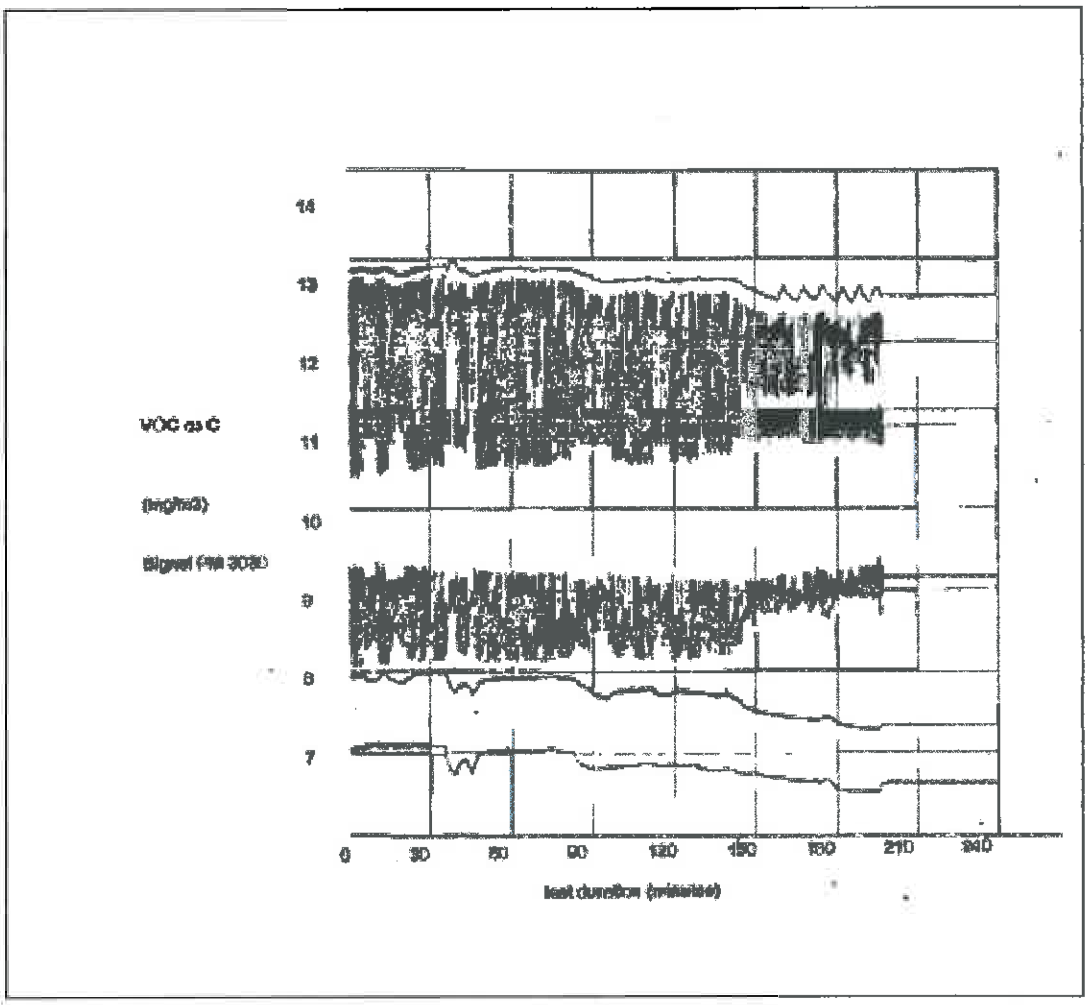
(iii) The Top Coat Booth Stack – BOCTC2.

(iv) The Top Coat Flash Off Enclosure Stack – BOC FO1.


50
45
40
VOC as C
35
(mg/m3)
30
Signal PM 3030
25
20
15
0
30
60
90
120
150
180
210
240
test duration (minutes)


VOC as C
(mg/m3)
Signal PM 3030
50
40
35
30
25
20
15
0
30
60
90
120
150
180
210
240
test duration (minutes)


VOC as C
(mg/m3)
Signal PM 3030
50
45
40
35
30
25
20
15
0
30
60
90
120
150
180
210
240
test duration (minutes)



VOC as C
(mg/m3)
Signal FID 3030
14
13
12
11
10
9
8
7
0
30
60
90
120
150
180
210
240
test duration (minutes)

MASS BALANCE CALCULATIONS.

The 4 off stacks have a diameter of approximately 0.5 m

Their mean efflux velocity is approximately 13 m/sec at the point of release.

As such each stack has a mass flow rate of

$$\frac{(0.5)^2}{2} \times 3.1415926 \times 13 - 2.5525\ m^3/sec$$

Based on 14 hours per day usage over a 5 day week over 48 weeks per annum this equates to a mass release for all 4 stacks of $1.23502 \times 10^8\ m^3$.

Based on a mean release of 45 mg/m^3 VOC as C this equates to 5.5576×10^9 mg/annum or 5.557 tonnes per annum VOC as C.

This equates to approximately 7.2 tonnes/annum VOC as pure solvents.

A mass balance inventory calculation on VOC tonnage over an 18 month recorded period, provided estimates of about 10 tonnes. However, BOC has already undergone a number of initiatives to reduce this figure over the last year in anticipation of the LA-APC application requirements. These include the introduction of line paint heaters to reduce solvent use. In addition, some paint stock is transferred to other sites to assist with urgent inter-branch shortages. This can equate to an estimated annual amount of about 0.5 tonnes by volume weight.

The independent monitoring analysis undertaken during March has already indicated that our current VOC levels are already in the order of 7.2 tonnes. In addition, a review of our current spray coatings equipment, procedures and coatings system is currently underway.

SECTION 6

VISUAL AND OLFACTORY ASSESSMENTS

6. VISUAL AND OLFACTORY ASSESSMENTS

6.1 VISUAL ASSESSMENT

In accordance with the provisions of PG 6/23 (1997) an assessment of process-associated releases was undertaken. The assessment was carried out with reference to the methods and procedures detailed in BS 2742c:1991.

The releases were evaluated: the discharge colour for all of the spray booths' extraction systems were determined as colourless and less than Ringelmann shade 1.

6.2 OLFACTORY ASSESSMENT

In accordance with the provisions of PG 6/23 an assessment of releases was undertaken at the adjacent upwind and downwind perimeter fence lines.

Perceptive odour evaluations were non quantitative and dependant upon the assessors, however an evaluation by subjective procedures was carried out by odour assessment techniques. The author was formally trained in Dynamic Dilution Olfactometry and in Odour Determination via Societe General de Surveillance (1991) and BASF (1989).

The site's Paint Shop releases were perceived as being of a low concentration odour, characteristic of "wet" solvents, with a typically neutral, non-aggressive note.

6.3. NOISE ASSESSMENT

With reference to noise, the operation of the spray booth extraction facilities detailed within this report was not perceived to be exceptional nor excessive as to be considered a nuisance with regard to noise and its effect on site personnel and the local community.

SECTION 7

INSTRUMENTATION AND CALIBRATION

7. INSTRUMENTATION AND CALIBRATION

The following instrumentation was used in this study;-

INSTRUMENT	SUPPLIER	CALIBRATION DATE/CERT
PM 3030	HALCYON	09.10.02
PM 3030	HALCYON	09.11.02
SPAN CALIBRATION GASES AS SUPPLIED CERTS.	BOC 80 AND 800 PPM METHANE IN AIR	09.06.02
AGL 6 BOXES 010, 014	HALCYON	18.11.02
SOLOMAT ZEPHYR MICROMANOMETER/PITOT 001,002	HALCYON	01.11.02
PE 8410 GC	HALCYON	DAILY
DETECTAWL	HALCYON	DAILY

SECTION 8

PREVAILING WEATHER CONDITIONS

8 PREVAILING WEATHER CONDITIONS

ATMOSPHERIC PRESSURE mBas	1,029
AMBIENT TEMP C	14
RELATIVE HUMIDITY %	52
WIND DIRECTION	NW
WIND SPEED m.p.h.	7 –12
VISIBILITY	> 1000 m
WEATHER	BRIGHT PERIODS, BLUE SKIES

Table 1: Simple error analysis for particulate measurement, 4 Point Sampling (or 8 Point Sampling when Pitot Ratios >4:1≤9:1)

Type of Error	Source of Error	Quoted uncertainty	Estimate of component standard uncertainty (1SD)	Combined uncertainties (1SD)	Combined uncertainty (1SD)	Expanded uncertainty (95% confidence limits)
Precision-like Errors						
Random	Errors in setting to isokinetic conditions	≤±1%	≤±0.58%	±4.66%		
	Minimum sampling time of 3 minutes	±8%	±4.62%			
Systematic						
Accuracy-like Errors						
Random	Measure flue dimensions to ±10mm/m	±2%	±1.15%	±1.15%		
Systematic	Number of sampling points (see note below)	±13%	±6.63%	±7.22%	±13.03%	±25.5%
	Minimum weight gain	assume ±2%	±1.5%			
	Pre/Post-pitot reading within 10%	±2.5%	±1.44%			
	Temperature variations of 10% on 150°C	±1/5%	±0.87%			
	Gas flow axis deviates up to 30°	≤±3.5% velocity	≤±2.02% velocity			

Note: Type A component uncertainty, quoted at 95% confidence limits. All other component uncertainties assumed to be Type B.

Table 2: Simple error analysis for measurement of mass flow particulates when not all the requirements of BS3405 are met.

Deviation from standard: Only nearest 2 points of 4 on each of sampling lines can be reached (circular duct); pre/post sampling velocities differed by 20%; Highest to lowest pitot reading 15:1.

Type of Error	Source of Error	Quoted uncertainty	Estimate of component standard uncertainty (1SD)	Combined uncertainties (1SD)	Combined uncertainty (1SD)	Expanded uncertainty (95% confidence limits)
Precision-like Errors						
Random	Errors in setting to isokinetic conditions	≤±1%	≤±0.58%	±4.66%		
	Minimum sampling time of 3 minutes	±8%	±4.62%			
Systematic						
Accuracy-like Errors						
Random	Measure flue dimensions to ±10mm/m	±2%	±1.15%	±1.15%		
Systematic	Number of sampling points, and highest / lowest pitot readings 15:1 (see note below)	±(13+12)%=25%	±12.78%		±20.7%	±40.8%
	Bias due to non-symmetrical points	±7.5%	±4.33%			
	Minimum weight gain	Assume ±2%	±1.5%	±14.88%		
	Pre/Post-pitot readings differ by 20%	±10%	±5.77%			
	Temperature variation of 10% on 150°C	±1.5%	±0.87%			
	Gas flow axis deviates up to 30°	≤±3.5% velocity	≤±2.02% velocity			

Note: Type A component uncertainty, quoted at 95% confidence limits. All other component uncertainties assumed to be Type B.

APPENDIX 4

VISUAL OLFACTORY LOG

BOC IPSWICH LOCAL AUTHORITY AIR POLLLUTION CONTROL - VISIBLE EMISSIONS & ODOUR MONITORING RECORD

Note: **Assessment for visible emissions**
Assessment for odour

PERIOD FROM: **TO:** **FREQUENCY: DAILY**

DATE	TIME	VISIBLE EMISSIONS						OFFENSIVE ODOUR		CORRECTIVE ACTION TAKEN (IF ANY)	COMMENTS	Wind Direction & Weather Conditions
		No Visible Emissions	Emissions Visible	No Visible Emissions	Emissions Visible	No Visible Emissions	Emissions Visible	None Detected	Offensive Odour Detected			

THIS DOCUMENT SHOULD BE RETAINED FOR A PERIOD OF NOT LESS THAN 4 YEARS

APPENDIX 5

PG 6/23 MONITORING LOG

	BOC IPSWICH PG6/23 LA-APC ENVIRONMENTAL COMPLIANCE SCHEDULE- SPRAY BOOTH AUTHORISATION.	STATUTORY REGULATION	DAILY TEST	WEEKLY TEST	MONTHLY TEST	ANNUAL TEST
1	SPRAY BOOTH STACK COMPLIANCE MONITORING.	ENV. PROTECTION ACT 1990				ANNUAL
2	SPRAY BOOTH TESTING OF DUCTWORK INTEGRITY AND CLEANLINESS	ENV. PROTECTION ACT 1990			6 MONTH INSPECTION	ANNUAL
3	LIDDING OF PAINT AND THINNER DRUMS etc.	ENV. PROTECTION ACT 1990		6 WEEKLY PGI		
4	STORAGE OF MATERIALS	HIGHLY FLAMMABLE LIQUIDS & LPG REGULATIONS 1972		6 WEEKLY PGI		
5	LOCAL EXHAUST VENTILATION (LEV)	COSHH REGULATIONS 2002. 9(2)				14 MONTH MAX
6	SPRAY BOOTH VISUAL OLFACTORY EMISSIONS	ENV. PROTECTION ACT 1990	ALL STACKS	WEEKLY UPDATE OF LOG		
7	VISUAL APPRAISAL OF EXTRACTION OF EQUIPMENT	ENV. PROTECTION ACT 1990	ALL BOOTHS		6 MONTHLY	
8	ENVIRONMENTAL EPA AWARENESS TRAINING	ENV. PROTECTION ACT 1990				ANNUAL
9	PAINT SPILLAGE AND CONTAINMENT TRAINING	ENV. PROTECTION ACT. 1992 SPECIAL WASTE REGS 1996 CONTROL OF POLLUTION ACTS I AND II				ANNUAL
10	STATUTORY NOTIFICATION OF REGULATOR PROCEDURE	ENV. PROTECTION ACT 1990				ANNUAL
11	VOC SOLVENT INVENTORY - SUBMISSION TO LOCAL AUTHORITY	ENV. PROTECTION ACT 1990				ANNUAL
12	ISSUE AND USE OF RPE AND PPE	PPE REGULATIONS 1992	ALL RPE/PPE			
13	WASTE MANAGEMENT	ENV. PROTECTION ACT 1990 SPECIAL WASTE REGULATIONS 1996 CONTROL OF POLLUTION ACTS	ALL WASTE			
14	LOGGING OF REPAIRS AVAILABILITY OF SPARES	ENV. PROTECTION ACT 1990	ALL REPAIRS			

APPENDIX 6

PLANNED MAINTENANCE – WORK ORDER SHOP SHEETS

BOC IPSWICH LOCAL AUTHORITY AIR POLLUTION CONTOL – STACK MAINTENANCE MONITORING RECORD

Note: Assessment for stack integrity, cleanliness and state of repair

PERIOD FROM: **TO:** **FREQUENCY: 12 MONTHLY**

DATE	TIME	STACK MAINTENANCE						STACK CLEANLINESS INSPECTION STATUS		CORRECTIVE ACTION TAKEN (IF ANY)	COMMENTS	Signature
		NO. 1 PRIMER SPRAY BOOTH		NO.2 TOPCOAT SPRAY BOOTH		NO.3 TOP COAT SPRAY BOOTH						
		As per guidance	Not as per guidance	As per guidance	Not as per guidance	As per guidance	Not as per guidance	All stacks OK	Stacks not OK			

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BOC IPSWICH LOCAL AUTHORITY AIR POLLUTION CONTOL – SPRAY PRESSURE MONITORING RECORD

Note: Assessment for pressure readings

PERIOD FROM: TO: FREQUENCY: 6 MONTHLY

DATE	TIME	SPRAY GUN PRESSURE						PRESSURE GUAGE STATUS		CORRECTIVE ACTION TAKEN (IF ANY)	COMMENTS	Signature
		NO. 1 SPRAY BOOTH		NO.2 SPRAY BOOTH		NO.3 SPRAY BOOTH						
		As per guidance	Not as per guidance	As per guidance	Not as per guidance	As per guidance	Not as per guidance	All gauges OK	Gauges not OK			

THIS DOCUMENT SHOULD BE RETAINED FOR PERIOD OF NOT LESS THAN 4 YEARS

BOCIPSHVLPLOG