

AIR QUALITY

## NOTES

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Finishing Shop



## 200 YEARS OF CASELLA HISTORY

Cesare Tagilabue established the company in Holborn, London in 1799 during the reign of George III. Within just a few years Louis Pascal Casella joined Cesare in a partnership and the new Casella name was born.

In the early years the product ranges being exported around the world included exploration, navigation, photographic, meteorological and medical research instruments. Our early customers included Charles Darwin and Dr. Livingstone.

During the 19th century, the product range continued to grow and Casella exhibited instruments including theodolites and surveying equipment at the first 'Great Exhibition' held in the Crystal Palace, Hyde Park London in 1851.

As the two World Wars of the last century raged, our expertise in optics, compasses and photogrammetry equipment was put to good use by the military. By the 1950's Casella had designed and built a significant amount of dust monitoring equipment for the deep mining industry, including a number of industry standard products.



Regent House Circa 1920's



Show Room

## CEL HISTORY

CEL Instruments have been manufacturing high quality instrumentation for the measurement of noise and vibration since the early 1970's. Originally formed from the company Computer Engineering Limited, a British company specialising in the design and manufacture of computer related equipment, CEL rapidly became well known for designing state of the art noise products in the UK.



In 1998, Casella acquired CEL Instruments, manufacturers of innovative noise monitoring equipment. The natural synergy formed from this integration allows Casella CEL to offer a broader and more comprehensive product range to both the occupational and environmental market sectors.

To keep one step ahead of an ever-changing market, Casella CEL is committed to an extensive programme of ongoing research and product development. The development programme involves considerable integration with Industry and Research bodies, to ensure the utilisation of the latest techniques and technologies available. It is this commitment that has enabled us to build an impressive product portfolio, allowing us to focus on the following areas:

Air Quality

Indoor Air Quality

Professional Meteorology

Recreational Meteorology

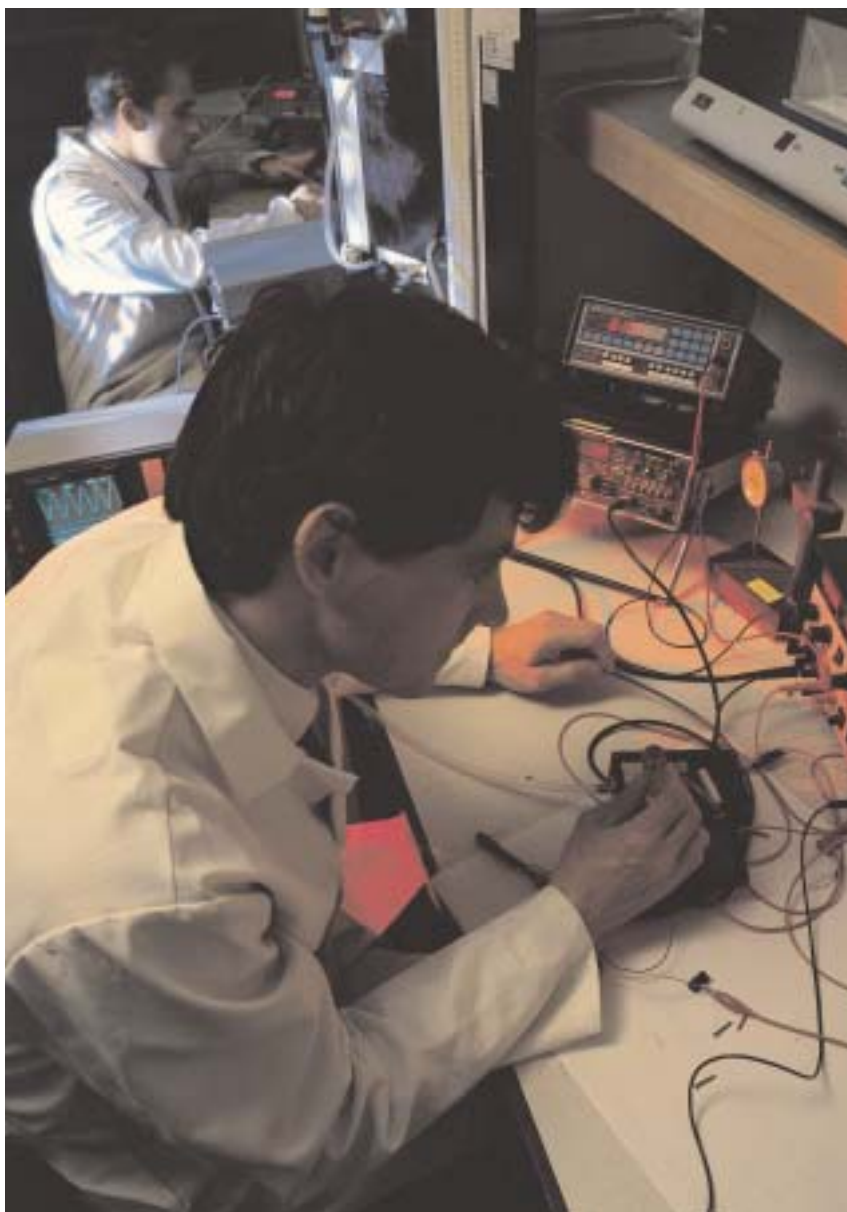
Noise

From our modern facilities in the UK we work continuously to improve and expand our business. Our products are now

exported world-wide through an extensive network of distributors and agents. With measurement division offices in both America and Spain, and with further expansion planned, this confirms Casella CEL as a truly International organisation.

Casella CEL is part of Casella Measurement  
- A division of the Casella Group.

'We have a commitment to you the customer to provide a 'total' service, which exceeds your expectations'



## VORTEX

The name of Casella CEL has, for many years, been associated with the design and manufacture of personal sampling pumps for the occupational health and hygiene market. We were instrumental in the development of the very first personal air sampling pump; a prototype unit based on a United Kingdom Atomic Energy Authority (UKAEA) specification in the late 1950's. Our reputation for robust and reliable equipment has lead to Casella CEL being the first name in this field. This expertise has now been applied to the latest range of personal sampling pumps; the VORTEX family, which has been further enhanced by the introduction of microprocessors and surface mount technology. The VORTEX range of pumps has been developed to provide from 5ml to 20 litres/min sampling capability suitable for a wide range of applications including solvent fumes, asbestos clearance and personal sampling

### VORTEX STANDARD 2 SERIES

The VORTEX Standard 2 series may be used for any air sampling applications using flow rates of between 0.5 and 3.5 litres/min. It is suited to many of the 'Total' and 'Respirable' dust sampling techniques as detailed within the Health and Safety Executive publication *Methods for the Determination of Hazardous Substances 14/3*. The sampler is based upon an efficient diaphragm pump whose flow rate is precisely maintained by microprocessor control circuitry. A rechargeable nickel-cadmium battery provides typically in excess of 8 hours continuous operation and flow adjustment can be made over the complete range via the tactile keypad, eliminating the need for trimming tools. 'Pump on' and battery/limit LED's complete this simple, but effective, pump design.



of dusts. This range is available as individual pumps or as complete kits with the appropriate accessories to suit particular applications and is fully supported by our

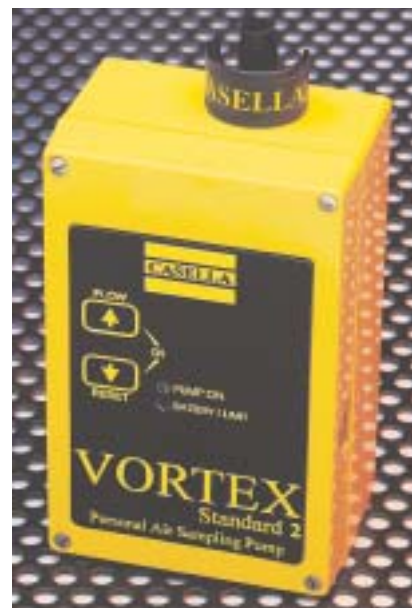
comprehensive service facility at Bedford. The Casella group also offers consultancy and analysis support services for personal air sampling.

### Features

- Low battery shut down
- Lightweight and portable
- Simple to operate
- 8 hours run time
- Flow compensation
- Flow adjustment via keypad
- Battery/limit LED
- Battery/limit audible alarm

### Applications

- Personal monitoring
- TWA and STEL monitoring
- Background monitoring



### Specification

Flow range	VORTEX STANDARD 2
Flow control accuracy	0.5 - 3.5 litres/min
Max pressure drop	±5% for selected flow
Nominal battery voltage	40cm H <sub>2</sub> O @ 2 litres/min, 15cm H <sub>2</sub> O @ 3.5 litres/min
Nominal battery capacity	4.8V
Run time	1.2Ahr
Recharge time	In excess of 8 hours
Operating temperature	14 hours
Dimensions	0 - 40°C
Weight	120 x 74 x 50mm
	500g

### Ordering Information

VORTEX Standard 2	158000B
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### Accessories and Spares

VORTEX Standard 2 battery charger	158046B
VORTEX Standard 2 5-way battery charger	158047D
Spare battery	158045B

### Contact Details

Sales	Tel: +44 (0) 1234 841468	Fax: +44 (0) 1234 841490	
Service	Tel: +44 (0) 1234 841468	Fax: +44 (0) 1234 841490	e-mail: info@casellagroup.com

VORTEX TIMER 2 SERIES

The VORTEX Timer 2 series has the many features already described for the Standard 2 series pump but with additional functions making this the ideal choice for most sampling techniques. The introduction of microprocessor control and surface mount technology provides precise and stable operation. Based around the efficient diaphragm pump with a flow controlled 0.5 - 3.5 litres/min range, the VORTEX Timer 2 series has a LCD timer display situated on the front panel. This display indicates the sample run time in minutes (1 minute resolution), which is needed for accurate calculation of the sampled volume. The timer can be reset to zero by activating the 'Reset' button located on the tactile keypad. This keypad also provides the flow control, eliminating the need for trimming tools. Two LED's provide 'pump status' indication i.e. 'pump running' and 'battery low/flow fault'. The 'flow fault' warning activates whenever the flow rate drops below its setting due to excessive back pressure, such as a tube restriction or filter blockage. Should the flow fault condition remain for 8 seconds then the pump automatically shuts down and the LED remains lit. The timer will hold the value at shutdown such that a valid sample volume can still be calculated; thus avoiding the wastage of valuable samples.

Features

- Elapsed timer
- Battery/limit LED
- Battery/limit audible alarm
- Low battery shut down
- Automatic flow fault shutdown
- Tactile keypad



- Lightweight and portable
- Simple operation
- 8 hours run time
- Flow adjustment via keypad

Applications

- Personal monitoring
- TWA and STEL monitoring
- Background monitoring

Specification

Flow range	VORTEX TIMER 2
Flow control accuracy	0.5 - 3.5 litres/min
Max pressure drop	±5% for selected flow
Nominal battery voltage	40cm H <sub>2</sub> O @ 2 litres/min, 15cm H <sub>2</sub> O @ 3.5 litres/min
Nominal battery capacity	4.8V
Run time	1.2Ahr
Operating temperature	In excess of 8 hours
Timer accuracy	0 - 40°C
Dimensions	<±10 seconds in 24 hours
Weight	120 x 74 x 50mm
	500g

Ordering Information

VORTEX Timer 2	159000B
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Accessories and Spares

VORTEX Timer 2 battery charger	158046B
VORTEX Timer 2 5-way battery charger	158047D
Spare battery	158045B

Contact Details

Sales	Tel: +44 (0) 1234 841468	Fax: +44 (0) 1234 841490	e-mail: info@casellagroup.com
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# 04 VORTEX POWER PLUS SERIES

## VORTEX POWER PLUS 2

The VORTEX Power Plus timer 2 series is designed for air sampling applications requiring flow rates up to 4.5 litres/min and can provide a run time nearing 11 hours whilst maintaining a light weight of only 525g. A tactile keypad provides control of the unit along with flow adjustment. An LCD timer display is provided which indicates the elapsed sample run time, essential for correct gravimetric calculations. Audible and visual alarms on battery low and pressure drop are some of the many features of this pump.

The VORTEX Power Plus 2 was developed with 'larger' pump users in mind and therefore considerable effort has been applied to the battery charging and management system. These developments have resulted in the VORTEX Power Plus Intelli-charger; a 19" unit providing charging and management for 5 pumps. These can be provided within an enclosure for up to 8 stations giving a total charging and storage of up to 40 pumps.

The charger monitors the battery condition and is capable of fast charging a fully discharged battery within 3 hours. Once the battery is fully charged the unit will automatically switch to 'trickle' charge, maintaining the pump in a ready condition. Additional 19" rack mounted Flow Meter and Flow Calibration stations complete the VORTEX Power Plus Personal Air Sampling (PAS) System.

### Features

- Lightweight and portable
- 11 hour run time
- High flow rate
- Battery management capabilities
- Audible/visual alarms
- Tactile keypad

### Applications

- Personal monitoring
- Monitoring full shifts
- Background monitoring
- Production facility monitoring
- TWA and STEL monitoring



VORTEX POWER PLUS 10-way intelli-charger

CASELLA  
CEL

Instrumentation  
Tel: +44 (0) 1234 844100  
Fax: +44 (0) 1234 841490



VORTEX IS

The VORTEX IS pump is an Intrinsically Safe (IS) version of the VORTEX Standard 2. It has been modified structurally and electrically so that it can be used safely in certain flammable atmospheres where an explosive risk exists. The pump, with it's IS certification, can also be used underground in mines and quarries. With its stainless steel case, and realible diaphragm pump, the VORTEX IS is the ideal personal sampling pump for 'Total' and 'Respirable' monitoring in harsh environments.

Features

- Intrinsically safe
- Robust stainless steel
- Low battery indication
- Pump running indicator
- 8 hour run time
- Lightweight and portable

Applications

- Personal monitoring in zoned areas
- TWA and STEL in zoned areas
- Background monitoring in zoned areas



04 VORTEX POWER PLUS SERIES

Specification

Flow range  
Flow control accuracy  
Max. pressure drop  
  
Nominal battery voltage  
  
Run time  
Operating temperature  
Timer accuracy  
Dimensions  
Weight

POWER PLUS TIMER 2  
1.5 - 4.5 litres/min  
±5% for selected flow  
50cm H<sub>2</sub>O @ 2 litres/min  
25cm H<sub>2</sub>O @ 4 litres/min  
6V (5x1.2V) incorporates  
'Polyswitch' short circuit protection  
Typically 11 hours @ 4 litres/min 20cm H<sub>2</sub>O  
0 - 40°C  
< ± 10 seconds in 24 hours  
120 x 74 x 50mm  
525g  
VORTEX Power Plus 2 Intelli-charger  
1 - 5 independent charging receptacles  
(19" rack-mounted enclosure, 3U high)  
Approx. 3 hours (700mA)  
80mA  
Negative delta V - prevents bulk overcharge  
0 - 30°C  
220 - 240V AC, 50 - 60Hz @ <150W  
483 x 132 x 350mm (front panel area)  
Approx. 4kg

VORTEX IS  
0.5 - 3.5 litres/min  
±5% for selected flow  
40cm H<sub>2</sub>O @ 2 litres/min  
15cm H<sub>2</sub>O @ 3.5 litres/min  
6V  
  
In excess of 8 hours  
0 - 40°C  
-  
125 x 85 x 50mm  
900g

Ordering Information

VORTEX Power Plus Timer 2	173005B	-
VORTEX IS	-	162005B

Accessories and Spares

5-way Intelli-charger	166006D	158047D
5-way Intelli-charger fitted in 3U Desktop enclosure	166081D	-
Flow Check Module fitted in 4U Desktop enclosure	166008D	-
Calibration Module fitted in 4U Desktop enclosure	166010D	-
Spare battery	166058B	B8383/8
Battery charger	-	B8436/Z

Due to the modular design concept based on standard 19" racking systems, the VORTEX Power Plus system can be custom configured to suit specific requirements, please contact the Casella CEL sales office for more details.

Contact Details

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## ASBESTOS SAMPLING PUMPS & ACCESSORIES

The asbestos head is designed to hold a gridded membrane for asbestos clearance or personal sampling.

## VORTEX ULTRA FLOW

The problem of asbestos is still with us and is the subject of stringent legislation for its removal and disposal. The requirement for quick sample collection and counting of airborne fibre in the shortest time possible means a far higher flow rate than with more conventional sampling methods is required. The VORTEX Ultra Flow is designed with this application in mind but also retains the portability of personal samplers. The instrument was the first within the VORTEX range to utilize a tactile, two-button on/off and flow setting control system. The robust metal case, built-in carry handle, and optional 'mast' are features which mean the unit is at home in asbestos clearance, leak checking, environmental and stack sampling applications requiring a 6 - 20 litres/min (free air) flow range. The unit's 7Ahr battery provides a typical run time of 5 hours through a 0.8 micron filter at 12 litres/min. An elapsed time counter, which can be reset via the tactile keypad, completes the features of the VORTEX Ultra Flow pump.

## Features

- Compact design
- Clearance sampling
- Optional mast for asbestos head
- Exposure sampling
- Rechargeable battery
- Flow compensation
- Wide flow range

## Applications

- Asbestos
- Personal
- Stack sampling
- Boundary monitoring
- TSP, PM10 and PM2.5 sampling



## Specification

### Flow range

### Max pressure drop

### Flow control accuracy

### Nominal battery voltage

### Nominal battery capacity

### Run time

### Operating temperature

### Dimensions

### Weight

## VORTEX ULTRA FLOW

6 - 20 litres/min (free air)  
6 - 12 litres/min (0.8 micron filter) 16 litres/min (GFA)  
200cm H<sub>2</sub>O @ 8 litres/min (0.8 micron filter)  
±2% (over 90 min)  
12V  
7Ahr  
5 hours (0.8 micron filter)  
0 - 40°C  
180 x 75 x 285mm  
4.3g

## Ordering Information

### VORTEX Ultra Flow

### VORTEX Ultra Flow battery charger UK

### VORTEX Ultra Flow battery charger EU

### Spare battery

### Asbestos Head

### Asbestos Sampling Head Support mast

171000D  
-CF36  
-CF35  
P123011  
P110004  
171006B

## Contact Details

### Sales Service

Tel: +44 (0) 1234 841468  
Tel: +44 (0) 1234 844146

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Fax: +44 (0) 1234 841490

e-mail: [info@casellagroup.com](mailto:info@casellagroup.com)



**VORTEX LO FLOW**  
Most toxic gases and vapours can be accurately evaluated by highly sensitive methods of chemical analysis, which means that far smaller samples need to be collected. In effect smaller volumes of air can be sampled than when sampling dust or fumes for gravimetric assessment. This, in turn, has made it possible to design and manufacture smaller personal sampling pumps specifically for this application. The VORTEX Lo Flow is manufactured to a design originally developed in the USA under the sponsorship of the National Institute of Occupational Safety and Health (NIOSH). The pump has a total flow range of 5 to 200ml/min which is selectable over two ranges and adjustable by the potentiometer mounted on the front of the unit. Calibration of the VORTEX Lo Flow is set by using a dry-flo, or bubble flow meter. The 'stroke counter' gives a simple but effective means of calculating the total volume sampled.

**Features**

- Intrinsically Safe
- Small and compact
- Robust stainless steel case
- Auto shut off and indicator
- 8 hour run time
- Simple operation

**Applications**

- Personal monitoring with sorbent tubes\*
- Sampling for gases with tedlar bags\*
- 'Grab sampling' from stacks
- TWA and STEL monitoring
- Background monitoring

(\*Refer to sampling accessories section for further details)

**Specification**

Intrinsically Safe	EEx ia IIC T5
Flow range	5 to 200ml/min (switch selectable range)
Flow control accuracy	±5% of pump stroke count linearly related to air flow
Max pressure drop	–
Nominal battery voltage	2.4V
Nominal battery capacity	0.5Ahr
Run time	In excess of 8 hours
Operating temperature	0 to 40°C
Dimensions	130 x 65 x 30mm
Weight	480g

**Ordering Information**

161000D

**Accessories and spares**

Battery charger	B8359/Z
Vortex 5-way battery charger	161006B
Spare battery	B8297/14

**Contact Details**

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#### BIRMINGHAM INTERNATIONAL AIRPORT

At Birmingham International Airport, the UK's 4th largest Airport, staff aim to minimise the impact of operations and activities on the environment. Historically residents in the local community complained of odours associated with kerosene. The cause of the odours was volatile organic compounds (VOCs). The Airport took these reports seriously. In a direct response to these concerns in 1995 the Environment Unit at Birmingham International Airport decided to begin monitoring VOC's in and around the airport and was in fact the first airport to carry out a monitoring program of this kind. Since the project was completed in December 1997 other airports have shown interest in the project and the methodology used by Birmingham International Airport.

A possible source of VOC's at airports is the incomplete combustion of aviation fuel (kerosene). This usually occurs during aircraft taxiing, engines idling and starting up and during the use of auxiliary power units. Birmingham International Airport purchased two Casella CEL SP15's, the predecessor to the VORTEX Lo Flow pump, as it was important for this survey that the pumps adhere to the British Standard BS 5501. The Casella CEL pumps were used to draw the air sample through a suitable VOC collection medium. The suggested

flow rate for this air quality monitoring is 45ml/min. This flow rate was easily selected using the potentiometer mounted on the front of the pump.

The monitoring sites were chosen according to national guidelines: in prominent, unsheltered positions avoiding other VOC point sources. As the aim of this monitoring survey was to assess the odours experienced by local residents the sampling took place in the vicinity of local communities. Angela Bryan Cemm, Environment Monitoring Officer, found that,

The Casella CEL pumps were ideal for our monitoring sites as their compact size meant they were inconspicuous enough to be left unattended at selected locations.

The environmental monitoring unit also purchased a Casella CEL Dry-flo flowmeter to allow the calibration of the air flow pumps before and after use.

The data collected was combined with data from the Ambient Air Quality Monitoring Station situated on the airfield, two rural control sites and an urban site in Solihull. The results of this monitoring survey were then analysed in conjunction with the Atmospheric Research and Information Centre (ARIC) based at Manchester Metropolitan University. The levels of VOC's at the chosen monitoring sites were found to be similar to the levels found at the

control sites and lower than at the urban site.

ARIC concluded that monitoring should be discontinued. The Environment Monitoring Working Group at Birmingham International Airport was satisfied that the survey was thorough enough to demonstrate that ambient levels of VOC's were very low and therefore not cause for concern. The Environment Monitoring Officers reported that they were pleased with the results of the project and the performance of the Casella CEL pumps,

"The pumps were very small and portable, easy to operate and gave concise readings."



#### VEDANI ITALSAE

A derelict sugar refinery that was abandoned over 20 years ago due to the sector crisis lies near Venice, Italy. Everybody in the town was aware that behind the 160,000 square metres of surface lay 750 cubic metres of asbestos. This extremely carcinogenic material has been used in the past to thermally insulate tanks and pipelines, gaskets and roofs of industrial plants.

Decontamination of the site was a serious problem that had to be faced. A specialised company, Professional S.A.S., located in Milan was entrusted with the job. Two safety requirements had to be met during the removal of the asbestos:

- The safety of the workers had to be guaranteed in the structurally unsafe building
- The dispersion of asbestos fibres into the environment had to be prevented.

The first step was to atomise specific fixing fluids onto all the surfaces and biodegradable fixing fluids onto the ground while the unsafe structures were removed. The second step was the creation of enclosures in every room; more than 100 structures were built and each of them put under negative pressure.

Vedani Italsae, Casella's Italian distributor, specialises in asbestos abatement. They provided Professional S.A.S. with materials and equipment as well as technical advice on the most innovative and effective abatement technology. Laura Segato at Vedani explained why the Casella CEL VORTEX Timer Personal Sampling Pumps were chosen to help meet the demands of this project.

"The VORTEX pumps were already well known and appreciated in previous projects for their simple use and extreme precision."

The team carried out 12 months continuous sampling, together with MOCF analysis, to be certain that the operations were performed correctly. Daily samples were taken at 1 litre/min. for 8 hour periods in and around the sugar refinery to verify that no fibre leakage had occurred. Samples were also taken inside the abatement area

to assess the minimisation of fibre dispersion by the special wetting agents, inside decontamination units and in particular in the after-shower cabinet, to ensure that workers leaving the site had been properly decontaminated.

When the work had been completed Azzini Idelmo, the Chief Executive of Professional S.A.S. was pleased with the performance of the Casella CEL VORTEX pumps,

"Thousands of samples taken with no problems, I am very impressed with the efficiency of these pumps."



To support our range of sampling pumps we are able to offer a comprehensive selection of the required sampling media and accessories necessary to undertake a full analytical survey.

Should you require any item that is not listed, please contact the Casella CEL sales office for further assistance.

#### DUST & FUME SAMPLING ACCESSORIES

1. Asbestos cowl
2. 37mm Open faced Filter Holder
3. 25mm open faced filter holder
4. Conical Inhalable Sampler (CIS)
5. IOM Head
6. Total Inhalable Head, (7HH)
7. A selection of cassettes for the IOM and the CIS head
8. Dewell Higgins Plastic Cyclone



#### CONICAL INHALABLE SAMPLER (CIS)

The Conical Inhalable Sampler is a cassette type filter holder for Inhalable sampling of general dusts using a 37mm filter. For use at 3.5 litres/min.

#### TOTAL INHALABLE SAMPLER

Also known as the 7 Hole Head or Man Made Mineral Fiber (MMMF) head, this is the most commonly used sampling head. The flow setting is 2 litres/min.

#### ASBESTOS HEAD

This sampling head is designed to hold a gridded filter for asbestos clearance or personal sampling.

#### PUF FILTERS

The PUF is a series of filters for use in the Conical Inhalable Sampler. These cassettes contain single or dual foam inserts (PUF filters) as well as the filter, which enables the sampler to be used for PM2.5, PM10 and Respirable sampling in addition to Inhalable sampling. The advantage of this approach to size-selective sampling is that all three fractions can be measured simultaneously, and personal sampling of PM10 and PM2.5 can at last be carried out. The development of these cassettes and PUF inserts has been carried out by the Health and Safety Laboratory (HSL) and was presented at the Aerosol and British Occupational Hygiene Society's 1997 conferences. This work has since been validated enabling Casella CEL to offer these cassettes and foam 'plugs' for PM10, Respirable and PM2.5. The cassettes are supplied complete with a stainless steel filter grid and are manufactured from a conductive plastic. This plastic has very low moisture absorption qualities to ensure stability in varying sampling conditions.



#### IOM HEAD

The I.O.M. inhalable dust sampler is now firmly established both in Europe and America. Using a cassette system, which eliminates direct handling of the filter paper and closely simulates the particle collection behaviour of the nose and mouth, it is a true inhalable sampler as specified in MDHS 14/3 and the ISO/CEN criteria.

The IOM Head allows the collection of many different dust fractions, either individually, or

at the same time. By using the Polyurethane foam (PUF) plugs in the inlet of the IOM it is now possible to collect two different fractions of dust at the same time, therefore saving valuable time and money. By using the correct combination of foams it is possible to collect combinations of Inhalable, Thoracic or Respirable dust. The IOM sampling head is to be run at 2 litres/min.



## RESPIRABLE CYCLONE

This unit is manufactured from conductive plastic. The air is drawn into the bottom of the unit where a cyclone is created, the larger particles are spun out into the base of the cyclone and the lighter respirable particles are drawn through the cassette onto the filter. The sampling pump is to be run at 2.2 litres/min. Plastic cassettes for use with this head are sold in packs of five.



## ROSIN / SOLDER FUME HEAD

The Solder fume head is used to sample for the fume generated from rosin-cored solder as used in the electrical and electronic industries. Uses 13mm filters at a flow rate of 1 l/min for long term samples or 2 l/min for short term samples



## FILTER MEDIA

We are able to supply a variety of filters, ranging from the standard GF/A and MCE Filters as well as a range of other specialist filters required for Occupational Health Sampling. These can be supplied pre-weighed if required. A full range of PUF filters for sampling different size fractions is also now available.



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### Ordering Information

Conical Inhalable Sampler (CIS)  
Cassettes for CIS  
Total Inhalable Sampler (7HH)  
Asbestos sampling head with cowl  
IOM sampling Head  
Plastic Cassettes for IOM  
Plastic Cyclone  
Rosin/Solder Fume Head  
25mm Open Faced Head (metal)  
37mm Open faced head (plastic)  
Single hole head for lead  
Filter head for welding fume

### SAMPLING HEADS

P118200  
P118201  
B8254/Z  
P110004  
P109009A  
P109010  
116000B  
P109047  
B8255/Z  
B7632/Z  
B8221/Z  
A8299/Z

### Ordering Information

Filters, 25mm GFA  
Filters, 37mm GFA  
Filters, pre-weighed 25mm GFA  
Filters, pre-weighed 37mm GFA  
Filters, 25mm gridded membrane 0.8(m  
Filters, 25mm membrane 0.8(m (MCE)  
Filters 13mm dia for Rosin head

### SAMPLING MEDIA

P102005  
P102006  
P117000  
P117001  
P102002  
P102009  
P109045

### Ordering Information

PUF PM2.5 filters for CIS  
PM2.5 Cassette for CIS  
PUF respirable filters for CIS  
Respirable Cassettes for CIS  
PUF PM10 filters for CIS  
PM10 Cassettes for CIS  
PUF thoracic filters for IOM  
PUF respirable filters for IOM  
PUF PM10 filters for IOM

### PUF FILTERS FOR CIS AND IOM HEADS

P118204  
P118203  
P118208  
P118207  
P118206  
P118205  
P109014  
P109015  
P109016

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e-mail: [info@casellagroup.com](mailto:info@casellagroup.com)



GAS AND VAPOUR SAMPLING

For Gas and vapour monitoring we are able to supply a comprehensive range of Gas Adsorption Tubes and Gas Bags to fit all your Personal Occupational Health monitoring requirements.

SOLVENT DESORPTION TUBES

The sorbent tube follows original protocol set by NIOSH and other methods for sampling gas/vapour compounds from various emission and workplace sources.

Charcoal

- 1. LARGE 400/200MG PK/50:  
Adsorbent: Activated coconut charcoal (20/40)  
Dimensions (mm) OD x Length: 8 x 100
- 2. SMALL 100/50MG PK/50  
Adsorbent: Activated coconut charcoal (20/40)  
Dimensions (mm) OD x Length: 6 x 70



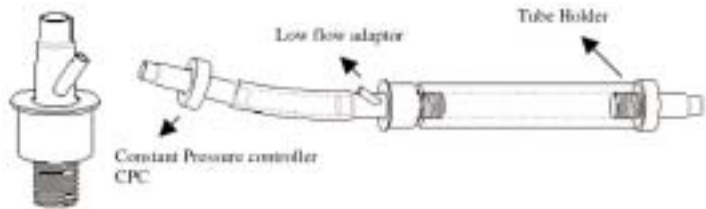
Silica Gel Tubes

- 3. LARGE Silica Gel with glass fibre filter (400/200), For acid mists  
Length 7x100 (pk 50)
- 4. SMALL 150/75MG PK/50  
Adsorbent: Activated silica gel (20/40)  
Dimensions (mm) OD x Length: 6 x 70  
(Other tubes are available on request)
- 5. Tube holder Small
- 6. Tube Holder Large
- 7. Tube cutter



LOW FLOW ADAPTOR

The Low Flow adaptor enables the Casella CEL pumps to be transformed into a low flow model enabling it to be used to sample for gases and vapours. Two of these can be linked together for dual tube sampling. Items sold individually, or as complete assembly.



Ordering Information

1. Large Charcoal Tubes	P109019	7. Tube cutter	P109025
2. Small Charcoal Tubes	P109020	8. Low flow adaptor	P109026
3. Small silica gel tubes	P109021	9. CPC	P109027
4. Large Silica gel tubes	P109022	10. Low flow Adaptor assembly(small)	P109031
5. Small tube holder	P109023	11. Low flow adaptor assembly (large)	P109032
6. Large tube holder	P109024		

Contact Details

Sales	Tel: +44 (0) 1234 841468	Fax: +44 (0) 1234 841490	
Service	Tel: +44 (0) 1234 841466	Fax: +44 (0) 1234 841490	e-mail: info@casellagroup.com

Bubblers and Impingers

These borosilicate glass impingers (for particles) and bubblers (for gases and vapours) are ideal for methods that require collection of airborne contaminants by drawing them into a solution.

Standard Midget Impinger and Bubbler

Reservoir Capacity: 25mL  
Impinger: standard glass stem  
Bubbler: fritted glass stem

Holder

Use this holder to conveniently wear the bubbler for personal sampling.



Threaded Midget Impingers and Bubblers

Make your sampling more convenient with these borosilicate glass apparatus. The vial can be capped after sampling, thus reducing sample handling in the field (no transferring of samples from reservoir to a separate vial).

- 1. Threaded Midget Impinger  
Vial Capacity: 22mL
- 2. Threaded Midget Bubbler  
Vial Capacity: 22mL
- 3. Spill-Resistant Midget Bubbler  
Vial Capacity: 40mL



## IMPINGER TRAP

Trap is used with bubbler and impingers to prevent contaminants entering and damaging the sampling pumps.



In line impinger trap



## ARNOLD BUBBLER

The Bubbler is used for wet chemistry methods of sampling airborne contaminants, such as acid mists. The unit is loaded with a suitable collection medium (e.g. de-ionised water) and connected to a pump unit. The contaminated air is drawn through the Bubbler and the pollutant is 'bubbled' out into the liquid for analysis.

### Ordering Information

Threaded Midget: Impinger	P109050
Threaded midget bubbler	P109051
Spill resistant midget bubbler	P109052
Standard bubbler	P109053
Standard impinger	P109054
Holder	P109055
In line Impinger trap	P109018
Arnold bubbler	P100011

## GAS SAMPLING BAGS

Gas sampling bags made of Tedlar are used for *grab sampling* of gases and vapours. They are used in various applications including stack emissions and landfill monitoring. Bags can be supplied with stainless steel valves or with additional septum rings.

Sizes available:  
1.0/5.0 & 12LTRS (sold in batches of 10.)  
25L (5 off)  
(bags may also be ordered singly.)



Bag with valve and septum



Valve assembly

### Ordering Information

	SINGLE SS VALVE (pkt 10)
1.0L	P109033
5.0L	P109034
12.0L	P109035
25L	P109036
Single 1L	P109037
Single 5L	P109038

### Ordering Information

	with Septum
1L	P109039
5L	P109040
12L	P109041
25L	P109042 (Pk 5)
Single 1L	P109043
5L	P109044

### Contact Details

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Service	Tel: +44 (0) 1234 841468	Fax: +44 (0) 1234 841490	e-mail: info@casellagroup.com



### 3M Badges

The monitoring of exposure to organic vapours is an important function for health and safety personnel within a wide range of industries. Any process, which involves high levels of organic vapours (e.g. adhesive fumes), presents a potential exposure risk to personnel.

At the time of this catalogue going to print, Casella CEL are negotiating to become the only Approved 3M Occupational Health and Environmental Safety Analytical Service Provider.

3M passive samplers are simple and effective devices ideally suited to personal monitoring. They collect organic, airborne contaminants using the scientific principle of diffusion and meet or exceed 25% accuracy (at a 95% confidence level) for a wide range of chemical compounds found in the workplace. They are convenient to use, with no batteries, hoses, pumps or equipment to calibrate. Their ease of use makes monitoring a simple process; just clip the

badge to clothing near to the breathing zone (e.g. shirt lapel, collar or pocket) for a period of time; typically an 8-hour shift and then after exposure, return the badge for analysis. Exposure can be calculated for a number of contaminants from a single badge if required. The shelf life of all 3M passive sampling badges is 18 months.

The 3M badges come in four variations:

#### The 3M 3500 series

A charcoal sorbent wafer for easy collection of over 125 organic vapours. Analysis may be performed by gas chromatography either in-house, or by using a pre-paid analysis service from us.

#### The 3M 3520 series

An organic vapour monitor with back-up section containing primary and back-up sorbent pads for sampling organic vapours which are difficult to collect or are in high humidity conditions. Especially suited for monitoring compounds like vinyl chloride, acrylonitrile, butadiene and methylene chloride, for which activated carbon shows limited capacity.



#### The 3M 3550 series

An ethylene oxide badge designed for monitoring personnel or work areas in the pharmaceutical, health care and chemical industries where ethylene oxide is a major concern.

#### The 3M 3720 series

A formaldehyde monitor designed for health care, laboratory, chemical, pulp/paper, foundry and textile industries where formaldehyde is a major concern.

+* Acetone (1.5)	Carbon Tetrachloride (8)	n-Heptane (8)	Perchloroethylene (8)
* Acetonitrile (2)	Cellosolve Acetate (8)	n-Hexane (8)	Phenyl Ether (8)
Acrylonitrile (8)	Chlorobenzene (8)	iso-Amyl Acetate (8)	n-Propyl Acetate (8)
Allyl Alcohol (8)	o-Chlorostyrene (8)	iso-Butyl Alcohol (8)	n-Propyl Alcohol (7)
Amyl Acetone (8)	o-chlorotolulene (8)	Isopropyl Acetate (8)	Propylene Dichloride (8)
n-Amyl Alcohol (8)	Chloroform (8)	*Isopropyl Alcohol (4)	Propylene Glycol Mono Methyl Ether (8)
s-Amyl Alcohol (8)	Cumene (8)	Methyl Acrylate (8)	Propylene Glycol Mono Methyl Ether Acetate (8)
Benzene (8)	n-Decane (8)	Methyl t-Butyl Ether (MTBE) (8)	Stryene (8)
Benzyl Chloride (8)	Diacetone Alcohol	Methyl Butyl Ketone (MBK) (8)	1,1,2,2-Tetrachloroethane (8)
Bromoform (8)	o-Dichlorobenzene (8)	Methyl Cellosolve (8)	Toluene (8)
t-Butyl Acetate (8)	p-Dichlorobenzene (8)	Methyl Cellosolve Acetate (8)	1,1,1-Trichloroethane (Methyl Chloroform) (6)
n-Butyl Acetate (8)	Diisobutyl Ketone (DIBK) (8)	* Methyl Chloride (3520 only) (4)	Trichloroethylene (8)
s-Butyl Acetate (8)	Epichlorohydrin (8)	+ Methyl Ethyl Ketone (MEK) (8)	* 1,1,2-Trichloro-1,2,2-Trifluoroethane (1)
Butyl Acrylate (8)	Ethyl Acetate (6)	Methyl Isobutyl Ketone (MIBK) (8)	+ Vinyl Acetate (8)
n-Butyl Alcohol (8)	Ethyl Acrylate (8)	Methyl Methacrylate (8)	Vinyl Toluene (8)
s-Butyl Alcohol (8)	Ethyl Benzene (8)	Methol Propyl Ketone (8)	Xylene (8)
t-Butyl Alcohol (8)	Ethylene Dichloride (EDC) (8)	Naphtha (VM&P) (8)	Total Hydrocarbons as n-Hexane
Butyl Glycidyl Ether (8)	* Ethyl Ether (4)	n-Octane (8)	

\* The number enclosed in brackets is the recommended sampling period in hours. This time has been estimated using the capacity of the 3500 organic vapour monitor, a relative humidity of <70% and the 1995 ACGIH TLV's. (Use of the 3520 allows the sampling time to increase).

\* This table shows only a selection of the compounds available, should you require additional information, please contact the Casella CEL sales office.

#### KEY:

\* Because of their high vapour pressures (low boiling points), the starred (\*) compounds are best sampled initially with the 3520 monitor (with back up section). Subsequent sampling may be done with the 3500 monitor if demanded by 3520 results.

+ Certain compounds (e.g. acetone, methyl ethyl ketone, vinyl acetate, etc.) may show a decreased recovery when sampled in relative humidity.

Refrigerate and/or expedite for analysis to help ensure accurate results.

#### Ordering Information

Organic vapour monitor 3500 (pack of 10)	3M3500
Organic vapour monitor with back up section 3520 (pack of 5)	3M3520
Ethylene oxide monitor 3551 (pack of 5)	3M3551
Formaldehyde monitor 3721 (pack of 5)	3M3721
Pre-paid analysis for 3500 monitors	P109008

#### Contact Details

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Service	Tel: +44 (0) 1234 841466	Fax: +44 (0) 1234 841490	e-mail: info@casellagroup.com



## ASBESTOS SAMPLING ACCESSORIES

### Acetone Vaporiser

The Acetone Vaporiser is specifically designed for the rapid and permanent mounting of membrane filters as used for sampling and analysing asbestos fibres. The unit is compact and portable for site or laboratory use and takes just two minutes to reach operating temperature.

Laboratories that provide analytical services to the asbestos removal industry have a high demand for this unit. The instrument utilises a very small amount of acetone and takes just five seconds to mount each filter. This simple and fast operation of the Acetone Vaporiser means it can be transported to site to reduce the time taken to obtain results from asbestos removal operations. The use of this type of instrument is well documented in Methods for Determination of Hazardous Substances (MDHS) 39 & 100, 'Asbestos fibres in air', published by the Health and Safety Executive in the UK. This document also covers sampling of asbestos and may have equivalents under local health and safety rules.

#### Features

- Portable
- Simple to operate
- Quick procedures



#### Applications

- Field analysis
- Laboratory applications
- Asbestos removal

### ASBESTOS CORER

The Asbestos Corer is used to collect samples from suspect materials such as pipe lagging, wallboard, vinyl asbestos, etc. with the minimum of dust generation. The kit consists of 5 interchangeable core tubes, one large, easy grip handle, a push rod for removing sample, a cleaning brush, 50 sample bags and a sharpening tool to renew the cutting edge of the tubes. The kit is supplied in a robust plastic carry case.



#### Specification ACETONE VAPORISER

Dimensions	92x132x200mm
Weight	1.9kg
Construction	Stainless Steel
Power Requirement	240V AC

#### Ordering Information

Acetone Vaporiser 240V AC	P112041 (110V AC and 12V available on request)
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#### Ordering Information

Asbestos Corer	P109048
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#### Contact Details

Sales	Tel: +44 (0) 1234 841468	Fax: +44 (0) 1234 841490	
Service	Tel: +44 (0) 1234 841466	Fax: +44 (0) 1234 841490	e-mail: info@casellagroup.com



### DRYCAL CALIBRATOR

DC-Lite is a revolutionary dry primary flow meter design that provides users with a primary flow standard for industrial hygiene, environmental and laboratory applications. DC-Lite combines patented DryCal(r) near frictionless piston technology with advanced photo-optic sensing to obtain volumetric flow readings quickly and accurately. It eliminates the need for messy soap film solutions. The DC-Lite is light, compact and low cost. Housed in a small case, the DC-Lite fits easily into a slim

briefcase for convenient transport. Each unit is power-packed with a variety of popular user conveniences such as AC/DC operation, a large alphanumeric LCD, push-button read and auto-read, automatic shut off, and a parallel printer port that interfaces with most standard IBM compatible printers.

Specification	DC-LITE CALIBRATOR	
Model	Range	Accuracy
DCL-L(low flow)	10ml-500ml/min	+/-1%
DCL-ML(medium/low)	50ml-5.0L/min	+/-1% 50-ml-2.0L/min +/-3.5% 2.0L-5.0L/min
DCL-M (medium flow)	100ml-12.0L/min	+/-1% 100ml-7.0L/min +/-1.25% 7.0L-12.0L/min
DCL-MH9medium/high)	200ml-20.0L/min	+/-1% 200ml-20.0L/min
DCL-H (high flow)	500ML- 30L/MIN	
Battery System	6V rechargeable sealed lead acid	
Operation time:	6-8 hours typically	
Size:	127x127x50 mm	
Weight:	1.2 kg	
Operation temperature:	0-55°C	
Humidity:	0-70% non condensing	
Warranty:	Instrument 1year Battery 6 months	



### ROTAMETERS

Rotameters have been the traditional method of calibrating the flow via a sampling head prior to undertaking a Personal Exposure measurement.

Rotameters can be calibrated to a UKAS Standard upon request with purchase. Rotameter stands can be easily dismantled for compact storage and transfer in between sites.

### DRY FLOW CALIBRATOR

Airflow is measured by displacement of a near frictionless glass float within a graduated glass cylinder. Dry Flow calibrators can be used in order to calibrate low flows,(0-200ml/min) where the flow is measured directly after a measured time period (60 or 120 seconds).

### Ordering Information

DC Lite L,	P112100*
DC Lite ML	P112101*
DC Lite M,	P112102*
DC Lite MH	P112103*
DC Lite H	P112104*
Dry-Flo Flowmeter	P112046* *Prefix part number with /UK for supply with UK charger/plus or EU for European.

### Ordering Information

	ROTAMETERS
Flowmeter, 0.3-3.0 litres/min	P109046
Flowmeter, 0.6 to 5.0 litres/min	P111014
Flowmeter 2-25l/min	CM357
Flowmeter Stand	100890B

### Contact Details

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Service	Tel: +44 (0) 1234 844146	Fax: +44 (0) 1234 841490	e-mail: info@casellagroup.com

## THE MICRODUST PRO

The Microdust pro from Casella CEL is a portable, real time monitor for assessing the concentration of suspended particulate matter. It is probably the most versatile instrument available with the ability to measure from  $1\mu\text{m}-3$  to  $2500\text{ mgm}-3$ .

It is the only hand-held real-time dust monitor on the market capable of graphically presenting variations in dust concentration on a real time scrolling graph - no longer is it necessary to wait to analyse results on a PC.

### Features

- An incredible measurement capability from  $1\mu\text{m}-3$  to  $2500\text{ mgm}-3$
- Comprehensive data-logger providing over 15,700 data points
- Detachable probe for identification of problem areas
- Options for TSP, PM10, PM2.5 or ISO Respirable measurement
- Instrument software calibration and zero routines
- 4 user defined calibration routines available for differing dust types
- Option of alkaline or rechargeable batteries
- 32bit WinDust pro PC software

### Applications

- Occupational health and safety monitoring
- Walk through surveys
- Site boundary monitoring and environmental measurement
- Industrial process monitoring
- Testing respiratory equipment or air filtration efficiency
- Research activities

### Operation

The Microdust pro measures particulate concentrations using a near forward angle light scattering technique (figure 1). Infrared light of 880nm wavelength is projected through the sensing volume where contact with particles causes the light to scatter (figure 2). The amount of scatter is proportional to the mass concentration and is measured by the photo-detector. By using a narrow angle of scatter (12-20) the majority of scattered light is in the diffracted and refracted components, which minimises the uncertainty associated with particle colour, shape and refractive index.

### Concentration range

The Microdust pro has the advantage that there is only one model which covers the entire measurement range (0 -  $2500\text{ mgm}-3$ ). It is possible to "fix" the range of the instrument, or have it as an "auto-ranging" device.

### Display

The pro incorporates a 128 x 64 pixel graphics LCD with backlight. Dust concentrations are presented in two unique ways:

- Graphical representation - the Microdust pro is the first hand-held real-time particulate measuring instrument to have



a scrolling graph of dust concentrations (figure 3). The graph is able to show a continuous trace over a number of time-bases. These may be set on the X-axis at 100 seconds, 200 seconds, 15 minutes and 1 hour. The Y-axis may be auto-ranging or fixed.

- Numerical values - instantaneous concentrations are displayed, as well as values for the Time Weighted Average (TWA) and maximum concentrations. These values can be reset at any time by a "one button" reset.

### Calibration

Each Microdust pro is individually factory calibrated, using a gravimetric technique. The instrument can be returned to this "factory" calibration setting at any time during its life by the use of a non-degradable calibration insert (supplied).

An individual gravimetric calibration is also possible. This involves the collection of a gravimetric (filtered) sample of the dust after it has passed through the probe optics. In this way, two averages are collected over the exposure period. One is from the filter, whilst the other is provided by the averaging function within the instrument. It is then possible to derive the difference in these two figures and correct accordingly (figure 4).

Additionally, it is possible to name and store 4 user defined calibration values within the instrument and select these according to the situation. All these procedures are accessible through the easy to use menu structure.



### Data-logging

The Microdust pro features an internal logger which can store up to 15,700 data points over 32 separate runs. The logging interval can be set from 1 second to 10 minutes. At 5 seconds, it is possible to record 22 hours of data; at 5 minutes, this equates to a total logging time of 50 days. Recorded values include:

- Average concentration between each logged point
- Summary maximum & average concentration for each run
- Date and time stamp

### Software

The WinDust pro software offers the user the ability to perform the following functions:

- Create a "profile" for the instrument. This specifies the logging interval, operating parameters, and an "identifier" or name for the instrument. This is particularly useful when more than one instrument is owned (figure 5).
- Transfer this control profile from the PC to the instrument.
- Recover data from the instrument
- Production of line graphs based upon historical data (figure 6)
- Tabular and report presentation of data files
- Real time presentation of prevailing conditions via the RS232 connection

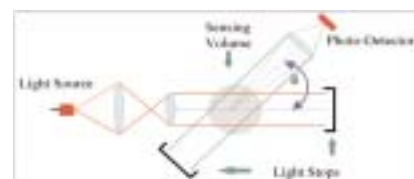


Figure 1



Figure 2



Figure 3

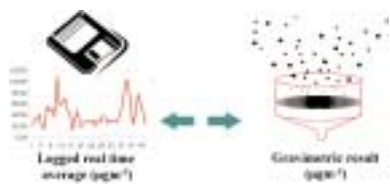


Figure 4.



Figure 5.

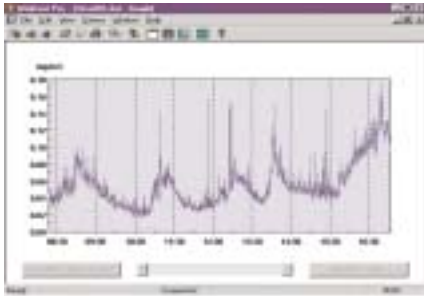


Figure 6.

#### Operation

Sensing Technique:	Near forward light scattering - 880nm infra red
Ranges:	All instruments provide 0 to 2500 mgm-3 over four ranges as standard: 0 - 2.5, 0 - 25, 0 - 250, 0 - 2500 mgm-3 Active range may be fixed or auto-ranging
Resolution:	0.001 mgm-3 (1µgm-3)
Operating Temp Range:	0 to 50°C (non condensing)
Storage Temp Range:	-20°C to +55°C
Zero Stability:	±0.002 mgm-3 /°C
Span Stability:	<0.7% FSD /°C

#### Power

Battery:	4 x AA / MN1500 cells - Alkaline or rechargeable NiCd
Operating Duration:	Alkaline (2700mAh) typically >20 hours NiCd cells (950mAh) typically >9 hours Internal NiCd fast charger circuitry N.B. Charger may be disabled for dry cell operation.
Battery Charging:	Universal input voltage range 100-240Vac, 47-63Hz

#### General

Analogue Output:	0 to 2.5 VDC FSD, 500Ω output impedance
Keypad:	7 key tactile membrane
Weight:	Instrument only = 0.97Kg (complete kit in carry case 4.5 Kg)
Dimensions:	Probe = 35mm Ø x 290mm total length Instrument H x W x D = 245 x 95 x 50mm Carry Case H x W x D = 135 x 490 x 370mm

#### Display

Display:	128 x 64 pixel LCD graphics panel with backlight
Displayed Values:	Rolling average concentration over a user selectable period (1 to 60 seconds)
Instantaneous reading:	Average concentration since power on or reset
Time weighted Average:	Maximum concentration since power on or reset
Maximum value:	Real time graphs of dust concentration
Scrolling Graphs:	Selectable time-base periods of 100 / 200 seconds, 15 minutes or 60 minutes Y Axis may be auto-ranging or fixed

Battery voltage:

Battery Voltage with status icon

#### Calibration

Factory Calibration:	Traceable isokinetic technique (wind tunnel) and ISO 12103-1, A2 fine test dust Dust box calibration for high concentrations
User Calibration:	Four user defined calibration settings available
Routine Calibration:	Software calibration for zero and span setting Optical calibration filter supplied (restores factory calibration)

#### Data Logging

Internal Memory:	64K EEPROM providing 15,700 data points
Logging Interval:	Adjustable from 1 to 600 seconds
Recorded Values:	Individual, average and max / min concentrations over logging period
Serial Interface:	RS232 up to 38.4K baud IrDa (Future expansion / optional extra)

#### Software

WinDust pro provides a friendly graphical interface for instrument configuration, data download and graphical report presentation	
Operating System:	Microsoft Windows 95, 98, NT or 2000
Requirements:	IBM compatible PC with RS232 serial port, 8Mb RAM, FDD, HDD, VGA colour graphics

#### Ordering Information

Microdust Pro in carry case	176000A	
Accessories		MICRODUST PRO Kit (176000A) includes:
Gravimetric dust adapter	103214B	Microdust Pro 0 - 2500mgm <sup>-3</sup>
Aspirated adapter	103187B	Individual calibration insert & Clean air bellows
Respirable dust adapter	103182B	Rechargeable batteries (x4)
Size selective adapter	151280B	Universal mains PSU (110V/240V ac) with UK, Europe and USA plug adaptors
Iso-kinetic adapter (for use with stack sampler)	103396B	Windows Windust Pro software & RS232 communication cable
In car charger	176086B	Hard carrying case



## MICRODUST 880 IS

The MICRODUST is an intrinsically safe real-time monitor of dust and aerosol levels in the workplace. The tried and tested method of forward light scatter detection has been further enhanced in the MICRODUST to provide users with not only the ability to detect airborne dust but also to record data for subsequent analysis. This, coupled with the instrument's Intrinsically Safe capabilities, makes it the ideal survey tool for portable and fixed applications in hazardous or non-hazardous environments. The MICRODUST provides the highest degree of sensitivity and the detachable measurement probe allows readings to be taken in relatively inaccessible areas. The versatility of this range of instruments is further enhanced with the provision of a very wide range of sensitivities from 1µg/m3 to 25g/m3.

With the datalogging versions this basic menu is supplemented with the 'logger menu' which allows the user to select the logging interval, logger mode and the elapsed log time. All these functions are accessed from the tactile membrane keypad; another key feature of the microprocessor controlled MICRODUST.

### Features

- Intrinsically safe
- Internal 30000 record datalogger
- Hand held
- Measurement of a wide range of particulate
- Choice of ranges and options
- High sensitivity
- Instantaneous read out
- Detachable measurement probe
- Rechargeable batteries and battery check indicator
- Twin purge for optical cleaning
- RS232 or analogue output

### Applications

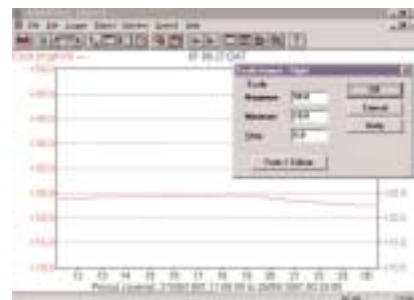
- Walk through surveys
- Workplace monitoring
- LEV filter efficiency assessments
- Ambient air quality
- Indoor air quality
- COSHH surveys
- Process monitoring
- Dust emission checks
- Boundary emission checks



## Windows Software



Configuration display



Graphical display

### Applicable Standards

- EN 0481 Workplace atmospheres
- EN 0838 Workplace atmospheres - Intrinsic Safety
- EN 50014 1993 Electrical apparatus for potentially explosive atmospheres - General requirements
- EN 50020 1995 Electrical apparatus for potentially explosive atmospheres. Intrinsic Safety 'I'

### Specification MICRODUST 880mm

Range 0-2.5 & 0-25 mg/m <sup>3</sup>	151146A
Range 0-25 & 0-250 mg/m <sup>3</sup>	151147A
Range 0-250 & 0-2,500 mg/m <sup>3</sup>	151148A
Range 0-2,500 & 0-25,000 mg/m <sup>3</sup>	151149A

### Accessories and Spares

Kit complete with charger, cleaning bellows trimming tool, handle, hard carrying case	P104100
Mains charger 240V AC	151090B
Mains charger 110V AC	151181B
Spare battery	151081C
Windows software with RS232 cable	151163A
Trimming tool	-HK302
Air cleaning bellows	102933A
Handle	151210A
Leather instrument cover	151240C
Hard carrying case	151182B

### Contact Details

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MICRODUST/PRO SAMPLING ADAPTORS

Optional adaptors are available for use with the MICRODUST range to ensure accurate measurements when used in static monitoring applications, as well as providing a filtered sample for calibration and characterisation.

The MICRODUST must be aspirated when used in fixed-site applications. A fan-driven aspirating unit (1) can be used to draw all suspended particles through the probe for static sampling in either ambient or occupational monitoring. If, however, you require gravimetric samples for calibration or further analysis, then one of the adaptors using in-line cassette type filter holders can be applied. These take the form of either a 'total inhalable' (gravimetric) adaptor (2) or the respirable adaptor (3), which are in turn connected to a personal sampling pump and are used in line with standard MDHS procedures. The filter holders support either 25 or 37mm filters and can be used to check the calibration of the instrument for a pre-defined aerosol monitoring application. Comparison between the logged reading and the gravimetric filter result can be used to optimise the instrument's calibration to a specific dust type. Both adaptors fit and lock over the measuring chamber using 'O' rings to seal the critical areas.

The probe clip, which is attached to the side of the instrument, has a tripod-mounting bush to help with fixed site monitoring.



SIZE SELECTIVE ADAPTER

The accessory range for the MICRODUST has been further expanded to include the latest in porous polyurethane foam filters (PUF filters) for size selective sampling of PM10, respirable or PM2.5 dust. This new technology is in the form of an adapter, used in conjunction with a VORTEX personal sampling pump. The adapter has a modified Conical Inhalable Sampler (CIS) inlet and cassettes, to hold the required foam 'plugs' that suit the appropriate sampling strategy.

The foam plugs were developed from work first reported by the Health and Safety Laboratory (HSL). The correct foam filter specifications and dimensions to yield the desired aerosol selection characteristics were identified during the HSL trials and provide elimination of particle sizes greater than PM10, respirable or PM2.5 (as appropriate). The larger particles become trapped and collect within the foam matrix, while all particles below these 'cut points'

pass through the PUF filters and into the MICRODUST measuring chamber, providing an instantaneous and logged reading. After passing through the MICRODUST, the particulate is then collected on to a 25 or 37mm GF/A filter for gravimetric analysis if required. The adapter is designed for use at 3.5 litres/min., as recommended for the standard CIS in MDHS 14.

This latest addition to the MICRODUST allows it to be used for real-time personal monitoring of PM10, PM2.5 and respirable fractions of particulate.

- 1. ASPIRATED ADAPTOR
- 2. RESPIRABLE DUST ADAPTOR
- 3. MICRODUST PRO WITH GRAVIMETRIC ADAPTOR & PUMP



Specification	MICRODUST
Sensing technique	Near forward light scattering
Infra red wave length	880nm
Range 0 - 2.5mg/m³	1µg/m³
Range 0 - 25mg/m³	10µg/m³
Range 0 - 250mg/m³	100µg/m³
Range 0 - 2.5g/m³	1mg/m³
Range 0 - 25g/m³	10mg/m³
Operating temperature	0 - 50°C
Power supply	7.2V 800mA Ni-Cd battery
Operating time	Typically >10 hours (>8 hours for 0 - 25mg/m³)
Analogue output	0 - 2.5V DC for FSD, 1kΩ output impedance
Display	16 character, 2 line, alphanumeric, back lit LCD
Weight	0.5kg
Size	36 x 15 x 5.5cm (including probe)
Zero stability	±1.5µg/m³/°C
Intrinsically Safe certification	Ex ia IIC T4
Internal memory capacity	64K EEPROM providing 30000 data points
Logging interval	Adjustable from 2 to 600 seconds
Serial interface	RS232 9600 baud
Software	Windows™3.11, 95, 98 and NT compatible

Ordering Information	
Gravimetric dust adapter	103214B
Aspirated adapter	103187B
Respirable dust adapter	103182B
Size selective adapter	151280B
Iso-kinetic adapter (for use with stack sampler)	103396B
Calibration certificate	M105042

Contact Details	
Sales	Tel: +44 (0) 1234 841468 Fax: +44 (0) 1234 841490
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## MICRODUST PRO ENVIRONMENTAL ENCLOSURE

With the introduction of the Air Quality Strategy in the UK and an increased awareness of environmental pollution from fine particulate, the demand for portable real-time monitors of PM<sub>10</sub> and PM<sub>2.5</sub> has increased. This need for real-time information is also a requirement in general industry when looking at Total Suspended Particulate (TSP), Inhalable and Respirable dust levels as a health issue.

Casella CEL has introduced 'The MICRODUST Environmental Enclosure' for exactly this application. This accessory provides a simple solution to fixed monitoring with the MICRODUST PRO and can be used for internal or, more importantly, ambient applications. The IP65 case is designed to accommodate a standard MICRODUST instrument as well as a sampling pump system to maintain a precise inlet flow rate. The pump provides purge air to the measuring optics, an essential feature for problem free monitoring.

The Microdust Environmental Enclosure has been designed as an accessory for existing users as well as for potential customers looking for a complete system. The complete system would require the purchase of:

- Environmental Enclosure – including:
- Internal pump system
- Battery
- Battery charger
- Microdust suited to the specific application.

The key component to this accessory is the inlet which utilises a modified CIS and 'foam plug' (PUF filter) cassette for size selective sampling. The new PUF filters can be fitted to suit PM<sub>10</sub>, PM<sub>2.5</sub> or respirable dust



applications within the modified CIS head and operate at 3.5 litres/min.

Casella CEL have taken this simple but very effective principle and applied it to the tried and tested real-time monitoring capabilities of the MICRODUST instrument. As with all the sampling adapters for the MICRODUST a filtered sample is collected after the optical measurement, allowing gravimetric analysis for comparisons or speciation of the dusts collected, to be conducted if necessary.

This new addition to the MICRODUST allows it to be used for real-time ambient monitoring of PM<sub>10</sub>, PM<sub>2.5</sub> and respirable fractions of particulate, an application requirement specified by many Casella CEL customers.

### Features

- PM<sub>10</sub>, PM<sub>2.5</sub> or respirable sampling
- 24 hour run time
- Internal datalogging
- Fully portable
- Filtered sample for gravimetric analysis

### Applications

- Real-time monitoring of PM<sub>10</sub> and PM<sub>2.5</sub>
- Boundary monitoring
- Air quality strategy monitoring
- Planning applications
- Process control monitoring

### Specification

Specification	MICRODUST
Flow range	0.5 to 3.5 litres/min.
Flow control accuracy	+/-5% of selected flow
Nominal battery voltage	12V
Nominal battery capacity	7Ahr
Run time	In excess of 24 hours
Enclosure rating	IP65
Dimensions	405 x 330 x 177mm
Weight (including MICRODUST)	8.5kg
Operating temperature	0 to +50°C
Operating humidity	0 to 95% RH, non-condensing

### Ordering Information

MICRODUST Environmental Enclosure including battery charger	176091A UK 176092A EURO 176093A USA
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### Accessories and Spares

Spare 12V battery	P123011
PUF filters for PM <sub>2.5</sub>	P118204
PUF filters for Respirable	P118208
PUF filters for PM <sub>10</sub>	P118206

### Contact Details

Sales	Tel: +44 (0) 1234 841468	Fax: +44 (0) 1234 841490	
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#### THE INSTITUTE OF CANCER RESEARCH

Technology from leading environmental company Casella CEL is being used by the Institute of Cancer Research to monitor air quality in its laboratory work.

The Chester Beatty Laboratory on Fulham Road in Chelsea is using a multi-disciplinary approach, unique in Britain, alongside the latest technologies to solve the mystery of genes involved in all types of cancer, and to develop new treatments for the disease.

Experiments within the laboratory require minimal dust levels and in order to monitor this, Health & Safety officer Sue Hunter specified a MICRODUST PRO unit from Casella CEL to carry out effective dust monitoring. The only hand-held real-time dust monitor capable of graphically presenting variations in dust concentration on a real-time scrolling graph, eliminating the need to wait for an analysis of results on a PC.

Sue Hunter comments: "Work at the laboratories includes creating tissue cultures which need to be housed within a very clean environment. The MICRODUST PRO is easy to use and takes instantaneous readings of dust levels enabling us to establish whether ventilation systems are working properly."

The real-time instrument features an



outstanding measurement capability from  $1\mu\text{gm}-3$  to  $2500\text{mgm}-3$ . It features software routines for zero and span calibrations, which eliminate the need for manual adjustments and trimming tools. Four user-defined calibration settings are also available to suit specific dust types.

Powerful datalogging and PC analysis software are supplied as standard.

"The support and after-care we have received from Casella CEL has been excellent and the MICRODUST PRO is very user-friendly," Sue adds.

10 REAL-TIME AEROSOL MONITOR

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#### BRITISH SKY BROADCASTING

Mr. Bill Wells, Company Safety Officer at British Sky Broadcasting, demonstrates one of the more unusual applications of the MICRODUST. Since its purchase the MICRODUST can be found in a variety of locations at BSKyB; from the studios to Prince Naseem Hamed's boxing ring.

The main function of the MICRODUST at BSKyB is to monitor the level of the mineral oil mist, a special effect that is widely used during filming of major sporting events. Bill Wells uses the MICRODUST to ensure the level of mineral oil mist is in compliance with the Health and Safety Executive (HSE) occupational exposure limit. If the crew and public are exposed to levels above the

published EH40 limit there is a possibility that it could result in respiratory disorders such as asthma. The ability of the MICRODUST to produce current data in  $\text{mg}/\text{m}^3$  and time weighted average (TWA) data makes complying to the HSE exposure limits a simple process.

Mr. Wells believes that the Casella CEL MICRODUST is an invaluable safeguard for BSKyB and any company that uses mineral oil mist. The MICRODUST datalogging facility protects the interests of BSKyB by providing an accurate and reliable record of the levels to which the crew has been exposed. At BSKyB the data printouts are also attached to the risk assessments for future reference. In addition to the archiving of data the LCD display shows instantly the mist levels in  $\text{mg}/\text{m}^3$ ; vital information to allow the team to decide when a break in production or a change of crews is necessary.

The MICRODUST's first assignment at BSKyB was at a Chris Eubank boxing match. 'Outside broadcasts' of this nature

involve highly sophisticated equipment and large numbers of crew.

Mr. Wells reported that, "The MICRODUST was an essential piece of equipment during this broadcast and still cost less than a weekends' catering for the crew!"

He believes that after only 3-4 broadcasts the MICRODUST had, "Paid for itself."

Another useful feature for Mr. Wells is that the MICRODUST is portable, an obvious benefit during outside broadcasts all over the UK. BSKyB also make full use of the long operating time of the MICRODUST and typically during one day's filming the MICRODUST is in operation for 8-9 hours.

As the fastest growing Television Company in the UK, BSKyB make full use of their MICRODUST and intend to purchase more in the future.

"The MICRODUST is simple to understand, operate, clean and calibrate and with the comprehensive software package the data can be recovered quickly and easily."



Ambient particulate monitoring is attracting considerable attention in today's environment as world wide air quality legislation comes into effect.

Major sources of particulate in our environment include industrial combustion and processing, energy generation, vehicle emissions and construction. The particulate matter created by these sources is responsible for many adverse environmental conditions including reduced visibility, contamination and soiling, but is also recognised as a contributory factor to many respiratory medical conditions such as asthma, bronchitis and lung cancer.

#### Providing Air Quality Data for Legislation

The health risks posed by particulate have led to a size specific dust monitoring standard in both the United States and Europe. These standards generally measure the occupational health, thoracic dust portion of airborne particulate, the nearest ambient equivalent being PM10 (particulate matter with mean aerodynamic diameter of  $<10\mu\text{m}$ ). The measurement of PM10 is now a requirement to assess the air quality within localised areas. This requirement has led to the establishment of air quality monitoring networks, to determine compliance with statutory air quality criteria throughout the UK and many other industrialised countries around the world. The need to assess and report air quality based on a 24 hour rolling average and the requirement to provide instantaneous readings has led to a new generation of 'real-time' monitors. The Casella CEL Ambient Particulate Monitor, the APM950 has been specifically developed to meet these requirements.

#### Providing Air Quality Data for Industrial Users

In addition to statutory Government driven monitoring, there is an increasing awareness of the amounts and composition of particulate emitted from various industrial processes. The need to quantify these emissions for health, safety and environmental considerations is now paramount to the responsible emitter. The APM950 can provide information on total dust levels as well as the more specific PM10 and PM2.5 fractions. The unit is versatile and robust enough to be moved from one location to another with relative ease, thus providing comparative information from different sites. A network of monitors for boundary monitoring is also an option.

Casella CEL has, for many years, produced robust and reliable instruments and this philosophy has been applied to the development of the APM950, making it the ideal choice for pollution specialists. This versatile instrument is based upon the proven optical dust measurement technology used in Casella CEL's range of portable dust detection equipment. The system has been thoroughly tested and validated at test sites in Oxford and the Midlands, and has undertaken trials by Government agencies.



The APM950 is supplied as standard with a US EPA approved PM10 sampling head, but can also be fitted with either a TSP or PM2.5 sampling head thus making it one of the most versatile instruments on the market. The Casella CEL PM2.5 impactor uses the WINS design (Well Impactor Ninety Six) which is fitted as a second stage impactor below the PM10 head. This design enables the instrument to measure both PM10 and PM2.5 concentrations consecutively. PM2.5 dust is collected on the standard 47mm filter that is inserted into a holder beneath the WINS unit.

#### Principles Of Operation

The APM950 separates dust using impaction techniques, providing both real-time monitoring (via infrared light scattering) and the more traditional gravimetric sample (via airstream filtration). A heater assembly eliminates errors resulting from moisture and humidity. The air sample is only subjected to the heater for 0.3 seconds which limits the evaporation of VOC's. A purge pump maintains a supply of clean air to all optically sensitive components within the probe and is also in action during automatic hourly calibration checks that ensure stable and drift-free measurement.

A programmable logger is used to sequence the overall system operation and can store up to 13,650 readings (expandable to 170,000 with PCMCIA memory card). The saved data may be extracted using a laptop PC, memory card or remotely via UHF radio or telephone modem. E-mails can also be sent via the 'Online Pro' software package.



The Casella CEL 'on-line' software provided with the system allows for both tabular and graphical displays of particulate concentration. The data can then be analysed to calculate hourly, daily and weekly rolling averages. The retrieved filter sample may be separately analysed providing a gravimetric measurement, which can be integrated with the logged data for individual site calibration. This is particularly useful in those studies examining dust from a known source, where particles have uniform characteristics, such as size, shape and density.

The APM950 is suitable for use in a wide variety of applications including road traffic emissions, landfill or quarry boundary monitoring and ambient air quality analysis. It can be used in conjunction with meteorological sensors (up to four may be directly connected to and logged by the APM950) such as wind speed and direction, temperature and relative humidity. These may be particularly useful in environmental impact assessments. The APM can also be combined with an analyser for roadside pollution monitoring.

#### Features

- Real-time and gravimetric measurement
  - Rapid response to changing concentrations
  - Analysis of filters for chemical compounds
  - Heated inlet to eliminate moisture
  - Low maintenance
- #### Applications
- Quantification of dust from industrial emissions
  - Roadside monitoring
  - Boundary monitoring
  - Quarry monitoring
  - Monitoring of dust from construction and demolition

#### Applicable Standards

ISO 6879  
Air quality performance characteristics

Federal Register  
EPA 40 CFR  
National Ambient Air Quality Standards for Particulate Matter

## Specification

Concentration measurement range	0 - 2000µg/m³ (resolution 1µg/m³)
Particle size range of maximum response	0.1 - 10µm
Sampling flow rate	16.7 litres/min. ±3% mass flow controlled (optional temperature compensated volumetric)
Span temperature stability	Typically 0.5% FSD /°C
Zero temperature stability	0.25 µg/°C
Measurement accuracy	Typically ±15% for a 24 hour sample run following gravimetric calibration.
Clock accuracy	±1minute/month, or better
Display	2 line, 16 character, backlit display showing operating conditions and parameters
Purge filter replacement interval	>5 years
Backup battery	Rechargeable lead acid, 6V 1.2Ah. Backup of program and data for typically one month.
Digital output	RS232C, 9600 baud rate, 8 data bits, 1 stop bit, parity: none
Operating temperature	-10 to +40°C, 0 - 100%RH
Enclosure dimensions	536 x 747 x 300mm
Inlet tube	Diameter - 33.8mm, length - 388mm (750mm max. length)
Enclosure	IP65 rating with wall mount brackets or galvanised steel frame

## Ordering Information

APM950 system with PM10 sampling head	153000D
APM950 2m frame	153075A

## Accessories and Spares

PM2.5 WINS impactor	153320B
20ml 'Dow Corning Oil' for PM2.5 impactor	153333A
TSP sampling head	153326B
47mm glass fibre filters	P102019
47mm pre-weighed glass fibre filters	P117002



Exploded view - WINS impactor for PM 2.5 sampling

## AMBIENT MONITORING SYSTEMS

Casella CEL can supply, for hire or purchase, a variety of systems for ambient air quality monitoring based around the APM950.

These include roadside pollution monitors which can utilise stand alone PM10 units or be combined with NOx analysers. There are two basic designs of enclosure:

### Typical Contents

- Chemiluminescent NOx Analyser
- Real-time/Gravimetric PM10 or PM2.5

Options include wind speed and direction, GSM, radio or landline telemetry.

### Typical Applications

- Provide evidence of compliance with the United Kingdom National Air Quality Standards
- IPPC Authorisations
- Undertake boundary monitoring around major industries and developments
- Validation of Stage 3 Road Traffic Pollution Modelling
- Monitoring of 'hot spots' in Air Quality Management Areas (AQMA's), Clear Zones and Low Emission Zones (LEZs)
- Design of Traffic Management Schemes

For hire please contact Darwin Hire on 0161 888 7100



Low cost multifunction cabin



Steel streetbox

## APM CASE STUDY

A state-of-the-art 'Real-Time' Roadside Pollution monitor developed by Casella CEL GMSS has been purchased by Copeland Borough Council.

The compact unit - used for ambient air quality monitoring - has been permanently positioned outside Whitehaven Civic Hall to monitor pollutants associated with vehicle emissions including oxides of nitrogen and particulates (PM10s).

Councillor Geoff Blackwell, Portfolio Holder for Development and Environment comments: "Results show that pollution levels are below European Union threshold limits and this is good news for our health. We also have the added advantage of being able to keep abreast of any changes as our town gets busier still."

The 'Real-Time' Roadside Pollution Monitor incorporates a non-switching dual-chamber chemiluminescent NOx analyser and real-time optical PM10 analyser. Additional options include wind speed and direction, as well as GSM or landline telemetry.

The new kit has been developed by Casella CEL GMSS for a number of applications including the validation of Stage 3 road traffic pollution modelling and the monitoring of 'hot spots' in Air Quality Management Areas (AQMA'S), clear zones and low emission zones. It can also be used in the design of traffic management schemes.

### Key advantages

- Does not use electrochemical cells,
- Technology is NETCEN tested
- AUN compatible - can be called using Airviro and other popular software
- Can be interfaced to Scoot traffic telematics.



### DUST DEPOSIT GAUGES

Deposit gauges are simple yet accurate methods of measuring deposited dust from the atmosphere. Airborne dust is deposited into a capture container mounted horizontally, or in the case of the directional gauge, into one of four vertical collection tubes. The dust remains in these containers or is washed through the system by natural means, (i.e. precipitation) into a collection bottle at the base. Samples are then measured by washing the collection area with distilled water and then passing this water through a pre-weighed and conditioned filter (normally 9cm) under suction. Any foam used (as in the 'Frisbee' type sampler) is then also washed in distilled water and passed through the same filter. The filter is again conditioned and weighed.

The Casella CEL 'Frisbee' dust deposit gauge uses a dry foam trap to reduce any sample contamination (e.g. from falling leaves). The sample, along with up to 120mm of rain, is collected in a large capacity HDPE collection bottle, positioned at the base of the unit. The gauge is also

fitted with a stainless steel and nylon bird guard to avoid extraneous contamination. A tripod is also supplied which can be inserted into the ground to give the gauge extra stability. This type of gauge is generally accepted to have the greatest sampling efficiency of those available.

The BS 1747 Directional Dust Gauge uses four tubular samplers mounted in a way to distinguish between dust from the four compass points. The dust collected in each of the four samplers is gravimetrically analysed to give a dust concentration from each point of the compass. This unit is especially useful if information is required as

to the source of pollutant dust at a particular location.

The Deposit Dust Gauge is the simplest of all the deposit gauges as it uses a single container mounted at the top of a pole.

### Applicable Standards

BS 1747 Directional Dust Gauges



### Ordering Information

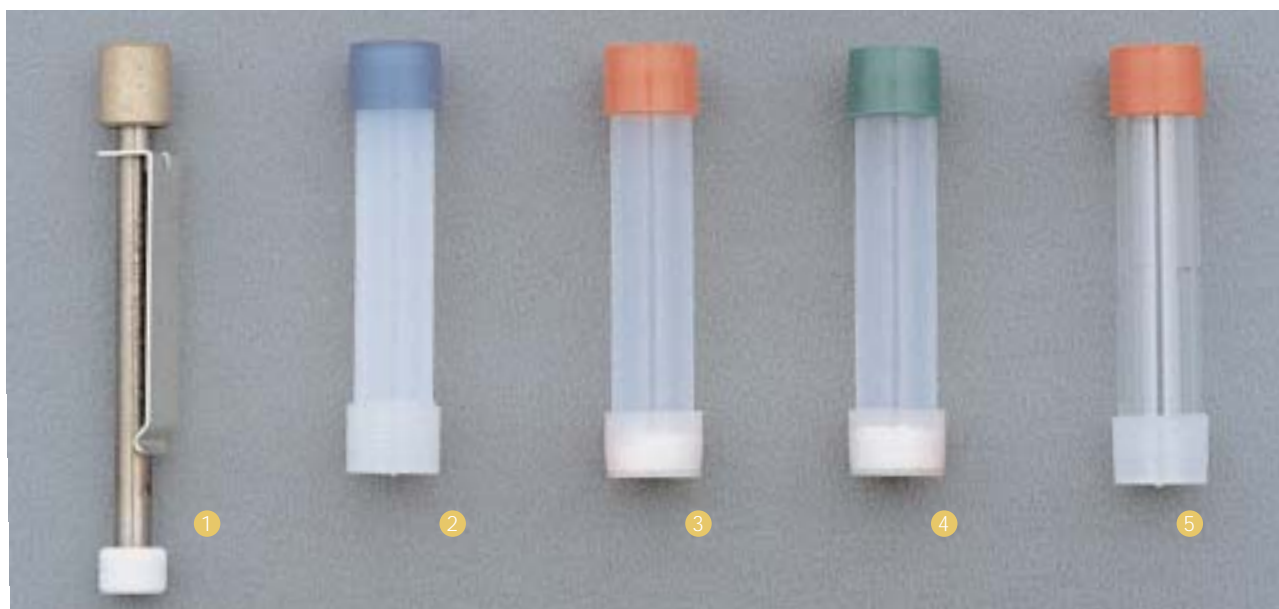
BS 1747 Directional Dust Gauge complete with calibration data	P121000 (BS-1747)
'Frisbee' Deposit Gauge	P121020
Deposit Dust Gauge	P121010 (ISO-4222)

### Accessories and Spares

'Frisbee' Deposit Gauge	
Foam insert	P121022
5 litre HDPE bottle	P121021
Spare collection head	P121023
BS 1747 Directional Dust Gauge	
Collection bottle	P121003
Deposit Dust Gauge	
Collection bucket with lid	P121011

### Contact Details

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### DIFFUSIVE SAMPLING TUBES

Passive sampling with diffusion tubes provides a simple and cost effective method of screening air quality in a particular area, giving a general indication of average pollution concentrations. The low cost per tube permits sampling at a number of locations in the area of interest, identifying zones with high concentrations that will require more detailed study. Passive sampler surveys are becoming increasingly popular in many parts of the UK and throughout the world.

Diffusion samplers are typically clear plastic tubes, open or with a membrane screen at one end and a pollutant absorbing chemical matrix at the other end. The tubes are prepared in a laboratory before exposure at the selected site location. Exposure involves removing the end cap and leaving the tube for between one week and one month. The diffusion sampler 'collects' the pollutant during the exposure period, at the end of which the tube is re-sealed and returned to the laboratory for analysis. The laboratory analysis of the quantity of the pollutant absorbed is then determined.

Different diffusive sampling tubes are available to monitor the main chemical pollutants:

- Nitrogen dioxide (NO<sub>2</sub>)
- Sulphur dioxide (SO<sub>2</sub>)

- Ozone (O<sub>3</sub>)
- Ammonia (NH<sub>3</sub>)

Hydrocarbons, including BTX (benzene, toluene and xylene), are monitored using the same principle of operation but with a passive diffusion monitor. One end of this tube is sealed with an end cap, whilst the other is fitted with a diffusion cap. The diffusion cap contains a gauze disk at the open end and is sealed to the tube with an 'O' ring. The tube is packed with a sorbent, either chromasorb 106 or tenax, depending upon which hydrocarbon is to be collected. After exposure, the tube is returned to the laboratory for analysis. Lead and other metals can be monitored by the use of an 'M' type sampler and a standard 37mm filter.

### Features

- Monitors supplied and analysed cost effectively
- No power supply required
- Exposure can be monitored over extended periods (28 days)
- Annual averages can be related to National
- Air Quality Standards
- Reliable cross comparisons with other sites

### Applications

- Ozone - rural background concentrations
- Nitrogen Dioxide - ambient air, adjacent to major roads
- Sulphur dioxide - pollutant levels downwind of industrial sources (e.g. power stations)
- Ammonia - within ammonia production or chemical processes
- BTX - oil storage facilities, petrol stations and major roads

### 1. BTX

### 2. AMMONIA

### 3. SULPHUR DIOXIDE

### 4. OZONE

### 5. NITROGEN DIOXIDE

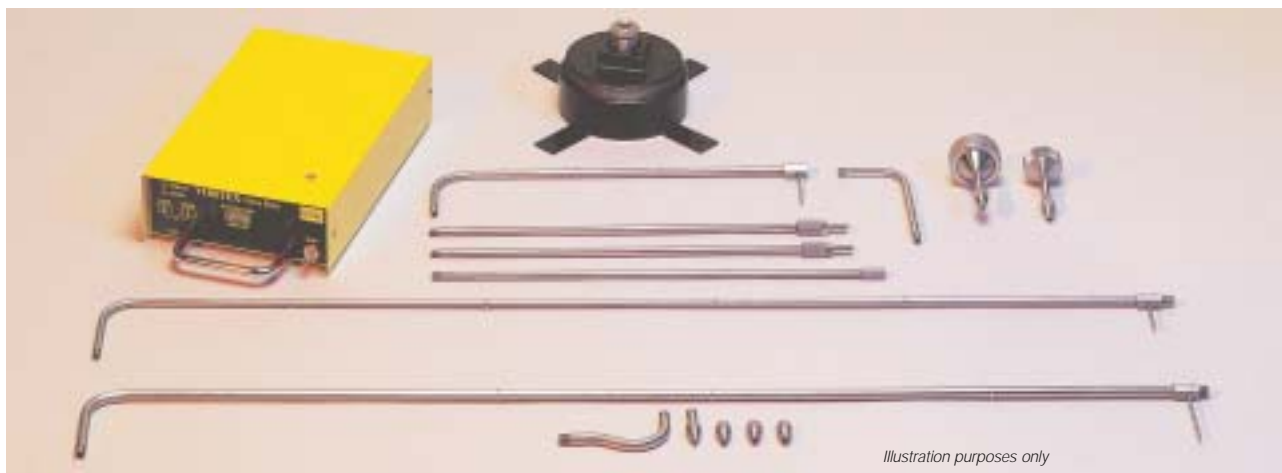
### Ordering information

BTX diffusive sampling tube	P124000
BTX diffusive sampling tube with analysis	P124001
Ammonia diffusive sampling tube	P124002
Ammonia diffusive sampling tube with analysis	P124003
Sulphur dioxide diffusive sampling tube	P124004
Sulphur dioxide diffusive sampling tube with analysis	P124005
Ozone diffusive sampling tube	P124006
Ozone diffusive sampling tube with analysis	P124007
Nitrogen oxide diffusive sampling tube	P124008
Nitrogen oxide diffusive sampling tube with analysis	P124009

### Contact Details

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## ISOKINETIC STACK SAMPLING SYSTEM

The Casella CEL Isokinetic Stack Sampling System is versatile, cost effective and easy to use. It was designed and manufactured as a direct response to meet customers' needs for a 'user-friendly' method of carrying out particulate compliance monitoring to the required standards (BS 3405 and ISO 9096).

The 'In-Stack' and 'Ex-Stack' capabilities allow the monitoring of a wider range of process emissions accounting for variables such as particulate nature, flow characteristics, duct sizes and duct access facilities.

As particulate loading varies across different application processes, a wide selection of filter holder and nozzle sizes are available including diameters of 25, 37 and 50mm.

This increases the system versatility by allowing different sampling rates, thus enabling the operator to collect volumes of adequate size to gain particulate mass in accordance with the regulations, and still maintain isokinetic conditions.

The standard isokinetic kit includes:

- VORTEX Ultra Flow pump
- Pump flow meter (3 - 12 litres/min)
- 1m probe
- Filter holder
- Interconnection

When used in conjunction with the MICRODUST attachment, simultaneous

real-time and gravimetric sampling can be achieved.

The required flow rate for the measured stack velocity and relevant nozzle can be identified from the graph below.

### Features

- Compact and portable
- Easy to use and assemble
- One-man operation

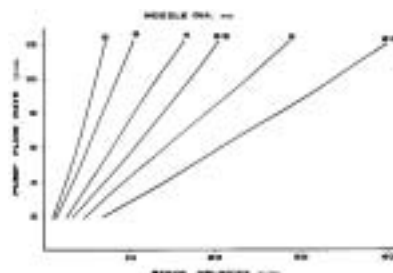
### Applications

- Emissions compliance monitoring
- Fast spot checks

### Applicable Standards

BS 3405 Measurement of particulate emissions

ISO 9096 Stationary emissions



The systems are designed for operators who may have a number of small ducts that

require emissions monitoring, which are operated at temperatures no higher than 150-200°C. Atmospheres should also be non condensing. These systems are not designed for use on large industrial type stacks.

If users do have a requirement to sample particulates by following the US Method 5 & BS EN 13284 procedures, please contact the Casella CEL sales office.

### Calibration Service

Casella CEL are also able to undertake the manual measurement of in-stack particulates concentrations in order to provide the data which is essential for the calibration of continuous particulate emission monitoring equipment. These measurements are carried out to the full requirements of British Standard BS6069:Section 4.3 by our Group Member Company, Casella Stanger, one of the largest stack emissions monitoring businesses in the UK.

Casella Stanger hold UKAS accreditation for this and a wide range of other stack emissions measurement methods. The point of contact for these services is Bill Bell, on 01902 385150.

### Continuous Emissions Monitoring Equipment

At the time of going to print Casella CEL is developing a range of continuous stack particulate detection monitors and broken bag detection systems. Please contact the sales office for further details.

### Specification

Pump capacity	VORTEX Ultra Flow 6 - 20 litres/min
Probe length	1m
Power supply	12V 7Ah, internal lead-acid battery

### Ordering Information

Standard isokinetic kit with 25mm filter holder	P118000 UK	P118004 EURO
Standard isokinetic kit with 37mm filter holder	P118001 UK	P118005 EURO

### Accessories and Spares

2" BSP stack access plug with support body	P118002
4mm nozzle as specified in BS 3405	P118033
4mm nozzle as specified in ISO 9096	P118050
Spare battery	P123011
Other nozzle diameters, filter holders and probe extensions are available on request	

### Contact Details

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Service	Tel: +44 (0) 1234 844146	Fax: +44 (0) 1234 841490	

AIRBORNE BACTERIA SAMPLER

The presence of airborne bacteria in closed areas such as sterile rooms and operating theatres is still very much a problem, even in the latest modern hospitals and manufacturing facilities. These airborne bacteria are responsible for the contraction of many infections and diseases, especially respiratory ones. The Casella CEL Airborne Bacteria Sampler (ABS) or Slit Sampler, is used to determine the presence of bacteria and thereafter the effectiveness of airborne bactericides. It is also used to check cross infection in hospital wards, to combat infections to wounds and burns and to eliminate those bacteria that attack food-manufacturing processes.

The Casella CEL ABS was originally developed by the Medical Research Council in the 1930's to help combat the spread of airborne diseases and reports in The Journal of Hygiene and Journal of Hospital Infection provide suggestions on methods and standards in this very important field. Full details can be found in the document 'Suggested bacteriological standards for air in ultraclean operating rooms', (Whyte et al., 1983).

The Casella CEL ABS is the only instrument that can sample at up to 700 litres/min. This allows a sizeable sample to be collected in a short period of time. The general nature and minute size of the bacteria being monitored makes such a high volume sample essential, if any are to be found, but it also minimises any intrusion the monitoring may make on the general day to day operations of the user.

Principles Of Operation

A pump unit is used to draw a pre-set volume of air through up to four horizontal slits at the top of the sampling unit. The air is then sampled onto an agar plate that is positioned on a rotating turntable. The rotational speed of the turntable is step variable, in order to suit the large range of bacteria concentrations which can be encountered. After a suitable sampling time (normally 5 minutes), the plate is incubated



at 37°C for a period of time (normally 24 hours), after which the bacteria become visible and the number of cultures can be counted and identified.

Using the set pump speed and time of exposure, it is possible to calculate the concentration of bacteria in the monitored area. The instrument contains a built in vacuum gauge and a slit to plate distance indicator. The latter ensures that a constant gap is set between the intake and the agar and thus ensures that consecutive samples are comparable.

Extension hoses are available to allow more remote monitoring, although care must be taken as bacterial losses can occur with extended tubes. The instrument must be ordered with a pump unit and can accommodate agar petri dishes of between 14 and 16cm diameter. (These are available from any good laboratory supply company).

Features

- Only unit known to sample at 700 litres/min
- Robust construction
- Built in slit to plate indicator
- Rotating turntable

- Extension hoses available
- Proven design

Applications

- Hospitals and Health Authorities
- Pharmaceutical companies (medicine manufacture)
- Research facilities, laboratory services and Universities
- Food processing plants (e.g. dairy and chilled products)
- Large restaurant and food serving facilities

Applicable Standards

- BS 5295 Environmental cleanliness in enclosed spaces, design and build of UCRm
- HTM 2025 The Health Technical Memorandum - Ventilation Healthcare

Complies with UK Ministry of Health 'Safety Code for Equipment and Installations'

The Journal of Sterile Services Management 9(1991); 2 9 - 10

Specification

Flow rate	175, 350, 525 or 700 litres/min (continuously variable)
Accuracy	±5%
Slits	4 slits - each 1 x 44.5mm
Turntable speed	1 rev. in 0.5, 2 or 5 minutes
Plate size	Approx. 15cm diameter
Dimension	Unit – 32 x 25 x 37cm Pump – 22 x 22 x 30cm
Weight	Unit – 10kg Pump – 6kg

Ordering Information

Bacteria Sampler	D7669/Z
Pump 220V - 240V 50Hz (supplied with standard 1.5m hose)	E7627/Z
Please note the pump unit must always be ordered with the sampler.	

Accessories and Spares

3m hose extension	X100095
5m hose extension	X100095/5

In addition to the ABS unit and pump, additional microbiological equipment will be required before monitoring can begin e.g. petri dish, agar jelly and incubator.

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#### AIR SAMPLING TABLES 2002

##### Key to sections

##### EH40 Tables

In the UK, the HSE publish Occupational Exposure Limit (OEL) values, which are revised annually. The version used here is EH40/2002. Users should refer to the current edition for the most up to date information.

The main table is referred to by number, 1,2.

##### Hazard Type

The following types of hazard are listed:

A	Asphyxiant
C	Carcinogenic
Co	Highly corrosive
FI	Highly inflammable
Mu	Mutagenic
Ox	Oxidising agent
RD	Respirable dust hazard
Sen	Respiratory sensitiser
Sk	Can be absorbed through the skin
Te	Teratogenic
Tx	Highly toxic

##### Sampler Type

The following code is used for sampling heads and sorbent tubes:

Cowl	Cowled sampling head
Cyc	Cyclone respirable sampler with 25 or 37mm cassettes
1HH	1 hole head for Lead sampling
7HH	7 hole head for inhalable sampling
OFF, 25	Open face filter holder for 25mm filter
OFF, 37	Open face filter holder for 37mm filter
LS	Liquid sorbent in Arnold Bubbler

LS/T	Arnold Bubbler, with charcoal trap to protect pump
F/LS/T	Pre-filter, Arnold Bubbler, with charcoal trap
GSB	Gas sampling bag
ST	Sorbent tube
ST: Ch1	Sorbent tube with charcoal sorbent (100mg)
ST: Ch4	Sorbent tube with charcoal sorbent (400mg)
ST: Si1	Sorbent tube with Silica gel sorbent (100mg)
ST: X	Sorbent tube with sorbent other than charcoal or silica gel

Please contact Casella CEL sales desk for further help

TDT: X	Thermal Desorption Tube
WFH	Welding Fume filter Holder

##### Filter Type

The following codes are used for filters:

GF/A/25	Glass fibre type A, 25mm diameter
GF/A/37	Glass fibre type A, 37mm diameter
MCE/A/25	Mixed Cellulose Ester, 0.8micron pore size, 25mm dia.
MCE/A/25GM	Mixed Cellulose Ester, 0.8micron pore size, 25mm dia. gridded for asbestos sampling
MCE/A/37	Mixed Cellulose Ester, 0.8micron pore size, 37mm dia.
Treated	Pre treated filter for specific application

Please contact Casella CEL sales desk for further help

##### Analysis

With each method a particular analytical instrument, or method, is recommended. The codes are as follows:

AA	Atomic Absorption spectrometer
Col	Colorimetric method
Grav	Gravimetric method - microbalance
GC	Gas Chromatograph

GC-ECD	GC + Electron Capture Detector
GC-ELCD	GC + Electrochemical Detector
GC-FID	GC + Flame Ionisation Detector
GC-FPD	GC + Flame Photometric Detector for Phosphorus
GC-FPS	GC + Flame Photometric Detector for Sulphur
GC-MS	GC + Mass Spectrometer
GC-NPD	GC + Nitrogen/Phosphorus Detector
GC-TCD	GC + Thermal Conductivity Detector
HPLC	High Performance Liquid Chromatograph
HPLC-UV	HPLC + UV spectrophotometric detector
IC	Ion Chromatograph
IC-ecn	Ion Chromatograph - Electrolytic Conductivity Detector
ICP-AES	Inductively Coupled Plasma - Atomic Emission Spectrometer
IR	Infra-red Spectrophotometer
ISE	Ion Specific Electrode
PCOM	Phase Contrast Optical Microscope
pol	Polarograph
SE	Solvent Extraction before further analysis
Titn	Titration (volumetric analysis)
TEA	Thermal Energy Analyser
UV	Ultra Violet Spectrophotometer
UV-VIS	UV Visible range Spectrophotometer
XRD	X-ray diffractometer
XRF	X-ray fluorescence Spectrophotometer

##### Direct reading methods

CDT	Colour Detection Tube
PGD	Personal Gas Detector

Substance Name in EH40 Lists	EH 40 Table	Hazard Types	Occupational Exposure Limits				Method Number	Head Type Code	Filter Type Code	Air Flow Rate	Sample Analysis Instrument	Direct Reading Methods
Acetaldehyde	2	Fl	20	37	50	92	N10SH 3507 3	LS/T		0.1	HPLC-UV	UVC
Acetic acid	2	Co	10	25	15	37	N10SH 1603 3	ST:Ch1		0.5	GC-FID	CDT/UVIC
Acetic anhydride	2	Co	0.5	2.5	2	10	N10SH 3506 3	LS/T		0.2	UV-VIS	UVC
Acetone	2	Fl	750	1810	1500	3620	OSHA 69	Carbostieve		0.0	GC-FID	CDT/UVIC
Acetonitrile	2	Fl	40	68	60	102	N10SH 1606 3				GC-FID	
Acetylene	p60	A Fl	-	-	-	-	OSHA CS1					CDT
Acrylamide	1	C Sk	-	0.3	-	-	MDHS 57	LS			HPLC-UV	UVC
Acrylonitrile	1	C Sk Tx	2	4.4	-	-	MDHS 1	ST:Ch1			GC-FID	
Aldrin (ISO)	2	Sk Tx	-	0.25	-	0.75	N10SH 5502 3	F/LS/T	GF/A/37	0.5	GCELCD	
Aliphatic hydrocarbons	p59	Fl	-	-	-	-	N10SH 1500 3	ST:Ch1			GC-FID	
Allyl alcohol	2	Sk Fl	2	4.8	4	9.7	NIOSH 1402	ST: Ch1			GC-FID	UVC
Aluminium metal												
Total Inhalable dust	2		-	10	-	-	MDHS 14/3	7HH/IOM	MCE/A/25	2.0	Grav	Microdust
Respirable dust	2	RD	-	4	-	-	MDHS 14/3	Cyc	MCE/A/37or 25	2.2	Grav	Microdust
Aluminium oxides												
Total Inhalable dust	2		-	10	-	-	MDHS 14/3	7HH/IOM	MCE/A/25	2.0	Grav	Microdust
Respirable dust	2	RD	-	4	-	-	MDHS 14/3	Cyc	MCE/A/37or 25	2.2	Grav	Microdust
"Aluminium, soluble salts"	2		-	2	-	-	OSHA ID121	*OFF, 37"	MCE/A/37	2.0	AA	
2-Aminoethanol	2		3	7.6	6	15	N10SH 2007 3	ST:Si1		0.05	GC-FID	CDT
Ammonia	2		25	18	35	25	NIOSH 6015/6	LS/T		0.1/0.15	VAS/IC	CDT/PGD/UVIC
Aniline	1	Sk	1	4	-	-	N10SH 2002 3	ST:Si1		0.05	GC-FID	CDT/UVIC
Antimony and compounds (as Sb) except stibine	1	Tx	-	0.5	-	-	N10SH 2(S2)	*OFF, 37"	MCE/A/37	1.50	AA	
Arsenic and compounds (as As) except arsine	1	Tx	-	0.1	-	-	MDHS 41/2	7HH/IOM	MCE/A/25	2.0	AA	
Arsine	2	Tx	0.05	0.16	-	-						UVC
Asbestos-Chrysotile	p39	C	-	-	-	1.5f/ml	MDHS 39/4	Cowl	MCE/A/25	1.0/4.0	Mic-PCOM	Fibrecheck
"Asbestos-Amosite,Crocidolite Etc."	p39	C	-	-	-	0.6f/ml	MDHS 39/4	Cowl	MCE/A/25	1.0/4.0	Mic-PCOM	Fibrecheck
Atrazine						-	OSHA IMISO295	*OFF, 37"	GF/A/37	0.5	HPLC-UV	
"Barium sulphate,"												
Total Inhalable dust	2		-	4	-	-	MDHS 14/3	7HH/IOM	GF/A	2.0	Grav	Microdust
Respirable dust	2		-	10	-	-	MDHS 14/3	Cyc	GF/A	2.2	Grav	Microdust
Benzene	1	C Fl	5	16	-	-	MDHS 96,72,80,88	ST:Ch1		0.02	GC-FID	UVC
Beryllium	1	C Tx	-	0.002	-	-	MDHS 29/2	7HH/IOM	MCE/A/25	2.0	AA	
g-BHC (ISO)	2	Sk	-	0.1	-	-	MDHS 94	F/LS/T	"GF/A/25,37"	0.2	GCELCD	
Bornan-2-one	2		2	13	3	19	MDHS 96	ST:Ch1		0.05	GC-FID	
Boron trifluoride	2	Tx	-	-	1	2.8	OSHA IMIS 0382	LS/T			ISE	UVC
Bromacil (ISO)	2	Tx	1	11	2	22	OSHA IMISB708	LS/T		0.1	HPLC-UV	
Bromine	2		0.1	0.66	0.3	2	OSHA ID108	LS		0.05	IC	UVC
Bromochloromethane	CHAN		200	1080	250	1340	NIOSH 1003 3	ST:Ch1		0.01	GC-FID	
Bromoethane	CHAN	Fl	-	-	-	-	NIOSH 1011 3	ST:Ch1		0.008	GC-FID	
Bromoethylene			-	-	-	-	NIOSH 1009 3	ST:Ch4		0.02	GC-FID	
Bromoform	2	Sk	0.5	5.3	-	-	NIOSH 1003 3	ST:Ch1		0.02	GC-FID	UVC
Bromomethane	2	Sk	5	20	15	59	OSHA 07	ST:Ch1		0.005	GC-FID	
Bromotrifluoromethane	2		1000	6190	1200	7430	OSHA 07	ST:Ch1		0.005/3hr	GC-FID	

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AIR SAMPLING TABLES



Substance Name in EH40 Lists	EH 40 Table	Hazard Types	Occupational Exposure Limits			Method Number	Head Type Code	Filter Type Code	Air Flow Rate	Sample Analysis Instrument	Direct Reading Methods
"Buta-1,3-diene"	1	C Fl	10	22	-	"MDHS 53,60,63,80,88,96"	TD:X			GC-FID	CDT
Butane	2	Fl	600	1450	750	MDHS 96	TD:Ch/X		0.005	GC-FID	PGD
Butan-1-ol	2	Sk	-	-	50	NIOSH 1401 3	ST:Ch1		0.02	GC-FID	
Butan-2-ol	2	Fl	100	308	150	NIOSH 1401 3	ST:Ch1		0.02	GC-FID	
Butan-2-one	"2, 3"	"Sk, Bmgv"	200	600	300	NIOSH 2500 3	ST:X		0.01	GC-FID	
trans-But-2-enal			-	-	-	NIOSH P285 3	LS/T		0.1/2hr	POL	
2-Butoxyethanol	"2,3"	"Sk, Bmgv"	25	123	-	"MDHS 72, 80"	ST:Ch1		0.02	GC-FID	
Butyl acetate	2	Fl	150	724	200	NIOSH 1450 3	ST:Ch1		0.02	GC-FID	CDT/UVIC
sec-Butyl acetate	2	Fl	200	966	250	NIOSH 1450 3	ST:Ch1		0.02	GC-FID	UVIC
tert-Butyl acetate	2	Fl	200	966	250	NIOSH 1450 3	ST:Ch1		0.02	GC-FID	
Butyl acrylate	2		1	5	5	OSHA CS1	ST:CH1			GC-FID	CDT/3M
n-Butyl glycidyl ether (BGE)	2		25	135	-	NIOSH S81 3	ST:Ch1		0.02	GC-FID	
Cadmium and compounds (as Cd)	1	C Tx	-	0.025	-	MDHS 10/2	7HH/IOM	MCE/A/25	2.0	AA	
"except CdO fume, CdS and CdS"											
Cadmium oxide fume (as Cd)	1	C Tx	-	0.025	-	MDHS 10/2	7HH/IOM	MCE/A/25	2.0	AA	
Cadmium sulphide and CdS pigments (respirable dust as Cd)	1	Tx	-	0.03	-	MDHS 10/2	Cyc	MCE/A/37or 25	2.2	AA	
Calcium carbonate											
Total inhalable dust	2		-	10	-	MDHS 14/3	7HH/IOM	MCE/A/25	2.0	Grav	Microdust
Respirable dust	2	RD	-	4	-	MDHS 14/3	Cyc	MCE/A/37or 25	2.2	Grav	Microdust
Calcium cyanamide	2		-	0.5	-	NIOSH 7020 3	"OFF, 37"	MCE/A/37	1.0	AA	
Calcium hydroxide	2		-	5	-	NIOSH 7020 3	"OFF, 37"	MCE/A/37	1.0	AA	
Calcium oxide	2		-	2	-	NIOSH 7020 3	"OFF, 37"	MCE/A/37	1.0	AA	
Calcium silicate											
Total inhalable dust	2		-	10	-	MDHS 14/3	7HH/IOM		2.0	Grav	Microdust
Respirable dust	2		-	4	-	MDHS 14/3	Cyc	GF/A/37or 25	2.2	Grav	Microdust
Carbon black	2		-	3.5	-	MDHS 14/2	7HH/IOM	GF/A/25	2.0	Grav	
Carbon dioxide	2	A	5000	9150	15000	NIOSH S249 3	GSB		0.01	GC-TCD	CDT/UVIC
Carbon disulphide	1	Sk Tx Fl	10	32	-	MDHS 15	ST:Ch1		0.02	GC-FPD	CDT/UVIC
Carbon monoxide	2	Tx	30	35	200						CDT/PGD
Carbon tetrachloride	2	Tx	2	13	-	MDHS 96	ST:Ch1		0.03	GC-FID	CDT
Cellulose											
Total inhalable dust	2		-	10	-	MDHS 14/3	7HH/IOM		2.0	Grav	Microdust
Respirable dust	2		-	4	-	MDHS 14/3	Cyc	GF/A/37or 25	2.2	Grav	Microdust
Chlorine	2	Tx	0.5	1.5	1	OSHA ID101	LS/T		0.5	ISE	CDT/PGD
Chlorine dioxide	2	Tx	0.1	0.28	0.3	OSHA ID 202	LS/T			IC	PGD/UVIC
Chlorobenzene	1	Fl	1	-	5	MDHS 96	ST:Ch1		0.02	GC-FID	CDT/UVIC
Chloroethane	CHAN	Fl	1000	2700	1250	NIOSH 2519 3	ST:Ch4			GC-FID	
2-Chloroethanol	2	Sk Tx	-	-	1	NIOSH 2513 3	ST:Ch1			GC-FID	
Chloroform	2	Sk	2	9.9	-	MDHS 96	ST:Ch1		0.03	GC-FID	
3-Chloropropene	CHAN		-	-	-	NIOSH 1000 3	ST:Ch1		0.2	GC-FID	
2-Chlorotoluene	2		50	264	-	MDHS 88	ST:Ch1		0.2	GC-FID	UVIC
"Chromium, Cr(II) & Cr(III) compounds(as Cr) "	2		-	0.5	-	MDHS 12/2	7HH/IOM	MCE/A/25	2.0	AA	
Chromium (VI) compounds (as Cr)	1		-	0.05	-	MDHS 52/3	7HH/IOM	Treated	2.0	AA	Col
"Coal dust, respirable"	2		-	2	-	MDHS 14/3	Cyc	GF/A/37or 25	2.2	Grav	Microdust

Substance Name in EH40 Lists	EH 40 Table	Hazard Types	Occupational Exposure Limits			Head Type Method Number	Code	Filter Type Code	Sample Analysis Air Flow Rate	Direct Reading Instrument	Methods
Cobalt & compounds (as Co)	1	Tx	-	0.1	-	MDHS 30/2	7HH/IOM	GF/A/25	2.0	AA	
"Copper, fume (as Cu)"	2		-	0.2	-	MDHS 14/3	7HH/IOM	MCE/A/25	2.0	AA	
"Copper, dusts & mists (as Cu)"	2		-	1	2	MDHS 14/3	7HH/IOM	MCE/A/25	2.0	AA	
Cotton dust	1	RD	-	2.5	-	See EH25"	IOM			Grav	Microdust
"Cresols, all isomers"	2	Sk	5	22	-	NIOSH 2546	ST:XAD		0.04	GC-FID	CDT/UVIC
Cumene	2	Sk	25	125	50	NIOSH 1501 3	ST:Ch1		0.05	GC-FID	UVIC
"Cyanides, except HCN, cyanogen and cyanogen chloride (as CN)"	2	Sk Tx	-	5	-	NIOSH 7904 3	F/LS/T	MCE/A/37	0.5	IS	
Cyclohexane	2	FI	100	350	300	NIOSH 15003	ST:Ch1		0.01	GC-FID	UVIC
Cyclohexanol	2		50	208	-	NIOSH 1402 3	ST:Ch1		0.02	GC-FID	UVIC
Cyclohexanone	2		10	-	20	NIOSH 1300 3	ST:Ch1		0.02	GC-FID	UVIC
Cyclohexene	2		300	1020	-	MDHS 96	ST:Ch1		0.01	GC-FID	UVIC
Cyclohexylamine	2		10	41	-	NIOSH 2010 3	ST:Si1		0.05	GC-FID	
"2,4-D (ISO)"	2	C Tx	-	10	-	NIOSH 5001	*OFF, 37"	GF/A/37	1.0/3hr	HPLC-UV	
DDT	2	Tx	-	1	3	NIOSH S274 2	*OFF, 37"	GF/A/37	1.5/1hr	GC-ECD	
"1,2-Diaminoethane"	CHAN		10	25	-	NIOSH P276 2	ST:Si1		0.1	GC-FID	
"Diatomaceous earth, respirable dust"	2	RD	-	1.2	-	MDHS 14/3	Cyc	GF/A/37or 25	2.2	Grav	Microdust
Dibromodifluoromethane	2		100	872	150	NIOSH 1012 3	ST:Ch1		0.02	GC-FID	
"1,2-Dibromoethane"	1	C Sk	0.5	3.9	-	NIOSH 1008 3	ST:Ch1		0.02	GC-FID	CDT/UVIC
Dibutyl phthalate	2		-	5	10	NIOSH 5020 3	*OFF, 37"	MCE/A/37	1.0/3hr	GC-FID	
"1,2-Dichlorobenzene"	2		25	153	50	MDHS 88/96	ST:Ch1		0.02	GC-FID	UVIC
"1,4-Dichlorobenzene"	2		25	153	50	MDHS 88/96	ST:Ch1		0.01	GC-FID	UVIC
Dichlorodifluoromethane	2		1000	5030	1250	NIOSH 1018 3	ST:Ch4/1		0.008	GC-FID	
"1,1-Dichloroethane"	2	FI	100	-	-	MDHS 96	ST:Ch1		0.02	GC-FID	
"1,2-Dichloroethane"	1	C FI Sk	5	21	-	MDHS 96	ST:Ch1		0.02	GC-FID	
"1,2-Dichloroethylene, cis & trans"	2		200	806	250	MDHS 96	ST:Ch1		0.01	GC-FID	UVIC
Dichlorofluoromethane	2		10	43	-	NIOSH 2516 3	ST:Ch4/4		0.01/4hr	GC-FID	
Dichloromethane	1	Sk	100	350	300	MDHS 96	ST:Ch1		0.02	GC-FID	CDT
(Methylene chloride)											
Dieldrin (ISO)	2	-	-	-	-	NIOSH 1013	ST:Ch1		0.01	GC-ECN	
Diethylamine	2	Sk Tx	-	0.25	-	NIOSH S283 2	*OFF, 37"	GF/A/37	1.5/2hr	GC	
Diethyl ether	2	FI	10	30	25	NIOSH 2010 3	ST:Si1		0.05	GC-FID	CDT
Diethyl sulphate	2	FI	100	310	200	NIOSH 1610 3	ST:Ch1		0.005	GC-FID	UVIC
Di-isopropyl ether	1	C Sk	0.05	0.32	-	OSHA CS1	ST:Si1			GC-FID	UVIC
Dimethoxymethane	2	FI	250	1060	310	NIOSH S368 3	ST:Ch1		0.005	GC-FID	
"N,N-Dimethylacetamide"	2	FI	1000	3160	1250	NIOSH 1611 3	ST:Ch1		0.01/4hr	GC-FID	UVIC
Dimethylamine	"2, 3"	"Sk, Bmgv"	10	36	20	NIOSH 2004 3	ST:Si1		0.1	GC-FID	UVIC
"N,N-Dimethylaniline"	"2, 4e"	FI	2	3.8	6	NIOSH 2010 3	ST:Si1		0.05	GC-FID	UVIC
"1,3-Dimethylbutyl acetate"	2	Sk	5	25	10	NIOSH 2002 3	ST:Si1		0.05	GC-FID	
Dimethylformamide	2	FI	50	299	100	NIOSH 1450 3	ST:Ch1		0.02	GC-FID	
"2,6-Dimethylheptan-4-one"	2	Sk	10	30	20	NIOSH 2004 3	ST:Si1		0.1	GC-FID	UVIC
			25	148	-	NIOSH 1300 3	ST:Ch1		0.02	GC-FID	
										UVIC	
"Dinitrobenzene, all isomers"	2	Sk Tx	0.15	1	0.5	NIOSH S214 2	F/LS/T	GF/A/37	0.2	HPLC	
"2,4-Dinitrotoluene"			-	-	-	NIOSH S215 2	F/LS/T	MCE/A/37	1.0	HPLC-UV	

Substance Name in EH40 Lists	EH 40 Table	Hazard Types	Occupational Exposure Limits				Method Number	Head Type Code	Filter Type Code	Air Flow Rate	Sample Analysis Instrument	Direct Reading Methods
"1,4-Dioxane"	2	Sk FI	25	91	100	366	NIOSH 1602 3	ST:Ch1		0.02	GC-FID	UVIC
Diphenylamine	2		-	10	-	20	OSHA 22	LS/T		0.5	HPLC-UV	
Diphenyl ether	2		1	7.1	-	-	NIOSH S72 3	ST:Ch1		0.02	GC-FID	
Disulfoton (ISO)	2	Tx	-	0.1	-	0.3	MDHS 14/3	7HH/IOM	GF/A/25	2.0	Grav	
"2,6-Di-tert-butyl-para-cresol"	2		-	10	-	-	NIOSH 226 2	ST:Si1		0.02	GC-FID	
Divinyl benzene	2		10	54	-	-	OSHA 09	ST:Ch1		0.02	GC-FID	
Dusts												
Total inhalable dust	para 32		-	10	-	-	MDHS 14/3	7HH/IOM	GF/A/25	2.0	Grav	Microdust
Respirable dust	para 32		-	4	-	-	MDHS 14/3	Cyc	GF/A/37or 25	2.2	Grav	Microdust
Emery												
Total inhalable dust	2		-	10	-	-	MDHS 14/3	7HH/IOM	GF/A/25	2.0	Grav	Microdust
Respirable dust	2		-	4	-	-	MDHS 14/3	Cyc	GF/A/37or 25	2.2	Grav	Microdust
Endosulfan (ISO)	2	Sk Tx	-	0.1	-	0.3	MDHS 94	7HH/IOM	GF/A/25	2.0	Grav	
"2,3-Epoxypropyl isopropyl ether"	2	FI	50	241	75	362	NIOSH S77 3	ST:Ch1		0.02	GC-FID	PGD
Ethane	1	A FI	-	-	-	-	OSHA CS1	ST: Ch1			GC-FID	
Particulate	2		-	10	-	-	NIOSH 5500 3	F/ST:Si5	GF/A/37	0.2/4hr	GC-FID	CDT
Vapour	2		-	52	-	104	NIOSH 5500 3	F/ST:Si5	GF/A/37	0.2/4hr	GC-FPD	CDT
Ethanthiol	2	FI	0.5	1.3	2	5.2	OSHA IMIS 1220	"OFF, 37"	GF/A/37	0.2	GC-FPD	CDT/UVIC
Ethanol	2	FI	1000	1920	-	-	NIOSH 1400 3	ST:Ch1		0.01/2hr	GC-FID	CDT
2-Ethoxyethanol	1	Sk Te	10	37	-	-	*MDHS 72,80,88;96*	ST:Ch1		0.01	GC-FID	
2-Ethoxyethyl acetate	1	Sk Te	10	55	-	-	*MDHS 72,80,88,*	ST:Ch1		0.02	GC-FID	
Ethyl acetate	2	FI	200	-	400	-	NIOSH 1457	ST:Ch1		0.01	GC-FID	CDT/UVIC
Ethyl acrylate	2	C Sk FI	5	21	15	62	NIOSH 1450 3	ST:Ch1		0.02	GC-FID	CDT
Ethylamine	2	FI	2	3.8	6	11	NIOSH S144 3	ST:Si1		0.05	GC-FID	CDT
Ethylbenzene	2	FI	100	441	125	552	NIOSH 1501 3	ST:Ch1		0.02	GC-FID	CDT/UVIC
Ethylene	2	A FI	-	-	-	-	OSHA CS1					CDT/PGD/UVIC
Ethylene oxide	"1, App 5"	C	5	9.2	-	-	MDHS 26	ST:CH1		0.01	GC-FID	PGD
Ethyl formate	2	Sk FI	100	308	150	462	NIOSH S36 3	ST:Ch1		0.02	GC-FID	
4-Ethylmorpholine	2	Sk	5	24	20	96	NIOSH S146 2	ST:Si1		0.02	GC-FID	
Fluoride (as F)	2		-	2.5	-	-	MDHS 35/2	7HH/IOM	MCE/A/25	2.0	ISE	
Fluorine	2	Tx Co	1	-	1	-	MDHS 70	LS/T		1.0	ISE	
Formaldehyde	1	C Tx	2	2.5	2	2.5	MDHS 78	ST:X			HPLC	
Formic acid	2	Co	5	9.6	-	-	NIOSH 2011	"OFF, 37"			IC-ECN	CDT
2-Furaldehyde	1	Sk	2	8	5	20	*MDHS 72,80*	ST:X		0.02	HPLC-UV	CDT/UVIC
Glutaraldehyde	1	Sen	0.05	0.2	0.05	0.2	MDHS 93	ST:X		0.2	HPLC-UV	
Grain dust	1	Sen	-	10	-	-	MDHS 14/3	7HH/IOM	GF/A/25	2.0	Grav	Microdust
Graphite												
Total inhalable dust	2		-	10	-	-	MDHS 14/3	7HH/IOM	GF/A/25	2.0	Grav	Microdust
Respirable dust	2		-	4	-	-	MDHS 14/3	Cyc	GF/A/37or 25	2.2	Grav	Microdust
Gypsum												
Total inhalable dust	2		-	10	-	-	MDHS 14/3	7HH/IOM	GF/A/25	2.0	Grav	Microdust
Respirable dust	2	RD	-	4	-	-	MDHS 14/3	Cyc	GF/A/37or 25	2.2	Grav	Microdust
n-Heptane	2	FI	500	-	-	-	NIOSH 15003	ST:Ch1		0.01	GC-FID	CDT/UVIC

Substance Name in EH40 Lists	EH 40 Table	Hazard Types	Occupational Exposure Limits				Method Number	Head Type Code	Filter Type Code	Air Flow Rate	Sample Analysis Instrument	Direct Reading Methods
Heptan-2-one	2	Sk	50	237	100	475	MDHS 96	ST:Ch1		0.05	GC-FID	UVIC
Heptan-3-one	2	Sk	35	166	100	475	MDHS 96	ST:Ch1		0.05	GC-FID	UVIC
Hexachloroethane												
Vapour	2		5	49	-	-	NIOSH 1003 3	ST:Ch1		0.02	GC-FID	
Total inhalable dust	2		-	10	-	-	MDHS 14/3	7HH/IOM	GF/A/25	2.0	Grav	Microdust
Respirable dust	2		-	4	-	-	MDHS 14/3	Cyc	MCE/A/37or 25	2.2	Grav	Microdust
"Hexahydro-1,3,5-trinitro-1,3,5-triazine"	2	Sk	-	1.5	-	3	MDHS 14/3	7HH/IOM	GF/A/25	2.0	Grav	
n-Hexane	2	FI	20	72	-	-	MDHS 96	ST:Ch1		0.01	GC-FID	UVIC
"Hexane, isomers except n-Hexane"	2	FI	-	-	-	-	MDHS 96	ST:Ch1		0.008	GC-FID	UVIC
Hexan-2-one	2	Sk	5	21	-	-	NIOSH 1300 3	ST:Ch1		0.02	GC-FID	UVIC
Hydrazine	1	C Sk Tx	0.02	0.03	1	0.13	NIOSH 3503 3	LS/T		0.2	UV-VIS	UVIC
Hydrogen	1	A FI	-	-	-	-						PGD
Hydrogen chloride	2	Co Tx	1	2	5	8	NIOSH S246 2	LS/T			ISE	CDT/PGD
Hydrogen cyanide	1	Sk Tx	-	-	10	11	MDHS 56/2	LS/T		0.05	ISE	CDT/PGD
Hydrogen fluoride (as F)	2	Co Sk Tx	1.8	1.5	3	2.5	MDHS 35/2	7HH/IOM		2.0	ISE	CDT
Hydrogen peroxide	2	Ox	1	1.4	2	2.8	OSHA ID 126SG	LS/T		0.2		
Hydrogen sulphide	2	Tx	5	7	10	14	NIOSH 6013	ST: Ch1		0.005	Col	CDT/PGD/UVIC
Hydroquinone	CHAN		-	2	-	4	NIOSH 5004 3	"OFF, 37"	MCE/A/37	1.0/3hr	HPLC-UV	UVIC
4-Hydroxy-4-methylpentan-2-one	2		50	241	75	362	NIOSH 1402 3	ST:Ch1		0.02	GC-FID	CDT
"2,2'-Iminodietanol"	2		3	13	-	-	NIOSH 3509 3	LS/T		0.5	IC	
"2,2'-Iminodi(ethylamine)"	2	Sk	1	4.3	-	-	NIOSH 276 2	ST:SI1		0.2	GC-FID	
Iodine and compounds	2	Tx	-	0.1	-	0.3	OSHA IMIS 1510	"OFF, 37"	MCE/A/37	2.0	XRF	
Iodomethane	1	Sk Tx	2	12	-	-	NIOSH 1014 3	ST:Ch1		0.1	GC-FID	CDT
"Iron oxide, fume (as Fe)"	2		-	5	-	10	MDHS 91	"OFF, 37"	MCE/A/37	2.0	ICP/AES	
Iron salts (as Fe)	2		-	1	-	2	MDHS 91	"OFF, 37"	MCE/A/37	1.0/2hr	ICP/AES	
Isobutyl acetate	2	FI	150	724	187	903	NIOSH 1450 3	ST:Ch1		0.02	GC-FID	CDT/UVIC
Isocyanates (all)	1	Sn Tx	-	0.02	-	0.07	MDHS 25/3	LS/T		0.05	HPLC-UV	
											CDT	
Isopropyl acetate	2	FI	-	-	200	849	NIOSH S50 3	ST:Ch1		0.01	GC-FID	CDT/UVIC
Ketene	2	Tx	0.5	0.87	1.5	2.6	NIOSH S92 2	LS		0.1	Col	UNIC
Lead and compounds	Page 40	Tx	-	0.15	-	-	MDHS 6/3	1HH/7HH/IOM	MCE/A/25	1.0	AA	
Limestone												
Total inhalable dust	2		-	10	-	-	MDHS 14/3	7HH/IOM	GF/A/25	2.0	Grav	Microdust
Respirable dust	2		-	4	-	-	MDHS 14/3	Cyc	GF/A/37or 25	2.0	Grav	Microdust
"Lindane, see g-BHC (ISO)"												
Liquefied petroleum gas (LPG)	2	FI	1000	1750	1250	2180	OSHA CS1				CDT	CDT/PGD
Lithium hydride	2	Tx	-	0.025	-	-	OSHA CS1	"OFF, 37"	MCE/A/37	2.0	AA	
Lithium hydroxide	2	Tx	-	-	-	1	NIOSH 7401	"OFF, 37"	MCE/A/37	2.0	AA	
Magnesite												
Total inhalable dust	2		-	10	-	-	MDHS 14/3	7HH/IOM	GF/A/25	2.0	Grav	Microdust
Respirable dust	2		-	4	-	-	MDHS 14/3	Cyc	GF/A/37or 25	2.2	Grav	Microdust
Magnesium oxide (as Mg)												
Total inhalable dust	2		-	10	-	-	MDHS 14/3	7HH/IOM	GF/A/25	2.0	Grav	Microdust
Respirable dust	2		-	4	-	10	MDHS 14/3	Cyc	GF/A/37or 25	2.2	Grav	Microdust
Malathion (ISO)	2	Sk	-	10	-	-	NIOSH 5012 3	"OFF, 37"	GF/A/37	1.0/2hr	GC-FPD	



Substance Name in EH40 Lists	EH 40 Table	Hazard Types	Occupational Exposure Limits			Method Number	Head Type Code	Filter Type Code	Air Flow Rate	Sample Analysis Instrument	Direct Reading Methods
Maleic anhydride	1	Sen Tx	-	1	-	3	NIOSH 3502	LS	0.8	HPLC-UV	
Mananese and compounds (as Mn)	CHAN		-	5	-	-	MDHS 91	*OFF, 37"	1.0/3hr	ICP/AES	
Manganese fume (as Mn)	CHAN		-	1	-	3	NIOSH 7300	*OFF, 37"	1.0/3hr	ICP/AES	
Man Made Mineral Fibre (MMMF)	1	C	-	5	-	-	MDHS 14/3	7HH/OM	1.0	Grav	
Marble			2f/ml				MDHS 59	Cowl	1.0	Mic-PCOM	
Total inhalable dust	2		-	10	-	-	MDHS 14/3	7HH/OM	2.0	Grav	Microdust
Respirable dust	2	RD	-	4	-	-	MDHS 14/3	Cyc	2.2	Grav	Microdust
Mercaptoacetic acid	2	Tx	1	3.8	-	-	OSHA IMIS2423	LS/T	0.2	HPLC-UV	
Methane	1	A FI	-	-	-	-					PGD
Methanethiol	2	Tx FI	0.5	1	-	-	OSHA CS1	ST:Sil		GC-FPD	CDT/UVIC
Methanol	2	SK Tx FI	200	266	250	333	NIOSH 2000 3	ST:Si1	0.01	GC-FID	PGD
2-Methoxyethanol	1	Sk Te	5	16	-	-	*MDHS 72,80,88,96*	ST:Ch1	0.1	GC-FID	
1-Methoxypropan-2-ol	2	Sk FI	100	375	150	560	*MDHS 72,80,88,96*	ST:Ch1	0.02	GC-FID	
Methyl acetate	2	FI	200	616	250	770	NIOSH 1458	ST:Ch1	0.01	GC-FID	CDT/UVIC
Methyl acrylate	2	FI	10	36	-	-	NIOSH S38 3	ST:Ch1	0.01	GC-FID	CDT/UVIC
Methylaniline	2	FI	10	13	-	-	NIOSH S148 2	ST:Si1	0.05	IC	CDT/UVIC
N-Methylaniline	2	Sk	0.5	2.2	-	-	NIOSH S153 3	LS/T	0.2	GC-FID	
3-Methylbutan-1-ol	2		100	366	125	458	NIOSH 1402 3	ST:Ch1	0.02	GC-FID	CDT
Methylcyclohexane		FI	-	-	-	-	MDHS 96	ST:Ch1	0.008	GC-FID	UVIC
Methylcyclohexanol	2		50	237	75	356	NIOSH S374 3	ST:Ch1	0.02	GC-FID	CDT
2-Methylcyclohexanone	2		50	233	75	350	NIOSH 2521 3	ST:X	0.01	GC-FID	CDT
"4,4'-Methylenedianiline (MDA)"	1	C Sk Bmgv	0.01	0.08	-	-	NIOSH 5029 3	*OFF, 37"	2.0	HPLC-UV	
Methyl ethyl ketone peroxides (MEKP)	2	Tx	-	-	0.2	1.5	NIOSH 3508 3	LS/T	0.5	Col	
5-Methylheptan-3-one	2		10	-	20	-	MDHS 96	ST:Ch1	0.05	GC-FID	
5-Methylhexan-2-one	2	Sk	20	95	100	475	OSHA IMIS 1776	ST:Ch1	0.05	GC-FID	
Methyl methacrylate	2		50	208	100	416	NIOSH 2537 3	ST:X	0.01	GC-FID	CDT/UVIC
4-Methylpentan-2-ol	2	Sk	25	106	40	170	NIOSH 1402 3	ST:Ch1	0.02	GC-FID	UVIC
4-Methylpentan-2-one	2	Sk Bmgv	50	208	100	416	NIOSH 1300 3	ST:Ch1	0.02	GC-FID	CDT/UVIC
4-Methylpent-3-en-2-one	2		15	61	25	102	MDHS 96	ST:Ch1	0.05	GC-FID	CDT
2-Methylpropan-1-ol	2	FI	50	154	75	231	NIOSH 1401 3	ST:Ch1	0.02	GC-FID	CDT

Substance Name in EH40 Lists	EH 40 Table	Hazard Types	Occupational Exposure Limits				Method Number	Head Type Code	Filter Type Code	Air Flow Rate	Sample Analysis Instrument	Direct Reading Methods
2-Methylpropan-2-ol	2	FI	100	308	150	462	NIOSH 1400 3	ST:Ch1		0.02	GC-FID	
1-Methyl-2-pyrrolidone	2		25	103	75	309	OSHA M139	ST:Si1		0.1	GC-NPD	
Methylstyrenes (except a-methylstyrene)	2		100	491	150	736	NIOSH 1501 3	ST:Ch1		0.05	GC-FID	UVIC
"N-Methyl-N,2,4,6-tetranitroaniline"	2		-	1.5	-	3	NIOSH S225 2	*OFF, 37"	MCE/A/37	1.5/1hr	Col	
Mica												
Total inhalable dust	2		-	10	-	-	MDHS 14/3	7HH/IOM	MCE/A/25	2.0	Grav	Microdust
Respirable dust	2	RD	-	0.8	-	-	MDHS 14/3	*Cyc,25"	GF/A/25	2.2	Grav	Microdust
Molybdenum compounds (as Mo)												
soluble compounds	2		-	5	-	10	MDHS 91	*OFF, 37"	MCE/A/37	1.0/1hr	AA	
insoluble compounds	2		-	10	-	20	MDHS 91	*OFF, 37"	MCE/A/37	1.0/1hr	AA	
Monochloroacetic acid	2	Sk Tx	0.3	1.2	-	-	NIOSH 2008 3	ST:Si1		0.2	IC	
Morpholine	2	Sk FI	20	72	30	109	NIOSH S150 2	ST:Si1		0.04	GC-FID	UVIC
Naphthalene	CHAN		10	53	15	80	NIOSH 1501 3	ST:Ch1		0.2	GC-FID	CDT/UVIC
"Nickel, inorganic compounds (as Ni)"												
water soluble	1	Tx	-	0.1	-	-	OSHA ID121	*OFF, 37"	MCE/A/37	2.0	AA	
water insoluble	1	Tx	-	0.5	-	-	MDHS 91	*OFF, 37"	MCE/A/37	2.0	ICP/AES	
"Nickel, organic compounds (as Ni)"	2	Tx	-	1	-	3						
Nitric acid	2	Co Ox	2	5.2	4	10	NIOSH S319 2	LS		0.2	ISE	CDT
4-Nitroaniline	2	Sk	-	6	-	-	NIOSH S7 3	*OFF, 37"	MCE/A/37	1.5	HPLC-UV	
Nitrobenzene	2	Sk Tx	1	5.1	2	10	NIOSH 2005 3	ST:Si1		0.2	HPLC	UVIC
Nitrogen dioxide	2	Tx	3	5.7	5	9.6	NIOSH 108 2	LS/T		0.2/1hr	Col	CDT/PGD/UVIC
Nitrotoluene (all isomers)	2	Sk Tx	5	29	10	57	NIOSH 2005 3	ST:Si1		0.05	GC-FID	
Octachloronaphthalene	2	Sk Tx	-	0.1	-	0.3	NIOSH S97 2	*OFF, 37"	MCE/A/37	1.0/ 5hr	GC-ECD	
n-Octane		FI	-	-	-	-	MDHS 96	ST:Ch1		0.01	GC-FID	CDT/PGD/UVIC
"Oil mist, mineral"	"2, p 32"	C	-	5	-	10	NIOSH 5026 3	*OFF, 37"	MCE/A/37	1.0	IR	
Oxalic acid	2	Tx	-	1	-	2	OSHA IMIS 1970	*OFF, 37"	MCE/A/37	2.0	IC	

Substance Name in EH40 Lists	EH 40 Table	Hazard Types	Occupational Exposure Limits			Method Number	Head Type Code	Filter Type Code	Air Flow Rate	Sample Analysis Instrument	Direct Reading Methods
2-Methylpropan-2-ol	2	FI	100	308	150	462	ST:Ch1		0.02	GC-FID	
1-Methyl-2-pyrrolidone	2		25	103	75	309	ST:Si1		0.1	GC-NPD	
Methylstyrenes (except a-methylstyrene)	2		100	491	150	736	ST:Ch1		0.05	GC-FID	UVIC
"N-Methyl-N,2,4,6-tetranitroaniline"	2		-	1.5	-	3	*OFF, 37"	MCE/A/37	1.5/1hr	Col	
Mlca											
Total inhalable dust	2		-	10	-	-	7HH/IOM	MCE/A/25	2.0	Grav	Microdust
Respirable dust	2	RD	-	0.8	-	-	*Cyc,25"	GF/A/25	2.2	Grav	Microdust
Molybdenum compounds (as Mo)											
soluble compounds	2		-	5	-	10	*OFF, 37"	MCE/A/37	1.0/1hr	AA	
insoluble compounds	2		-	10	-	20	*OFF, 37"	MCE/A/37	1.0/1hr	AA	
Monochloroacetic acid	2	Sk Tx	0.3	1.2	-	-	ST:Si1		0.2	IC	
Morpholine	2	Sk FI	20	72	30	109	ST:Si1		0.04	GC-FID	UVIC
Naphthalene	CHAN		10	53	15	80	ST:Ch1		0.2	GC-FID	CDT/UVIC
"Nickel, inorganic compounds (as Ni)"											
water soluble	1	Tx	-	0.1	-	-	*OFF, 37"	MCE/A/37	2.0	AA	
water insoluble	1	Tx	-	0.5	-	-	*OFF, 37"	MCE/A/37	2.0	ICP/AES	
"Nickel, organic compounds (as Ni)"	2	Tx	-	1	-	3					
Nitric acid	2	Co Ox	2	5.2	4	10	LS		0.2	ISE	CDT
4-Nitroaniline	2	Sk	-	6	-	-	*OFF, 37"	MCE/A/37	1.5	HPLC-UV	
Nitrobenzene	2	Sk Tx	1	5.1	2	10	ST:Si1		0.2	HPLC	UVIC
Nitrogen dioxide	2	Tx	3	5.7	5	9.6	LS/T		0.2/1hr	Col	CDT/PGD/UVIC
Nitrotoluene (all isomers)	2	Sk Tx	5	29	10	57	ST:Si1		0.05	GC-FID	
Octachloronaphthalene	2	Sk Tx	-	0.1	-	0.3	*OFF, 37"	MCE/A/37	1.0/.5hr	GC-ECD	
n-Octane		FI	-	-	-	-	ST:Ch1		0.01	GC-FID	CDT/PGD/UVIC
"Oil mist, mineral"	"2, p 32"	C	-	5	-	10	*OFF, 37"	MCE/A/37	1.0	IR	
Oxalic acid	2	Tx	-	1	-	2	*OFF, 37"	MCE/A/37	2.0	IC	

Substance Name in EH40 Lists	EH 40 Table	Hazard Types	Occupational Exposure Limits			Method Number	Head Type Code	Filter Type Code	Air Flow Rate	Sample Analysis Instrument	Direct Reading Methods
Ozone	2	Ox Tx	-	-	0.2	0.4	NIOSH S8 2	LS	0.1	Col	CDT/PGD
"Paraffin wax, fume"	2		-	2	-	6	OSHA IMIS 2000	*OFF, 37"	1.0/2hr	GC-FID	
Parathion (ISO)	2	Sk Tx	-	0.1	-	0.3	NIOSH 5012 3	*OFF, 37"	1.0	GC-FID	
Pentacarbonyl iron (as Fe)	2	Tx FI	0.01	0.08	-	-	OSHA IMIS 1512	LS/T	1.0	Col	
Pentachlorophenol	2	Sk Tx	-	0.5	-	1.5	NIOSH 5512 3	F/LS/T	1.0	HPLC-UV	
Pentaerythritol											
Total inhalable dust	2		-	10	-	20	MDHS 14/3	7HH/IOM	2.0	Grav	Microdust
Respirable dust	2		-	4	-	-	MDHS 14/3	*Cyc, 37"	2.2	Grav	Microdust
"Pentane, all isomers"		FI	-	-	-	-	MDHS 96	ST:Ch1	0.005	GC-FID	PGD/CDT/UVIC
Pentan-2-one	2	FI	200	716	250	895	NIOSH 1300 3	ST:Ch1	0.02	GC-FID	UVIC
Pentan-3-one	2	FI	200	716	250	895	OSHA IMIS D707	ST:Ch1	0.02	GC-FID	UVIC
Pentyl acetate	2		50	270	100	541	NIOSH 1450 3	ST:Ch1	0.02	GC-FID	CDT
Phenol	1	Sk Tx	2	-	-	-	NIOSH 3502 3	LS/T	0.2	GC-FID	CDT/UVIC
p-Phenylenediamine	2	Tx	-	0.1	-	-	OSHA IMIS 2042	LS/T	0.2	HPLC-UV	UVIC
"Phenyl-2,3-epoxypropyl ether"	2		1	6.2	-	-	NIOSH S74 3	ST:Ch1	0.1	GC-FID	
Phenylhydrazine	CHAN	C Sk	-	-	-	-	NIOSH S160 3	LS/T	0.2	UV-VIS	
2-Phenylpropene	2		50	246	100	491	NIOSH 1501 3	ST:Ch1	0.05	GC-FID	CDT
Phorate (ISO)	2	Sk Tx	-	0.05	-	0.2	NIOSH 5012 3	*OFF, 37"	1.0/2hr	GC-FPD	
Phosgene	2	Tx	0.02	0.08	0.06	0.25	NIOSH 219 2	LS/T	0.1	Col	CDT
Phosphine	2	Tx	-	-	0.3	0.42					CDT/UVIC
Phosphorus trichloride	2	Tx	0.2	1.3	0.6	3.8	NIOSH 6402 3	LS	0.2	Col	
Phthalic anhydride	1	Sen	-	4	-	12	NIOSH S179 2	*OFF, 37"	1.0/2hr	HPLC-UV	
Picric acid	2	Tx	-	0.1	-	0.3	NISOH S228 2	*OFF, 37"	1.0/3hr	HPLC-UV	
Plaster of Paris (see Gypsum)											



Substance Name in EH40 Lists	EH 40 Table	Hazard Types	Occupational Exposure Limits			Method Number	Head Type Code	Filter Type Code	Air Flow Rate	Sample Analysis Instrument	Direct Reading Methods
"Platinum compounds, soluble (as Pt)"	2	Sen	-	0.002	-	-	MDHS 46/2	MCE/A/25	2.0	AA	
Portland cement											
Total inhalable dust	2										
Inhalable dust	2		-	10	-	MDHS 14/3	7HH/IOM	GF/A/25	2.0	Grav	Microdust
			-	4	-	MDHS 14/3	*Cyc,37"	GF/A/37	2.2	Grav	Microdust
Propane	1	A FI	-	-	-	MDHS 96					PGD
Propan-1-ol	2	Sk FI	200	500	250	625	ST:Ch1		0.02	GC-FID	CDT
Propan-2-ol	2		400	999	500	1250	ST:Ch1		0.005	GC-FID	CDT
Propionic acid	2		10	31	15	46	ST:Ch1		0.02	GC-FID	UVC
n-Propyl acetate	2	FI	200	849	250	1060	ST:Ch1		0.02	GC-FID	CDT/UVIC
Propylene oxide	1		5	12	-	-	ST:Ch1		0.01	GC-FID	
Pyrethrins (ISO)	2		-	5	-	10	*OFF,37"	GF/A/37	1.0/6hr	HPLC-UV	
Pyridine	2	FI	5	16	10	33	ST:Ch1		0.2	GC-FID	
Resorcinol	2		10	46	20	92	LS		0.2	HPLC-UV	
Rosin based solder flux fume	1	Sen	-	0.05	-	MDHS 83	swinnex	13mm mem	2.0	GC-FID	
Rouge											
Total inhalable dust	2		-	10	-	-	7HH/IOM	GF/A/25	2.0	Grav	Microdust
Respirable dust	2	RD	-	4	-	-	*Cyc,37"	GF/A/37	2.2	Grav	Microdust
Rubber fume	"1, p32"	C	-	0.6	-	-	7HH/IOM	GF/A/25	2.0	Grav+ SE	
Rubber process dust	"1,32"	C	-	6	-	-	7HH/IOM	GF/A/25	2.0	Grav	
Selenium and compounds (as Se)	2	Tx	-	0.1	-	-	*OFF,37"	MCE/A/37	2.0	ICP/AES	
"Silica, amorphous"											
Total inhalable dust	2		-	6	-	-	7HH/IOM	MCE/A/25	2.0	Grav	Microdust
Respirable dust	2	RD	-	2.4	-	-	*Cyc,25"	"GF/A/25,37"	2.2	Grav	Microdust
"Silica, respirable crystalline "	1	RD	-	0.3	-	-	*Cyc,37"	MCE/A/37	2.2	IR	
"Silica, fused, respirable dust"	2	RD	-	0.08	-	-	*Cyc,37"	MCE/A/375	2.2	IR	
Silicon											
Total inhalable dust	2		-	10	-	-	7HH/IOM	MCE/A/25	2.0	Grav	Microdust
Respirable dust	2	RD	-	4	-	-	*Cyc,237"	MCE/A/37	2.2	Grav	Microdust

Substance Name in EH40 Lists	EH 40 Table	Hazard Types	Occupational Exposure Limits			Method Number	Head Type Code	Filter Type Code	Air Flow Rate	Sample Analysis Instrument	Direct Reading Methods
Silicon carbide (not whiskers) Respirable dust	2		-	10	-	MDHS 14/3	7HH/IOM	MCE/A/25	2.0	Grav	Microdust
	2	RD	-	4	-	MDHS 14/3	*Cyc,237"	MCE/A/37	2.2	Grav	Microdust
Sodium azide (as Na N3)	2	Tx	-	0.1	-	OSHA IMIS 2243	F/LS/T	GF/A/37		UV-VIS	
Sodium fluoroacetate	2	Sk Tx	-	0.05	-	NIOSH S301 2	*OFF, 37"	MCE/A/37	1.0	IC	
Sodium hydrogen sulphite	2		-	5	-	OSHA IMISS050	*OFF, 37"	MCE/A/37	2.0	IC	
Sodium hydroxide	2		-	-	-	MDHS 91	*OFF, 37"	MCE/A/37	2.0	ICP/AES	
Starch											
Total inhalable dust	2		-	10	-	MDHS 14/3	7HH/IOM	GF/A/25	2.0	Grav	Microdust
Respirable dust	2		-	4	-	MDHS 14/3	*Cyc,237"	MCE/A/37	2.2	Grav	Microdust
Styrene	2	Tx	-	0.15	-	NIOSH 5016 3	*OFF, 37"	GF/A/37	2.0	HPLC-UV	
Sucrose	1	FI	100	430	250	1080	ST:Ch1		0.02	GC-FID	CDTUVIC
Sulphur dioxide	2	Tx	2	5.3	5	13	F/LS/T	MCE/A/37	0.2	Titr	CDT/PGD
Sulphur hexafluoride	2		1000	6070	1250	7590	GSB			GC-TCD	
Sulphuric acid	CHAN	Tx Co Ox	-	1	-	NIOSH 187 2	LS		0.2	Col	
Sulphuryl difluoride	2		5	21	10	42	GSB		0.05/1hr	GC-FPD	
"2,4,5-T (ISO)"	2		-	10	-	20	*OFF, 37"	GF/A/37	1.0/3hr	HPLC-UV	
"Talc, respirable dust"	2	RD	-	1	-	MDHS 14/3	*Cyc,37"	MCE/A/37	2.2	Grav	Microdust
Tantalum	2		-	5	-	10	*OFF, 37"	MCE/A/37	1.5/1hr	ICP/AES	
Tellurium and compounds (as Te) except H2Te	2	Tx	-	0.1	-	MDHS 91	*OFF, 37"	MCE/A/37	2.0	ICP/AES	
"1,1,1,2,2-Tetrabromoethane"	2	Sk	0.5	7.2	-	NIOSH 2003 3	ST:Si1		0.2	GC-FID	
"1,1,1,2,2-Tetrachloro-2,2-difluoroethane"	2		100	847	100	847	ST:Ch1		0.005	GC-FID	
Tetrachloroethylene	2		50	345	100	689	ST:Ch1		0.02	GC-FID	CDT

Substance Name in EH40 Lists	EH 40 Table	Hazard Types	Occupational Exposure Limits			Method Number	Head Type Code	Filter Type Code	Air Flow Rate	Sample Analysis Instrument	Direct Reading Methods
Tetrachloronaphthalenes (all isomers)	2		-	2	-	4	NIOSH S130 2	GF/A/37	1.5/1hr	GC-ECD	
Tetrahydrofuran	2	Sk FI	50	150	100	300	NIOSH 1609 3	ST:Ch1	0.02	GC-FID	UVIC
Tetramethyl succinonitrile	2	Sk	0.5	2.8	2	11	NIOSH S155 2	ST:Ch1	0.1	GC-FID	
"Thallium, soluble compounds (as Tl)"	2	Sk Tx	-	0.1	-	-	MDHS 91	*OFF, 37"	2.0	ICP/AES	
Titanium dioxide											
Total inhalable dust	2		-	10	-	-	MDHS 14/3	7HH/10M	2.0	Grav	Microdust
Respirable dust	2	RD	-	4	-	-	MDHS 14/3	*Cyc, 37"	2.2	Grav	Microdust
Toluene	2	Sk FI	50	191	150	574	*MDHS 72,80,88,96"	ST:Ch1	0.02	GC-FID	CDT/UVIC
o-Toluidine	1	C Sk	0.2	0.89	-	-	NIOSH 2002 3	ST:Si1	0.1	GC-FID	UVIC
Tributyl phosphate	2		-	5	-	5	NIOSH S208 3	*OFF, 37"	1.5/1hr	GC-FPD	
"1,1,1-Trichlorobis(chlorophenyl)ethane" (see DDT)	2										
"1,1,1-Trichloroethane"	2		100	555	200	1110	MDHS 96	ST:Ch1	0.02	GC-FID	CDT
Trichloroethylene	1	C Sk Mu	100	550	150	820	MDHS 96	ST:Ch1	0.02	GC-FID	CDT/UVIC
Trichlorofluoromethane	2		1000	5710	1250	7140	NIOSH 1006 3	ST:Ch4	0.02	GC-FID	
Trichloronitromethane	2		0.1	0.68	0.3	2.1					CDT
"1,2,3-Trichloropropane"	2		50	306	75	460	NIOSH 1003 3	ST:Ch1	0.02	GC-FID	
"1,1,2-Trichlorotrifluoroethane"	2		1000	7790	1250	9740	NIOSH 1020 3	ST:Ch1	0.005	GC-FID	
Triethylamine	2	FI	10	25	15	37	NIOSH S152 2	LS/T	0.2	GC-FID	CDT/UVIC
Trimanganese tetraoxide	CHAN		-	1	-	-	MDHS 91	*OFF, 37"	1.0/3hr	ICP/AES	
"Trimethylbenzenes, all isomers"	2		25	125	-	-	OSHA IMIS 2505	ST:Ch1	0.02	GC-FID	CDT
Triphenyl phosphate	2		-	3	-	6	NIOSH S210 3	*OFF, 37"	1.0/2hr	GC-FPD	
Tri-o-tolyl phosphate	2	Tx	-	0.1	-	0.3	NIOSH S209 3	*OFF, 37"	1.0/2hr	GC-FPD	
Tungsten and compounds (as W)											
Soluble	2		-	1	-	3	NIOSH 7074 3	*OFF, 37"	1.5	AA	
Insoluble	2		-	5	-	10	NIOSH 7074 3	*OFF, 37"	1.5	AA	





## Absorption

The process of transferring matter or energy into another body.

## Acclimatisation

The ability of a body to adapt to its thermal environment.

## Accuracy

The numerical difference between an instrument reading and the true value of the quantity being measured. Often expressed as limits that will not be exceeded when the instrument is used within its stated operational conditions, i.e.  $\pm 5^\circ\text{C}$ .

## Actual Pressure

The atmospheric pressure at the level of measurement.

## Adsorption

The collection of vapours from the atmosphere by condensation on the surface of a porous solid with a high surface area (e.g charcoal). The adsorbed material can be recovered by thermal or solvent desorption.

## Advection

The horizontal transport of heat or cold, in the atmosphere, or the oceans. When a warm air mass passes over a cold land or sea surface it causes the air to cool and the water vapour held within it to condense.

## Air Monitoring

The sampling for and measurement of pollutants in the atmosphere.  
See also Sorbent Tubes, Sampling Bag, Filter Method, Arnold Bubbler, Colour Tubes, Badge Monitors, MDHS and Sampling Conventions.

## Air Temperature

Typically expressed in  $^\circ\text{C}$ , it is the temperature of the ambient air.

## Air Velocity

The magnitude and direction of air flow, typically expressed in metres per second.

## Alveoli

The tiny air sacs of the lungs, where gas-exchange takes place. The blood takes up oxygen from the air and gives up carbon dioxide, which is then exhaled.

## Ambient

The surrounding environment atmosphere.

## Ambient Monitoring

The monitoring of air quality outside buildings, being representative of the air that the general (or identified) population is breathing.

## Ambient Temperature – $t_a$

The average temperature of the air surrounding an instrument/sensor or experienced by the operative during the work activity. This parameter forms one of the fundamental input values for the calculation of various derived values related to heat stress.

## Aneroid Capsule

A thin semi-evacuated metal capsule, which when used in a barometer deforms with changes in pressure. One end being fixed and the other moves a pen on a chart or a hand on a dial. Aneroid means without air.

## Area, Effective Radiating ( $A_r$ )

The surface area of a body, that exchanges radiant energy with a radiant source, measured in  $\text{m}^2$ .

## Arnold Bubbler

An impinger in which air is bubbled through a liquid to absorb gases or vapours from the atmosphere, particularly for substances which may not be suitable for adsorption onto charcoal or other sorbents. The absorption may be by simple dissolution or by chemical reaction to trap the substance being monitored. The liquid is then analysed by an appropriate method to determine the concentration. An activated carbon filter is required to stop moisture entering the pump.  
Basic kit for sampling with an Arnold Bubbler:

- VORTEX pump
- Arnold Bubbler (impinger equivalent)
- Activated carbon filter
- Connecting tubes
- Flowmeter
- Tools for pump flow rate adjustment

## Asbestosis

A fatal disease of the lungs caused by repeated exposure to airborne asbestos fibres.

## Asphyxia

Suffocation from a lack of oxygen. Chemical asphyxia is produced by a substance which combines with the blood's haemoglobin to reduce its capacity to transport oxygen. An example of a chemical asphyxiant is carbon monoxide.

## Aspirated

Forced air flow over a sensor.

## Badge Monitors

A passive sampling method which does not require the use of sampling equipment. The badges are typically used for gas/vapour monitoring and are worn by the user. The sample is collected by diffusion.

## BCURA

British Coal Utilisation Research Association. Responsible for the design of an isokinetic stack monitoring system for particulate upon which British standard measurement techniques were based.

## BIOH

British Institute of Occupational Hygienists  
Integration of Institute of Occupational Hygienists (IOH) and the British Examining Board of Occupational Hygiene (BEBOH).

## Black Globe Temperature

The temperature within a matt black, hollow sphere. It monitors the radiant temperature of the ambient air.

## Body Heat Balance

The balance between the body's heat production and its loss to the environment.

Expressed as  $H=M+C+R-E$

Where:

H = Body heat content

M = Metabolism

C = Convective heat transfer

R = Radiant heat exchange

E = Evaporative heat transfer

## Body Heat Storage

The change in heat content of the body, either + or -.

## Bronchiole

The finest of the lung's bronchi leading to the alveoli.

## BSI

British Standards Institution

## BTEX

Common petroleum fraction solvents – Benzene, Toluene, Ethylbenzene and Xylenes.

## Carbon Dioxide

A colourless, odourless, un-reactive gas commonly produced by combustion and decay. It is also an asphyxiant.

## Carbon Monoxide

Formed when carbon is burned in a limited supply of oxygen, resulting in incomplete combustion. It is tasteless, odourless, colourless and extremely toxic.

## Carcinogenic

A substance which is able to cause cancer.

## CE

A mark to identify conformity to European Standards.

## CENELEC

European Committee for Electrotechnical Standardisation.

## COSHH

Control Of Substances Hazardous to Health Regulations – UK legislation first implemented in 1989, requiring a suitable and sufficient assessment of both the risk of exposure to hazardous substances in the workplace and what measures may be required to control exposure.

## Cross Wind

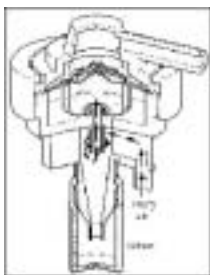
See Wind

## Cumulative Data

A measured sound level data set obtained over a run-time time interval.

### Cyclone Head

A respirable dust size selective sampling head used in particulate monitoring. Centrifugation separates the particulate; the larger particles falling into the grit pot, whilst the smaller respirable particles are carried upwards and captured on a filter



The full name for this type of respirable dust cyclone is the Dewell Higgins cyclone. For setting the flow rate see Flow Meters, also see Sampling Conventions.

### Dew Point

The temperature at which the water vapour in the air first starts to condense, typically expressed in °C.

### Diffraction

Radiation being bent or curved from its original course; for example light being bent as it passes through a narrow slit.

### Diffusion Tube

An inert tube of plastic or stainless steel which contains an absorbing matrix capable of collecting specific target air pollutants. They are used for ambient monitoring and are analysed in a laboratory.

### Draught Risk

Predicts the percentage of people dissatisfied due the Draught sensation. Function of the air temperature, average air velocity and the turbulence intensity.

### Dust

Solid particles, usually produced by a mechanical process, with a range of particle diameters from 0.1µm up to a maximum of 100µm. Dust can also include fumes, which condense from the vapour state, usually from volatilisation of molten metals, high boiling liquids or combustion.

### EH

Environmental Hygiene (HSE Guidance Notes)

### EMC

Electro Magnetic Compatibility – European Standards.

### EPA

Environmental Protection Agency (USA)

### Equivalent Continuous Sound Level - LEQ

The sound level which when maintained continuously for an interval is energy-equivalent with a varying sound level for the same interval. (See time-average sound level).

### Fahrenheit

Temperature scale where the ice point of water is 32°F and the boiling point of water is 212°F at sea level.

### Filters

- Glass fibre filters (GF/A) – Used for general gravimetric monitoring
- Mixed Cellulose Ester filters (MCE) – Typically used when further chemical analysis is required. Also available with a printed grid for use in asbestos monitoring
- Teflo – Standard filter for monitoring of PM<sub>10</sub>, as recommended by US EPA.

Standard filter sizes are 25, 37 and 47mm diameter.

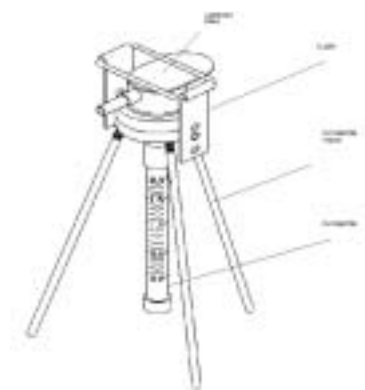
All filters are delicate, especially GF/A and must always be handled with flat tipped tweezers, never by hand.

It is important to remember to remove the backing paper from a membrane type filter before sampling. The backing is usually blue.

Several of Casella CEL's sampling heads incorporate a filter cassette system to hold the filter. The aim of the cassette is to reduce filter handling, and thus make loading the sampling head quicker and easier. Another advantage is to reduce potential under reading as all the particulate drawn in is weighed, not just the particulate on the filter paper. Under reading often occurs when particulate is deposited on the inner surfaces of the sampling head, and not included in the final sample.

### Flowmeter (Rotameter)

The flowmeter is read from the flat top of the float. If you are using a flowmeter with a 'ball' type float, the reading is taken from the equator of the ball.



### Fumes

See Particulate

### Gas

Material that is in the gaseous phase under the surrounding conditions. In confined spaces gases are commonly measured as:

- Toxic (TOX)  
The risk of intoxication by toxic gases and vapours. Many chemical products and organic products are capable of emitting toxic gases which produce various levels of risks to any persons in contact with them. LTEL – Long Term Exposure Limit  
STEL – Short Term Exposure Limit
- Oxygen (OX)  
Risk of asphyxiation from lack of oxygen or risk of fire from excessive oxygen. Measured as a % of the air  
24% hyperventilation  
21% normal  
17% rapid breathing lack of muscle co-ordination  
12% Dizziness, headaches, rapid tiredness  
9% unconsciousness  
6% death in a few minutes
- Explosive (EX)  
The risk of explosion due to combustible gases and vapours. There are three requirements for an explosion; oxygen, fuel and a source of ignition.  
LEL – Lower explosion limit, below which there is not enough gas to maintain an explosion  
UEL – Upper explosion limit above which there is not enough oxygen

The LEL is measured and the result scaled 0 – 100%; when the reading reaches 100% there is enough explosive gas in the air to cause an explosion.

### GF/A

See Filters

### Global Radiation

See Radiation

### Gravimetric

The determination of particle concentration using pre and post weighed filters.

### Heat Capacity

The ability of a substance to store heat. Defined as the mass multiplied by the specific heat of a body.

### Heat Content of a Body

The body mass multiplied by the average specific heat and the absolute mean body temperature.

## Heat Cramp

A heat related problem characterised by contractions of the voluntary muscles, usually as the result of restricted salt intake and profuse sweating without significant dehydration.

## Heat Exhaustion

A heat related illness characterised by muscular weakness, distress, nausea, vomiting, dizziness, pale clammy skin, and fainting. Associated with lack of heat acclimatisation, poor physical fitness, poor health and an inadequate water intake.

## Heat Stress

Physiological strain caused by an increase in core body temperature.

The human body maintains its core temperature at 37°C over a wide range of conditions by thermo-regulatory means.

This equilibrium is affected by:

- Metabolic heat generation
- Evaporation (rate determined by RH%, air velocity, and clothing)
- Convection (if ambient >37°C then body gains heat)
- Radiation
- Conduction  
In hot environments heat loss by radiation/convection will be limited and core temperature will rise. Greater heat stress = higher physiological strain.

## Heat Stress Index (H.S.I.)

Uses two estimated quantities from environmental and metabolic rate data:

- The required evaporative heat loss by sweating to achieve heat balance ( $E_{req}$ )
- The maximum evaporative heat loss possible in that environment ( $E_{max}$ )

The ratio of  $E_{req}$  to  $E_{max}$  is calculated and then related to allowable exposure time.

If  $E_{req}$  is less than or equal to  $E_{max}$  then the worker can continue to work in that environment without any ill effects.

If  $E_{req}$  is greater than  $E_{max}$  then heat will build up in the body, therefore limiting the working time allowed in that environment. This is based upon a maximum allowable increase in heat load in the body.

Measurement required:

- Globe temperature
- Air temperature
- Wet-bulb temperature
- Air velocity
- Metabolic work rate

There are several heat stress indices, the choice of which one to use is based upon the clothing indices.

Work rates and clothing indices can be found in the TABLES section of the Glossary.

## Heat-Stroke

Medical condition arising from exposure to heat causing an excessive rise in body temperature and a failure of the heat regulating mechanism. Characterised by a sudden and sustained loss of consciousness preceded by vertigo, nausea, headache, cerebral dysfunction, bizarre behaviour, and body temperatures in excess of 41.1°C.

There is a numeric value ranging from 0 to 100, which indicates the heat load on the operative.

## HSL

Health and Safety Laboratory - UK

## Hyperpyrexia

A body core temperature exceeding 40°C (104°F).

## ICP/AES (Inductively Coupled Plasma Atomic Emission Spectroscopy)

Metal ions in a solution are sprayed into a plasma torch. Each metal then emits a characteristic line or atomic spectrum of wavelengths which can be detected, (usually one major line per element) where the intensity of each line is proportional to the concentration of the element. This is a very sensitive and specific analytical method which is useful, for example, for contaminated soils. Sample preparation usually involves drying, grinding and sieving with acid digestion or other extraction procedure.

## Impinger

See *Arnold Bubbler*

## Infra-red

Wavelength just beyond the red end of the visible light spectrum

## Intrinsically Safe (I.S.)

An instrument that will not cause ignition in a specified gas mixture under specific conditions, i.e. can be used in potentially flammable areas subject to individual instrument compliance.

## IOM

Institute of Occupational Medicine - UK

## Ionisation

The charging of a molecule by removing one or more electrons.

## IOSH

Institute of Occupational Safety and Health – UK.

## IP

Ingress Protection codes – as per EN 60529 : 1992

## ISO

International Standards Organisation.

## LD<sub>50</sub> (Lethal Dose 50)

The dose which causes 50% mortality in the species exposed.

## LEV

See *Local Exhaust Ventilation*

## Linearity

The closeness of a calibration response to a straight line.

## Local Exhaust Ventilation

Control of emissions into the atmosphere using localised extraction systems.

## LUX

The luminescence per square meter, of surface area.

## MDHS

Methods for the Determination of Hazardous Substances – UK guidelines.

## Mean Radiant Temperature – $t_r$

Value associated with the radiation temperature in °C experienced by the operative from radiating surfaces. These surfaces act as heat sources that will add to the heat load of the operative and consequently cause the core temperature to rise.

## MEL

Maximum Exposure Limits

See *OEL*

## Membrane Filter

See *Filters*

## Mesothelioma

An aggressive cancer of the pleural lining of the lung caused almost exclusively from exposure to asbestos. Invariably fatal.

## Metabolic Rate (MR)

Chemical energy transfer into free energy per unit time.

## Metabolism

The transformation of chemical energy into energy that is used to perform work and produce heat.

## MHSAW Regulations

The Management of Health and Safety at Work Regulations implemented in 1993. The regulations require the employer to assess and adequately control all risks in the workplace and provide a system for managing health and safety at work.

## Micron

1 millionth of a metre,  $1 \times 10^{-6}m$ .

## Mist

Liquid droplets suspended in the atmosphere. Mist reduces visibility to a lesser extent than fog.

## MMMF

Man Made Mineral Fibres.

## Modem - Modulator/Demodulator

A device that allows computers or electrical equipment to communicate using telephone lines.

## MSHA

Mine Safety and Health Administration – UK

## NAMAS

National Accreditation of Measurement and Sampling.

The accreditation standard now administered by United Kingdom Accreditation Service (UKAS - formerly the National Measurement Accreditation Service). In the UK, accreditation to this standard demonstrates compliance with EN 45001.

## NEBOSH

National Examining Board of Occupational Safety and Health – UK

## NIOSH

National Institute of Occupational Safety and Health – USA.

## Occupational Hygiene

The science associated with the anticipation and recognition of workplace hazards and the evaluation and control of subsequent risks to health.

## OEL

Occupational Exposure Limits

In the UK, the limits are defined in the HSE's guidance EH40. The limits are in two groups, Table 1 lists Maximum Exposure Limits (MEL) and Table 2 lists Occupational Exposure Standards (OES).

Maximum Exposure Limits

These are statutory limits that should not normally be exceeded. In addition, all efforts should be made to reduce the exposure, as far below the MEL as is reasonably practicable by means other than respiratory protection. These limits apply particularly to substances that are known to be carcinogenic or are respiratory sensitisers, for example.

Occupational Exposure Standards

These are applied to all other materials and, in general, exposures below the standard would be regarded as demonstrating adequate compliance with the statutory requirements. Occasional exposures above the standard would not necessarily be regarded as unacceptable if the reasons for the excursion had been identified and steps were being taken to rectify the situation.

For each material, exposure limits are expressed as an 8-hour time weighted average (TWA) and as a 15-minute short-term exposure limit (STEL). If no STEL is quoted then a level of three times the 8 hour TWA may be assumed but the total duration of excursions above the TWA should not exceed one hour in any 24 hour period.

## OES

See OEL

## Ozone

Under certain conditions three oxygen atoms combine to form Ozone ( $O_3$ ). It is a highly reactive and toxic gas produced, for example, near electrical equipment containing high voltages.

## Parameter

A measured or calculated value.

## Particulate

- Aerosol – Liquid or solid particles suspended in air
- Mist or Fog – Liquid aerosol, fog is made up of larger particles than mist
- Dust – Solid particles in the air, produced by an abrasive or mechanical action
- Fumes – Solid particles formed by condensation after volatilisation of welding or flame cutting
- Smokes – Similar size to fumes, produced during combustion

## Passive Sampling

Air sampling without the aid of a sample pump. Typically employs diffusion tubes.

## Personal Sampling

Occupational sampling of airborne pollutants with sampling equipment worn by the operator. The sample head or collection device must be within the operator's breathing zone (OBZ) which is usually defined as within 200mm of the mouth or nose. For occupational Hygiene purposes, personal sampling is regarded as the normal procedure unless static samples can be shown to be representative of individual exposures.

## Photometer/Nephelometer

Optical measurement device based upon the scattering effect of light by particulate. Under clean air conditions all light is prevented from reaching the receiver by a light stop. When dust particles enter the sample volume, the light beam is scattered forward within a narrow angle to the receiver

The particles scatter the beam by reflection, refraction, and diffraction.

## PM<sub>10</sub>

Particulate matter having a mean aerodynamic diameter of 10 microns, usually relates to ambient particulate monitoring.

## PPB

Parts Per Billion

## PPM

Parts Per Million

## Predicted Mean Vote (PMV)

PMV index predicts the mean value of the thermal votes of a large group of people exposed to the same environment. The index is used to predict the number of people likely to feel uncomfortably warm or cool. It is scaled from -3 to +3, with -3 being cold, +3 being hot and 0 being thermally comfortable.

## Predicted Percentage Dissatisfied (PPD)

A qualitative prediction of the number of thermally dissatisfied people for a given steady state condition. The PPD predicts the percentage of a large group of people likely to feel thermally uncomfortable.

## Pressure, Atmospheric ( $p_a$ )

Pressure exerted by the weight of the air, it is 760mmHg at sea level and decreases with altitude and increases with depth

## Pressure Drop (Back Pressure)

The differential pressure across a restriction, such as a filter; normally measured in cm of  $H_2O$ .

## PUF Filters

Porous Polyurethane Foam filters for particle size selection

## Radiant Heat Exchange (R)

Heat exchange by two radiant surfaces at different temperatures.

## Radiant Heat Transfer Coefficient ( $h_r$ )

The rate of heat transfer between two black surfaces, per unit temperature difference.

## Radon gas

Radioactive gas which occurs naturally in the environment. It is odourless and has no colour or taste. It occurs from the radioactive decay of uranium present in all earth materials, rocks and soils. It is the heaviest of the inert gases and being an inert gas, it does not react to form compounds. It has a half life of only 3.825 days.

## Real-Time

The monitoring of changes to parameters as they occur.

## Reflection

Relates to radiation changing its course after a collision with the surface of an object.

## Refraction

The bending effect of light or waves as they pass through a medium of a different density.

## Resolution

Smallest incremental charge which can be measured by an instrument.

## Respirable

See *Sampling Conventions*

## Response Time

The time it takes an instrument to register a designated percentage (usually 90%) of a step change in the variable being measured.

## Rotameter

See *Flowmeter*

## Run-Time

The measurement time elapsing from start to finish.

## Sampling Bag

Used to collect gases and vapours. Air is drawn in to the bag by a pump and can be analysed by gas chromatography or similar methods.



## Sampling Conventions

The size convention of particulate varies and is classified by how far they can travel into the respiratory system:

- Total inhalable – Mass fraction of total airborne particles which are inhaled through the mouth and nose
- Extrathoracic – Mass fraction of inhaled particles failing to penetrate beyond the larynx
- Thoracic – Mass fraction of inhaled particles penetrating beyond the larynx
- Tracheobronchial – Mass fraction of particles penetrating beyond the larynx but failing to penetrate to the unciliated airways
- Respirable – Mass fraction penetrating to the unciliated airways
- High risk respirable – Particles of D50 2.5 micron that are most dangerous to high risk people; the very old, very young and asthmatics
- PM<sub>2.5</sub> – Ambient convention similar to high risk respirable
- PM<sub>10</sub> – Ambient convention similar to Thoracic

The following sampling heads are for monitoring of particulate:

- Total inhalable sampler – Seven-hole head  
*Total inhalable*
- Conical inhalable sampler - 37mm  
*Total inhalable*
- I.O.M. (Institute of Occupational Medicine)  
*Total inhalable*
- Open faced filter holder 37mm and 25mm *Total inhalable, particularly oil mist*
- Welding fume head  
*Total inhalable, particularly welding fume*
- Asbestos head with cowl  
*Airborne fibres*
- Dewell Higgins Cyclone  
*Respirable*
- GK 2.69

For measurement of the Respirable fraction, a size-selective head such as the Dewell Higgins cyclone is required.

## SBS

See *Sick Building Syndrome*

## Sensor

A device that responds to a change in condition. See *Transducer*

## Sick Building Syndrome (SBS)

A widespread occupational health concern that is most commonly associated with air-conditioned buildings. Symptoms are varied but will usually include irritated eyes, nose and throat, headaches and lethargy.

## Silicosis

A lung disease caused by excessive inhalation of crystalline silica dust.

## Solar Radiation

See *Radiation*

## Sone

The unit of subjective loudness equal to 40 phons.

## Sorbent Tubes

Used to adsorb sample gases and vapours. Contain one or more layers of sorbent whose type depends upon the gas/vapour to be sampled. Air to be sampled is drawn through the tube trapping the airborne chemicals. The tube can then be analysed. Basic kit for gas/vapour sampling:

- VORTEX 'Lo Flow' pump
- Sorbent tubes
- Tube holder
- Connecting tube
- Dry flow flowmeter
- Tool for pump flow adjustment

## Span Gas

Calibration gas used to calibrate monitoring instruments.

## Stack Monitoring

The characterisation and quantification of emission parameters and components discharged from point (chimney) emission sources.

## Static Sampling

Sampling at a fixed location.

## Statistical Analysis

The classification of the magnitudes of sound levels into a statistical cumulative distribution from which various statistical levels can be derived.

## Statistical Level

A notional sound level value corresponding to a value in the cumulative frequency distribution usually expressed as a percentage of all the classified data points.

## STEL (Short Term Exposure Limit)

## Sweat Rate

Indication of the body's ability to lose thermal energy via evaporation.

## Telemetry

The transmission of data over a distance.

## Temperature (T)°C

The degree or intensity of heat of a body in relation to others.

## Temperature, Core (t<sub>co</sub>)

Temperature of the tissues and organs of the body, sometimes called Deep Body Temperature.

## Temperature, Radiant (t<sub>r</sub>)

See *Black Globe Temperature*

## Thermal Strain

The sum of the physiological responses of an individual to the environmental and metabolic heat load imposed on them.

## Thoracic

See *Sampling Conventions*

## Time-Average Sound Level

The calculated sound level generated by obtaining the time-integral of the square of the instantaneous pressure.

## Transducer

A device which converts one form of energy to another, for example wind energy to electrical energy in an anemometer.

## TWA (Time Weighted Average)

See *OEL*

## UKAS

United Kingdom Accreditation Service. See *NAMAS*

## USEPA

United States Environmental Protection Agency.

## Vapour

Liquid or moisture diffused or suspended in air.

## VOC

Volatile Organic Compounds.

- Volatile – Easily converted into a vapour
- Organic – Carbon based
- Compound – Chemical combination of different elements to form a substance, the component atoms cannot be separated by physical means. Compounds are not necessarily stable

## WBGT/I and WBGT/O

The wet bulb globe temperature is an index of the mean temperature effect in °C on a person during a period of time in which they are active. When core temp >38.5°C symptoms begin to appear. Changes can be rapid so workers should be supervised – reduction in work rate is the first sign.

Health and Safety at Work regulations stipulate that employers must reduce risk to employees and external contractors on site to conditions that could cause heat stress. Initially developed by the U.S. Marines, it is now used worldwide. The method is standardised in ISO 7243.

It is an empirical index based on analysis of heat exchange between man and the environment. Transducers have to respond to and measure the same factors as a human being:

- Ambient air temp
- Air movement
- Relative humidity
- Radiant heat

## XRF (X-Ray Fluorescence)

X-ray fluorescence occurs when a sample is exposed to a low energy radioactive source. The atom in the sample becomes excited and ejects an inner shell electron. The gap left is filled by an electron from a higher shell. A series of electron transitions then take place, causing the atom to emit excess energy in the form of X-ray photons. The energy of these photons is characteristic to the atom and the element. As the concentration of an element increases, the number of characteristic X-rays increase proportionally.

## NOTES

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