OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

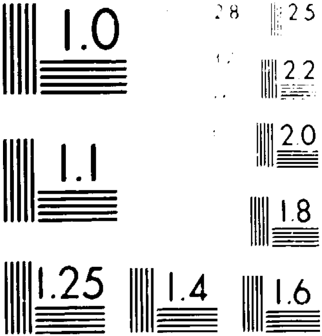
FAIR USE POLICY

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org


1.0
2.8
2.5
2.2
2.0
1.1
1.8
1.25
1.4
1.6

RESTRICTED

12027

DP/ID/SER.A/402
26 November 1982
English

COTTON DUST CONTROL IN THE TEXTILE INDUSTRY

SI/CPR/82/802

CHINA

Technical Report*: Dust Measurement and Control in Chinese Cotton Textile Mills

Prepared for the Government of the People's Republic of China
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of Richard Stuart Bridge,
Expert in Environmental Dust Levels in Textile Mills

United Nations Industrial Development Organization
Vienna

* This document has been reproduced without formal editing

V.82-34213

ABSTRACT.

COTTON DUST CONTROL IN THE TEXTILE INDUSTRY

SI/CPR/82/802

THE PEOPLE'S REPUBLIC OF CHINA

A 2-month mission was undertaken at the request of the Government of the People's Republic of China to draw the attention of the textile industry to the problem of dust in the working environment and to demonstrate what is required to measure and control environmental dust emission in cotton textile mills.

A seminar on 'Environmental Dust Measurement and Control in Textile Mills' was given and environmental dust surveys were carried out in two cotton textile mills.

Environmental dust levels were found to be significantly above both the U.K. and U.S. dust standards in the mills tested.

It is recommended that modifications be made to Chinese manufactured dust samplers and that several samplers be used in order to obtain more comprehensive measurements.

Retrofitting dust removal machinery in blowroom lines, carrying out improvements to card cleaning systems and increasing the filtration efficiency of second stage rotary drum filters would give significant reduction in environmental dust levels.

It would be advantageous for a Chinese delegation to visit Europe in order to study the dust control measures now being taken in the textile industry.

Contents

ANNEXES

1 PURPOSE OF MISSION

The mission was undertaken at the request of the Government of the People's Republic of China to draw the attention of the textile industry to the importance being attached in many countries to the problem of dust in the working environment and to demonstrate what is required to measure and control dust in textile mills.

1.1 Duty Station

Beijing

1.2 Duties of the Expert

Attached to the Institute of Textile Engineering in Beijing, the expert will:

i) Present a review of the international standards and current methods of dust control in the cotton industry in Europe and the U.S.A.

ii) Advise how to measure the environmental dust levels and what instrumentation is required.

iii) Advise what measures are required to lower the dust content in cotton carding and spinning, including possible modifications in processing equipment and general mill design.

iv) Prepare a final report setting out the findings of his mission and his recommendations to the Government on further action which might be taken.

2 ACTIVITIES

2.1 Seminar

A three day seminar on 'Environmental Dust Measurement and Control in Textile Mills' was given at the Engineering Institute on September 6 - 8, 1982 to an invited audience from the Chinese Textile Industry and Staff from the Engineering Institute.

A digest of the seminar is contained in Annex (II)

A two day discussion on the seminar was held on September 9 - 10, 1982.

A list of Chinese Members present for seminar and discussions is contained in Annex (III)

2.2 Measurement of Environmental Dust Levels in Textile Mills.

An environmental dust survey was carried out in part of Beijing No. 2 Cotton Textile Mill. Testing was conducted in the blowroom, cardroom and spinning room in areas producing the mid count range 27.8tex.

Dust levels were found to be significantly above both the U.K. and U.S. dust standards.

Recommendations are given in Annex (IV) on how a reduction of dust levels may be achieved.

An environmental dust survey was carried out in part of Beijing No. 3 Cotton Textile Mill. Testing was carried out in the card areas , spinning room and in returned air system.

Dust levels were found to be significantly above both the U.K. and U.S. dust standards.

Recommendations are given in Annex (V) on how a reduction of dust levels may be achieved.

2.3 Instruction of Staff in the Measurement of Dust Levels.

Staff of the Engineering Institute, Beijing No. 2 and No. 3 Mills were instructed in the sampling techniques for environmental cotton dust analysis whilst the environmental dust surveys were being carried out in the mills.

3 RECOMMENDATIONS

1) Dust samplers operating in a similar manner to the Rotheroe & Mitchell sampler are manufactured in China. These samplers are not fitted with a cage over the sampling head and thus measure total dust and fly. Fitting a cage similar to that used with the Rotheroe & Mitchell sampler to Chinese samplers would then enable the dust level results to be compared with the U.K. dust standard.

2) Several samplers should be used (ideally 6 or more) in order to obtain comprehensive measurements over a wide area within a short time scale.

3) A significant reduction in environmental dust levels would be obtained by retrofitting dust removal machinery in blowroom lines, carrying out improvements to card cleaning systems and increasing the filtration efficiency of second stage rotary drum filters.

4) A Chinese delegation visit Europe in order to study the dust control measures now being taken in the textile industry. Technical discussions may also be held with Governmental Authorities, machinery manufacturers, filtration and air conditioning equipment manufacturers.

ANNEX I

WORK PROGRAMME

Post: SI/CPR/82/802 Expert in cotton dust control in the textile industry.

Name: Richard Stuart Bridge.

August

25	Travel to Vienna
26-27	UNIDO Briefing
28-30	Travel to Beijing. Met at airport by Mr. Wang, counterpart engineer on project and Mr. Yuan, interpreter from Institute of Textile Engineering.
31	U.N.D.P. Briefing. Preliminary discussion of programme with Mr. Wang and Mr. Yuan from Institute of Textile Engineering, Mr. Wu from Beijing Textile Industrial Department, Mrs. Yung from the Foreign Affairs Department of Ministry of Textile Industry and Mr. Sissingh S.I.D.F.A. Dinner party given by Mr. Li, Deputy Director of Engineering Institute.

September

1.	Visit to Beijing No. 2 Cotton Textile Mill
2	Visit to Textile Institute. Visit to Beijing No. 2 Woolen Textile Mill
3	Visit to the Great Wall and Ming Tombs.
4	Visit to the Imperial Palace and Temple of Heaven.
6-8	Present seminar on Environmental Dust Measurement and Control in Textile Mills at Institute of Textile Engineering. (Annex II)
9-10	Answer detailed questions on seminar from Chinese Members present. (Annex III).

September

13-20	Conduct tests of environmental dust levels in blowroom and card area of Beijing No. 2 Cotton Textile Mill in conjunction with Chinese counterparts present at seminar.
21	Discussion with Chinese counterparts on the results obtained in the blowroom and carding areas and correlation between the various sampling instruments.
22	Preparation for technical report.
23	Visit to Fragrant Hills and Summer Palace.
24-29	Continue tests of environmental dust levels in drawframe, roving frame and ringframe areas of Beijing No 2 Cotton Textile Mill. Instruct Staff from Engineering Institute and Beijing No. 2 Mill in the operation of the sampling instruments and measurement of environmental dust levels.
30	Preparation for technical report.

October

1-3	Chinese National Day Holiday.
4	Presentation of environmental dust levels obtained in Beijing No. 2 Cotton Textile Mill and discussion of results with members of No. 2 Mill. (Annex IV)
5	Preparation for technical report.
6-14	Conduct tests of environmental dust levels in card area, spinning room and returned air system of Beijing No. 3 Cotton Textile Mill, Instruct Staff from Engineering Institute and Beijing No. 3 Mill in the operation of the sampling instruments and measurement of environmental dust levels.
15	Presentation of environmental and returned air dust levels obtained in Beijing No. 3 Cotton Textile Mill and discussion of results with members of No. 3 Mill. (Annex V)
16	Preparation of technical report.
18	U.N.D.P. Debriefing. Dinner party given by Mr. Du, Deputy Director of Engineering Institute.

October

19-21	Travel to Vienna
22	UNIDO. Debriefing.
23	Depart Vienna.

Last day of service 24th October 1982.

ANNEX II

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

DIGEST OF SEMINAR

ENVIRONMENTAL DUST MEASUREMENT & CONTROL IN TEXTILE MILLS

RICHARD STUART BRIDGE

UNIDO CONSULTANT

PRESENTED AT ENGINEERING INSTITUTE OF
TEXTILE INDUSTRIAL MINISTRY, BEIJING,
ON 6th - 8th SEPTEMBER 1982.

1. Introduction

It is only in recent years that environmental dust emission has become a cause for concern in some western countries.

This is in part, due to the increased awareness in governmental authorities of the textile workers occupational disease known as byssinosis. The adoption of dust control measures also assist in increasing process efficiency and product quality. These technical aspects will be discussed in detail later.

2. Cause and effect of Byssinosis

The disease is caused by breathing in dust set up during the processing of cotton, flax and hemp. This dust is mainly of vegetable origin and is included in the impurities picked up in harvesting of the fibres. Principle carriers of the active substances are the leaves, stalks and outer pods of the plant. In the first processing stages the impurities are pulverized to dust. This dust contains agents which induce a narrowing of the respiratory passages, particularly the fine bronchi.

Byssinosis can be caused only by dust inhaled which travels deep into the lung, as far as the alveoli, where it lodges. The chief culprits are dust particles ranging in size from 1 to 5 μm. The byssinosis agents are soluble in water. In the lung alveoli they are dissolved aqueously from the dust particles and thus pass into the blood stream.

The symptoms of byssinosis are similar to those of bronchial asthma and bronchitis, and may be graded as follows:

Grade 0	No 'chest tightness' or difficulty in breathing.
Grade ½	Occasional 'chest tightness' or difficulty in breathing on the first day of the working week.
Grade 1	'Chest tightness' or difficulty in breathing on the first day of the working week.
Grade 2	'Chest tightness' or difficulty in breathing on the first and other days of every working week.

Grade 3 'Chest tightness' or difficulty in breathing on the first and other days of every working week accompanied by permanent incapacity.

In the first stages of byssinosis a cure is still easily possible, by reducing or discontinuing the inhalation of cotton dust. In the advanced stage (grade 2 and 3) the disease becomes chronic; the bronchi remain permanently constricted and a cure is no longer possible. It must be stressed that it is not inevitable that a person employed in the mill will contact byssinosis. This depends on the persons sensitivity to cotton dust.

Mill Fever

This condition occurs among cotton workers on first employment in a mill. It is characterised by the onset of a short dry cough, sneezing, headache and a raised temperature on getting home in the evenings. Normally these symptoms subside completely in a few days. This should be distinguished from byssinosis which does not normally appear until some months or years after starting in a mill.

3. Legislation on Environmental Cotton Dust Levels

Regulations governing the maximum permissible dust levels for various countries are listed in FIG 1.

It can be seen that there has been a wide range of maximum dust levels adopted using different sampling methods and to date there is no internationally accepted dust standard. It should be noted that only the U.S. and U.K. legislation is known to be based on extensive medical studies carried out linking the incidence of byssinosis, the product of airborne dust concentrations and years of exposure of an operative to that dust concentration.

FIG. 1

ENVIRONMENTAL COTTON DUST-KNOWN WORLD LEGISLATION.

COUNTRY	MAXIMUM DUST LEVEL mg/m^3	SAMPLER TYPE
U.K.	0.5	(a)
U.S.A.	0.2	(b)
AUSTRALIA	0.2	(b)
WEST GERMANY	1.5	(c)
SWITZERLAND	1.5	(c)
CANADA (QUEBEC PROVINCE)	1.0	(d)
SWEDEN	0.5	(e)
BELGIUM	1.0	(e)
ARGENTINA	1.0	(e)
POLAND	4.0	(e)
U.S.S.R.	4.0	(e)
C.S.S.R.	8.0	(e)
ITALY (REGION TRENTINO ALTO ADIGE)	1.0	(e)

SAMPLER TYPE

(a) - dust less fly using Rotheroe & Mitchell sampler.

(b) - Vertical Elutriator sampler.

(c) - Gravicon sampler

(d) - personal sampler.

(e) - dust sampler type not known but understood to measure total dust and fly.

4. SAMPLING EQUIPMENT EMPLOYED FOR ENVIRONMENTAL COTTON DUST ANALYSIS.

4.1 Rotheroe & Mitchell L60 Air Sampler

This sampler is used by the U.K. Health & Safety Executive and is recommeded by them for use in measurement of environmental dust levels. The sampler is an area sampler with a flow rate of up to 60 litres per minute and is powered by a mains AC supply (figure 2). Details of the sampling technique using this instrument appear in 5.1

4.2 Vertical Elutriator Cotton Dust Sampler

The Vertical elutriator dust sampler was selected by the U.S. Occupational Safety & Health Administration (OSHA) as the instrument to be used to determine dust levels in cotton mills.

This sampler works on the principle of producing a slow, laminar, up-flow of air that equals the falling speed of dust particles at the upper end of the respiratory range. Particles with a falling speed greater than this, such as cotton fly and lint fibres and dust particles larger than 15 microns aerodynamic diameter will not be carried to the filter and thus will not be sampled. The sample outlined will include all fine dust except lint and will approximate the sum of alveolar and broncho-tracheal deposition.

The sampler is an area sampler with a flow rate of 7.4 $\pm$ 0.2 litres per minute controlled by a critical orifice and is powered by a mains AC supply (figure 3). Details of the sampling technique using this instrument appear in 5.2

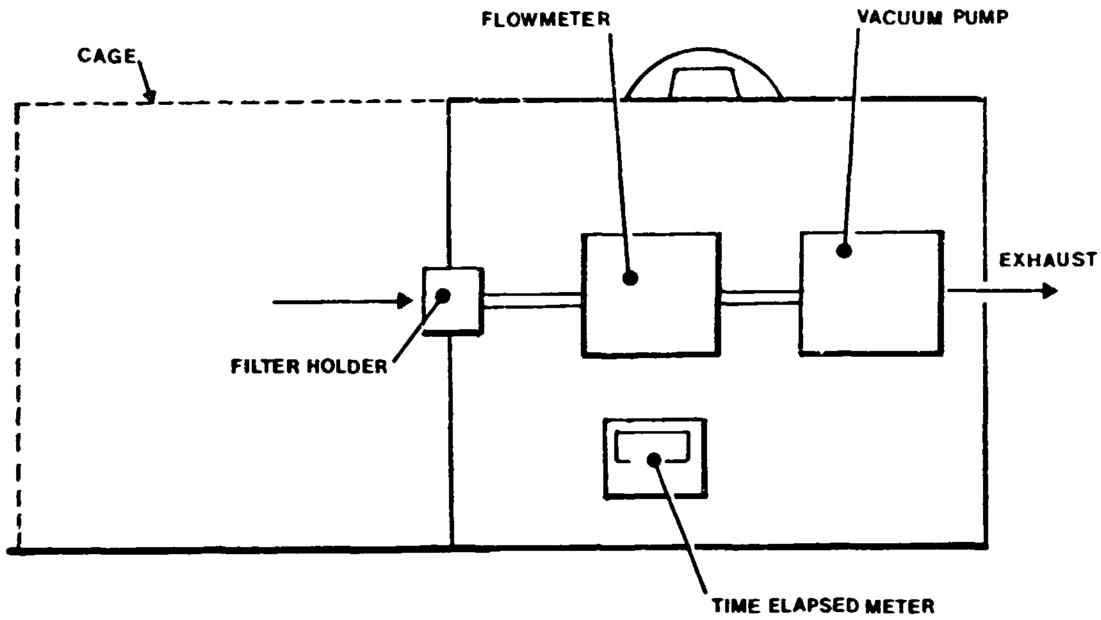
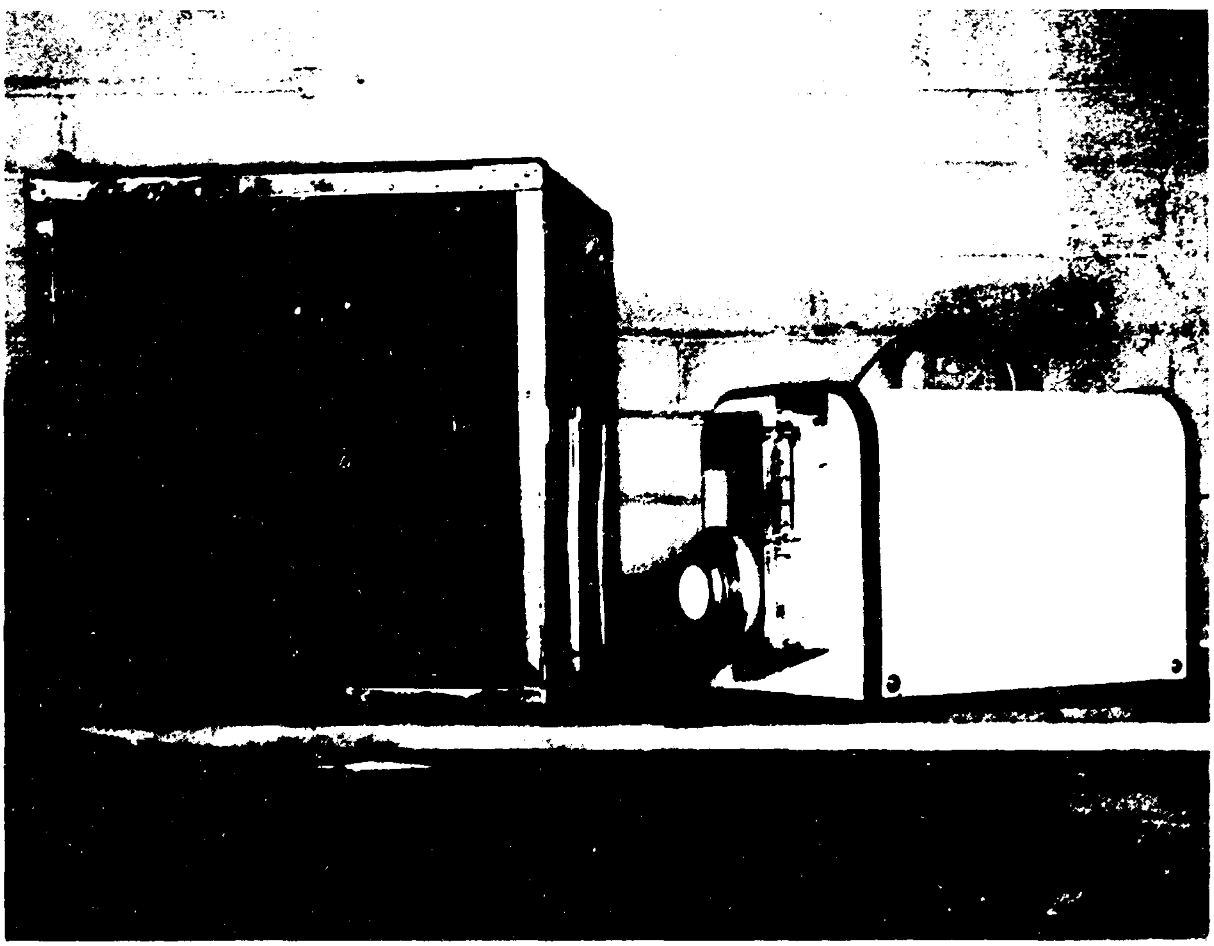


FIG 2
Schematic Diagram of Rotheroe & Mitchell L60 Air Sampler



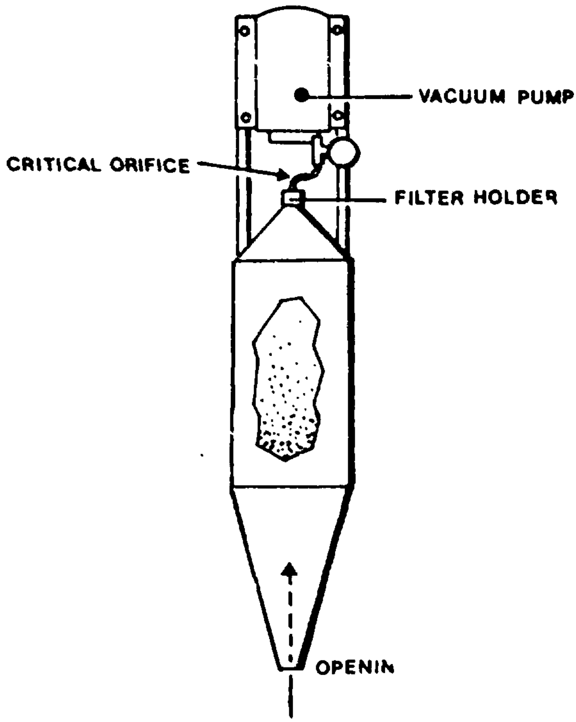
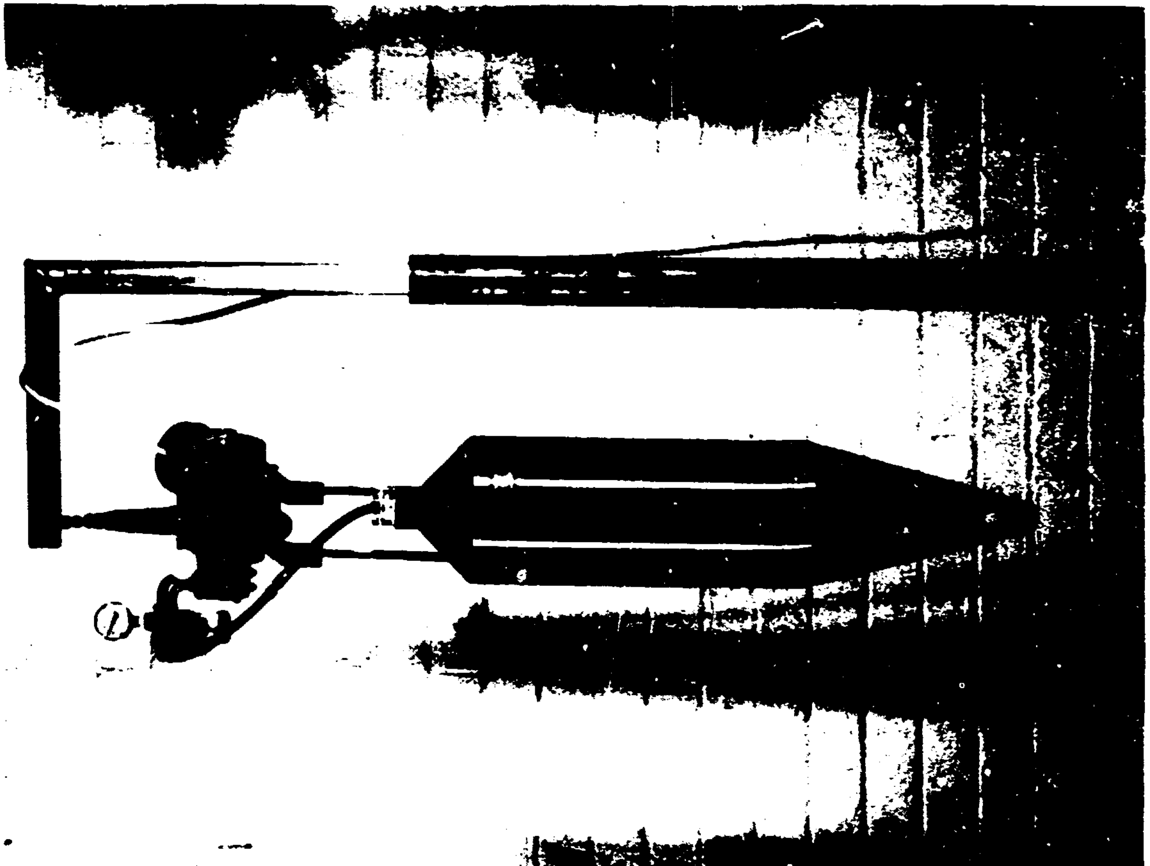


FIG 3

Schematic Diagram of Vertical Elutriator



4.3 Gravicon Dust Sampler

This sampler is used in West Germany and Switzerland for measuring dust levels. The sampler is an area sampler powered by a mains AC supply. It has a high flow rate which is adjustable between 250 and 600 litres per minute. Total dust and cotton lint is collected on a membrane filter for subsequent weighing.

4.4 Personal Dust Sampler

These samplers are made by a number of manufacturers and consist of a portable battery operated pump having a flow rate of 1.5 litres per minute to which an open face filter is attached by means of flexible tubing. The filter is then attached to the workers lapel or collar. Sampling is carried out over an entire eight hour day with the employee performing his normal work.

The use of this sampler for dust measurement has declined since it was replaced by the Vertical elutriator as the measuring instrument used in the U.S.A.

4.5 Short term samplers

These are portable, battery operated dust monitors which give a direct digital read-out of dust concentration in mg/m^3.

4.5.1 GCA Model RDM 101 Respirable Dust Monitor.

The monitor operates by dust impacting a Mylar disc between a carbon-14 source and a Geiger-Mueller tube. The reduction in beta radiation counts during the first and last twenty seconds sampling is a direct measure of the mass.

The instrument operates at a flow rate of two litres per minute with a sampling time of four minutes, the dust concentration being shown by a digital read-out in mg/m^3

4.5.2. TSI Respirable Aerosol Mass Monitor.

This monitor operates using a Piezo electric mass sensing technique with electrostatic dust collection. It can monitor a mass concentration range of 0.01 to 10 mg/m^3 with the impactor having a 3.5 micron or 8 micron cut off. The instrument operates at a flow rate of one litre per minute with a two minute sampling time. The dust concentration in mg/m^3 is shown by a digital read-out.

Short term samplers can be used for monitoring engineering dust control measures in a mill. These instruments are not recommended by either the U.K. Health & Safety Executive or OSHA for making dust measurments that will satisfy legislation requirements.

5. Sampling Techniques for Environmental Cotton Dust Analysis.

The sampling techniques described will concentrate on the use of the Rotheroe & Mitchell sampler and the Vertical elutriator which measure dust levels applicable to U.K. and U.S.A. legislation.

5.1 Using the Rotheroe & Mitchell L60 Air Sampler

5.1.1. Equipment

Rotheroe & Mitchell L60 Air Sampler fitted with a 37 m.m. filter holder.

12" cube of 2 m.m. wire mesh fitted with an aperture for filter holder.

Stand of sufficient height to place sampler filter holder at a height of 5 feet.

Supply of 37 m.m. diameter Whatman G.F.A. filters

Filter containers.

Tweezers.

Microbalance capable of weighing to at least 0.01 mg, e.g. Cahn Model 25 Electromicro-balance or similar instrument.

5.1.2. Procedure

The G.F.A. filters are preweighed to an accuracy of 0.01mg and placed in numbered filter containers.

The sampler is assembled at the test site and filter carefully placed in holder of the air sampler, the 2 m.m. mesh cage then being placed over it. Sampling is carried out for three hours during which time the volume of air-flow through the instrument is monitored in order to determine the average air-flow over the three hour test period. On completion of the test the filter is carefully removed and placed in the filter container.

The filter is then reweighed to an accuracy of 0.01mg. The increase in weight is obtained and the volume of air passing through the sampler determined, thus enabling the dust concentration to be calculated using the following equation:

$$\text{Dust level mg/m}^3 = \frac{\text{Increase in weight of filter mg}}{\text{Number of cubic metres of air sampled}}$$

Notes: (1) Conditioning of filters before and after use is not necessary using G.F.A. glass microfibre filters due to their insensitivity to changes in relative humidity.

(2) Sampler and cage must be free from dust and fly before each test is carried out.

5.2 Using The Vertical Elutriator Cotton Dust Sampler

5.2.1 Equipment

Vertical elutriator cotton dust sampler

Stand to enable bottom inlet of sampler to be at a height of 5 feet.

Filter holders, consisting of 3 piece cassettes, constructed of polystyrene.

Supply of 37 m.m. diameter filter backing pads.

Supply of 37 m.m. diameter polyvinyl chloride membrane filters with a pore size of 5 μm.
Tweezers.
Microbalance capable of weighing to 0.01 mg.
Radioactive deionizing source.

5.2..2 Procedure

The membrane filters are preweighed to an accuracy of 0.01 mg and assembled together with backing pads in numbered 3 piece cassettes.

The sampler is assembled at the test site.
The top section is removed from the cassette and the cassette is installed in the ferrule of the elutriator where it is securely taped in place. The bottom plug of the cassette is then removed and the hose containing the critical orifice attached to the cassette. Sampling is carried out for a minimum of three hours during which time the vacuum gauge is monitored. On completion of the test the cassette is carefully removed, the top section and bottom plug replaced, then placed in a suitable container with the exposed filter side uppermost.

The filter is removed from the cassette and reweighed to an accuracy of 0.01 mg. The increase in weight is obtained and the volume of air passing through the sampler determined from the flow rate and test duration thus enabling the dust concentration to be calculated using the following equation:

$$\text{Dust level mg/m}^3 = \frac{\text{Increase in weight of filter mg}}{\text{Number of cubic metres of air sampled}}$$

Notes: (1) PVC membrane filters are insensitive to changes in relative humidity, therefore conditioning is not necessary.

(2) PVC membrane filters are prone to static build up in use. Static charges are removed prior to filter weighing by use of a radioactive deionizing source.

(3) The elutriator, motor and relief valve screen must be cleared free of lint and fly before each test is carried out.

6. Selection of Test Sites for Dust Sampling

Dust sampling sites are chosen using experienced judgement. They are sites representative of positions where operatives would be likely to spend a majority of their time and also positions that would be likely to give the highest dust emission values.

Factors that have to be taken into account include the layout of the room, position of the air conditioning system, filter plant exhaust, and machine configuration etc. Unlike noise measurement there are no laid down standard sampling positions.

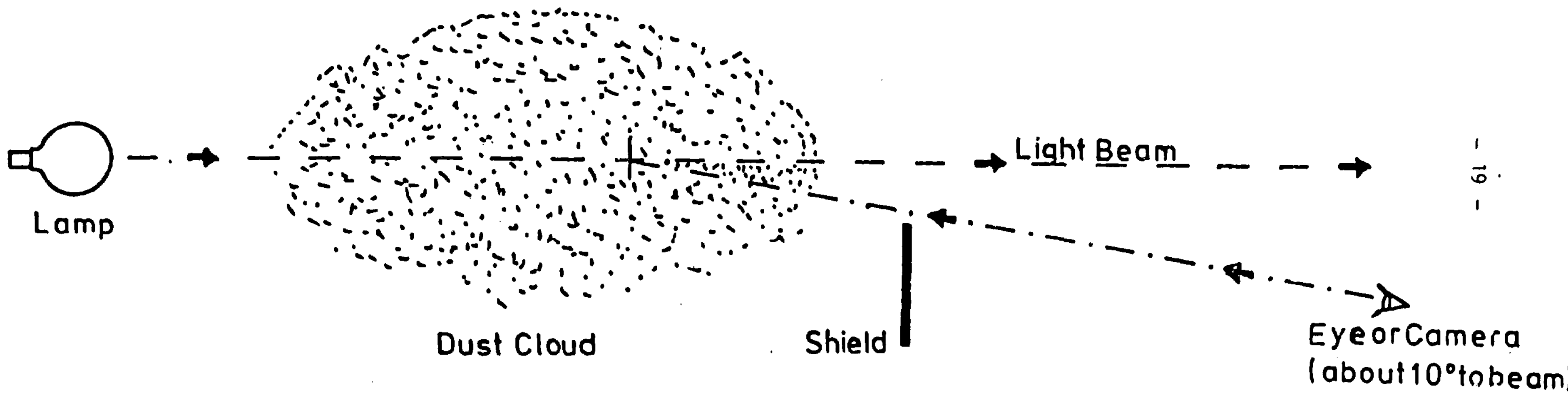
In general, the sampling points chosen are from the following areas:

a) Opening - by the blenders.
b) Blowing - at the lap formers.
c) Carding.
d) Combing
e) Draw fames.
f) Speed frames
g) Ring and Rotor Spinning
h) Winding
i) Beaming - by the beam with the sampler facing the creels.

7. Visual Location of Dust Emission Sources

Dust emission from a machine can be seen by the use of Tyndall beam lighting which is extremely sensitive and can be applied to any machine where dust is generated. A powerful beam of light is used to illuminate the fine dust particles emitted using the method shown in Figure 4. The effect is similar to that occuring in a darkened room that is lit only by a powerful beam of light, e.g. in a cinema; if one looks towards the source of light the fine particles of dust and smoke can be seen as a cloud in the light beam. Dust emissions can be filmed using this technique thus giving a permanent record.

FIGURE 4 TYNDALL BEAM METHOD OF SHOWING DUST EMISSIONS



8. ENVIRONMENTAL DUST LEVELS FOUND IN TEXTILE MILLS

There is a wide range of dust levels that can be found for each processing area of different mills. This is due to dust levels obtained being dependant on many factors, i.e. type and grade of material processed, processing conditions, type of machinery used, presence or absence of air conditioning, etc. Dust level measurements have been made in a large number of mills in different countries using the vertical elutriator sampler and the results obtained have been within the following ranges.

	Dust Level Range using Vertical Elutriator mg/m^3
a) Opening	0.10 - 1.91
b) Blowing	0.36 - 1.03
c) Carding	0.04 - 2.18
d) Combing	0.06 - 0.26
e) Drawframes	0.05 - 1.14
f) Speedframes	0.03 - 0.42
g) Ringframes	0.04 - 0.30
h) Open End Spinners	0.06 - 0.20
i) Winding	0.07 - 0.32
j) Beaming	0.06 - 0.45

Specific examples were given in order to illustrate differences in dust levels obtained using both Rotheroe & Mitchell and Vertical Elutriator samplers.

9. Sources of Dust Emissions from Processing Machines

9.1 Blowroom

The main source of environmental dust emission is in the manual loading of blending hopper bale openers and waste hopper feeders. The remaining blowroom processing machinery, which is largely enclosed, cause little dust emission provided it is well maintained and operated in the correct manner.

It must be ensured that there is a negative pressure at any open points to allow airflow to pass into the machine and that blow out areas are not created.

9.2 Cards

All high production cards are equipped with dust collection systems. Some dust emission can still occur however from the following areas:

a) Rotating flats
b) Cylinder sides from which blowout can occur.
c) Sliver turn round guides on Coiler.

The latest models of high production cards are almost fully enclosed in order to reduce dust emission to an absolute minimum.

9.3 Drawframes

The drawframe has in recent years, because of higher operating speeds, developed into a machine that releases a lot more dust. The main source of dust liberation is from the exhaust of the drafting system which usually passes into the room after going through the filter box. A futher source of dust emission is in the creel area. Dust emission from the drawframe can be greatly reduced by simply ducting the exhaust from the drafting system directly away to a central filtration system, thus preventing its escape into the surrounding atmosphere.

9.4 Combers

Very little dust emission occurs at the comber, this is particularly so if the exhaust is ducted directly to a central filtration system.

9.5 Speedframes

One source of dust emission from these machines is the exhaust from the waste storage cabinet. Ducting this exhaust to a central filtration system can reduce dust levels.

9.6 Ringframes

Due to the large number of spindles fitted on a ringframe it is not practicable to fit dust capture devices on each spindle. Some slight improvements are possible by ducting the exhausts from the waste storage cabinets to a central filtration system.

9.7 Open End Spinners

These machines are supplied with complete suction systems, so there is practically no dust emission. It is important that the exhaust air is ducted to a central filtration system as this exhaust usually contains high concentrations of microdust.

9.8 Winders

Some manufacturers of modern winders offer an integrated air conditioning and dust control system. Air conditioning in the room can assist in lowering dust levels.

9.9 Beamers

The main source of dust emission occurs at the beamer headstock. Dust collection hoods over the headstock assist in reducing dust levels.

10. Filtration Plants.

The construction and operation of two differing types of modern filtration plant was described in detail:

10.1 System 1

A three stage system consisting of a pre-separator, fibre separator and rotary air filter.

The pre-separator function is the division of the returned or exhaust air into a conveying air stream and a pre-filtered one.

The fibre separator removes textile waste from the conveying air stream. A pneumatically controlled mechanism compresses and discharges the separated waste material into bags, carriages or other containers.

The rotary air filter carries out final filtration of dust and fibres from room air, or return air systems. The drum rotates either continually or intermittently, according to need. The dust and fibres are evacuated from the drum surface by means of a simultaneously traversing suction nozzle. The drum filter medium may be either a washable fine mesh screen or a filter mat. The filtered air then passes into the air conditioning system.

10.2 System 2

A two or three stage system consisting of a rotary waste separator, rotary fine dust filter and electrostatic precipitater.

The rotary waste separator removes the bulk of the fibrous waste by building up a mat on a rotating cage. The rotation is governed by a pressure switch giving intermittent turning and constant pressure drop across the cage. Expulsion rollers strip the mat of waste automatically from the cage and deposit into carriages or bale presses.

A rotary fine dust filter is the second stage of a submicron filtration plant, or an independent unit handling the return air from an air conditioning plant. The capturing of smaller particles is undertaken by the filter media with which the drum is clad. The dust collected is removed to a suitable filter bag or returned to the rotary waste separator by a traversing suction nozzle in a similar manner to the rotary air filter previously described. The filtered air either then passes into the air conditioning system (two stage) or to an electrostatic precipitator. (three stage)

An electrostatic precipitator is used when high levels of filtration and low emission standards are demanded. The particles in the air stream are carried into the electrostatic precipitator at speeds of 500 - 750 feet per minute. As the particles pass the ionising wires they receive a positive charge. Carrying this positive charge downstream, they are repelled by the positively charged plates and attracted to the negative potential plates, where they stay until cleaned off. As build up occurs, the particles will be attracted to the negative potential plates further from the leading edge. An automatic wash sequence periodically cleans the plates of particle accumulation. The filtered air then passes into the air conditioning system.

ANNEX III

LIST OF CHINESE MEMBERS PRESENT FOR SEMINAR ON DUST MEASUREMENT AND CONTROL AND DISCUSSIONS HELD AT ENGINEERING INSTITUTE OF TEXTILE INDUSTRIAL MINISTRY, BEIJING ON 6th-10th SEPTEMBER 1982

Mr.	Yuan Dian-Wen	Interpreter, Engineering Institute of Textile Industrial Ministry.
Mr.	Tao Shu Zuen	Engineer " " "
Mr.	Wang Xi Zhang	" " " "
Mrs.	Wang Yan Gin	" " " "
Mr.	Xu Zhe Ning	" " " "
Mr.	Li Jing Tian	" " " "
Mrs.	Lu Mei Shang	" " " "
Mr.	Lou Wan Xang	" " " "
Mr.	Yan Wai Der	" " " "
Mrs.	Zhan Xian Yuen	" " " "
Mr.	Li Fa Men	" " " "
Mr.	Lu Guang Hu	Engineer, Beijing No. 2 Cotton Textile Mill
Mr.	Zhou Xu Chu	" " " " " " "
Mr.	Li Zhe	Beijing No. 1 Cotton Textile Mill
Mrs.	Yen Wei Han	Engineer, Beijing Textile Engineering Department
Mr.	Wu Yuan Hua	" " " " "
Miss	Suen Leng Yuan	" Machinery Research Institute
Mr.	Xan Her Lin	" Beijing Chemical Fibre Machinery Factory
Mrs.	Wang Shang Ling	Beijing Cotton Textile & Printing Dyeing Industrial Co.
Mr.	Xei Bao Kang	Engineer, Construction Dept. of Textile Industrial Ministry
Mr.	Lu Ting Wei	" Shanghai Textile Engineering Institute
Mr.	Zhao Guo Qien	" Shanghai No. 7 Textile Mill
Mr.	He Lin Yu	" Shanghai No 1 Textile Machinery Manufacturer
Mr.	Zhang Rong Hua	" Shanghai Cotton Textile Company.
Mrs.	Jang Yi Nan	" " " "
Mr.	Fan An Xm	" " " "
Mrs.	Gas Qu Xa	Lecturer, Shanghai Textile Professional Training School
Mr.	Xu Shu Wan	" Huatang Textile Industrial College
Mrs.	Fang En Zhe	Engineer, Tianjin Cotton Textile Company.
Mrs.	Yang Shu Ying	Lecturer, Tianjin Textile Industrial College

Mr. Li Si Xu	Doctor,	Tianjin No 1 Cotton Textile Mill
Mr. Zhang Zhe Zheng	Engineer,	Laoning Textile Engineering Institute
Mr. Li Fen Chen	"	Jinzou Textile Mill
Mr. Gu Li Lao	"	Honan Textile Industrial Department
Mr. Yei Wen Hua	"	Honan Textile Research Institute
Mr. Yang Bai Qing	"	" " " "
Mr. Gai Yu Qi	"	Zungzou No. 5 Cotton Textile Mill
Mr. Fai Cheng Zheng	"	Toyuan Cotton Textile Printing & Dyeing Mill
Mr. Lien Jei Zhang	"	Shejuazung No. 5 Cotton Textile Mill
Mr. Wu Zhe Yeu	"	Wuxi Textile Research Institute
Mrs. Wang Jang Chang	"	Hodan Textile Machinery Manufacturer
Mrs. Zhang Cuen Zheng	"	Shanxi Textile Industrial Department
Mr. Her Fen Shang	Lecturer,	Northwest Textile Industrial College
Mr. Bao Fen Hao	Engineer,	Shandong Textile Engineering Institute.

ANNEX IV

ENVIRONMENTAL DUST MEASUREMENTS TAKEN IN BEIJING NO. 2 COTTON TEXTILE MILL

1. Introduction.

An environmental dust survey was carried out in part of Beijing No. 2 textile mill. This mill, built in 1954, has 145,000 spindles and covers a range count of 6 - 100 tex. Following discussions with Chinese counterparts , it was decided to conduct tests around machinery producing the main mid count range 27.8 tex. Testing was carried out using Rothreroe & Mitchell L60 and vertical elutriator cotton dust sampler. Dust sampling was also carried out by Chinese counterparts using their own manufactured dust samplers.

2. Machine Details and Operating Conditions.

All the processing machinery installed in the areas tested is of Chinese manufacture

2.1 Blowroom

One cotton opening line consisting of:
2 circular bale openers (1974)
1 step cleaner (1954)
A number of beater parts (1954)
3 Scutchers (1954)

Material processed: 70% Chinese cotton.
15% Pakistan cotton.
15% U.S. cotton (West Texas, Arizona)

Production rate: 700 kg per hour.

2.2 Cards

42 lap feed cards (1954) fitted with taker in and doffer exhaust points and under card cleaning.
Total airflow approximately 590 c.f.m./card.

Production rate: 20 kg per hour

Sliver weight: 18 grains per 5 metres.

2.3 Drawframes

1st passage

5 Twin head drawframes (1973) with suction cleaning in drafting zone passing to waste storage cabinet.
Exhaust air passing into room.

Processing speed: 200 metres per minute
Sliver weight: 17 grains per 5 metres.

2nd passage

5 Four head drawframes (1954) with suction cleaning after drafting zone passing to waste storage cabinet.
Exhaust air passing into room.

Processing speed: 100 metres per minute
Sliver weight: 17 grains per 5 metres.

2.4 Roving Frames

5 Roving frames (1954) each having 104 spindles.

Flyer speed: 700 R.P.M.
Roving weight: 6.3 grains per 10 metres.

2.5 Ring Frames

28 Ring frames (1954) each of 440 spindles. Fitted with broken end collection system.

Spindle speed: 16,000 R.P.M.
Count span: 27.8 tex.

3. Filtration and Air Conditioning System

3.1 Blowroom

Air from conditioning plant is returned to room via overhead ducts.
Trash from blowroom plant passes to underground cellar. Exhaust air then passes to bag filter.

3.2 Cardroom

Air from conditioning plant is returned to room via overhead ducts. Exhaust air passes into cards and also through a mesh covered duct placed in the wall adjacent to roving frame No. 31. Exhaust from cards passes through a rotary waste separator, cyclone, then a rotary screen filter and is returned to air conditioning system.

3.3 Spinning Room

Air from conditioning plant is returned to room via overhead ducts. Exhaust air is removed by ducts placed in side walls.

4. Test Equipment

4.1 Used by Expert

One Rotheroe & Mitchell L60 dust sampler fitted with a 12 inch cube of 2 m.m. wire mesh covering the sampling point in order to exclude fly.

One vertical elutriator cotton dust sampler.

In order to obtain comparative measurements both samplers were placed in close proximity to each other on stands, so that the sampling inlets were positioned at a height of 5 feet.

4.2 Used by Chinese Counterparts

A number of sampling instruments were produced by the Chinese counterparts who had attended the seminar. It was decided to conduct joint testing in blowroom and card areas using all the samplers in order to obtain correlation measurements.

All the samplers used, with the exception of the Honan 51-1111 sampler were gravimetric samplers. They consisted of an open face filter and holder connected to pumps of differing airflow rates, with means of monitoring and controlling the airflow.

Shanghai DK60-2	Flow rate 20 litres per minute
Shanghai DK-2A	Flow rate 200 litres per minute
Tianjin - 72	Flow rate 20 litres per minute
Beijing - 76	Flow rate 30 litres per minute

The Honan 51-1111 sampler was a short term instrumental sampler manufactured in Japan and indentical to T.S.I Respirable Aerosol Mass Monitor (See Annex II, 4.5.2.)

5. Test Procedure

The test procedure used for both the Rotheroe & Mitchell L60 dust sampler and the vertical elutriator cotton dust sampler is described in Annex II, (5.1 and 5.2)

The sampling positions chosen are shown in figures 1, 2 and 3. They were chosen as being representative of positions where operatives would be likely to spend a majority of time in the room and also positions that would be likely to give the highest dust emission values.

The samplers operated by Chinese counterparts were placed in close proximity to the Rotheroe & Mitchell and vertical elutriator samplers in order to obtain comparative dust measurements.

6. Test Results

The test results are shown in table 1 for the blowroom, table 2 for the card area, table 3 for the drawframe area, table 4 for the roving frame area and table 5 for the spinning room.

7. Discussion of Results.

The Rotheroe & Mitchell L60 results should be compared with the U.K. Health & Safety Executive recommended maximum dust level of 0.5 mg/m^3.

The vertical elutriator results should be compared with the U.S. Occupational Safety & Health Administration (O.S.H.A.) cotton dust standard of 0.2 mg/m^3.

The results from the Chinese samplers (with exception of Honan 51-1111) which measure total dust and fly, may be compared with the West German and Swiss dust standard of 1.5 mg/m^3.

It can be seen from the tables that the environmental dust levels are significantly above both U.K. and O.S.H.A. dust standards in all the areas tested.
The dust level results from the Chinese samplers significantly exceed the West German and Swiss dust standards in most of the areas tested. Variations in dust levels between Chinese gravimetric dust samplers for the same sampling position is most likely explained by variations in fly pick up on the open face filters.
The Honan 51-1111 sampler results do not appear to correlate directly with the vertical elutriator results.

The absence of Rotheroe & Mitchell results for the first four sampling positions was due to a delay in obtaining the instrument.

The dust levels are particularly high in the blowroom and card areas.

8. Conclusions

From the dust levels measured under the mill conditions prevailing at the time of testing and visual observations, the following conclusions can be made:

1) The environmental dust levels measured in all areas significantly exceed both the U.K. recommended maximum dust level and the O.S.H.A. dust standard.

2) The high dust levels result from a number of factors, these include:

   a) Dust emission from the blowroom machinery. The opening machinery was only designed to remove trash from the cotton. No dust removal points are incorporated in the opening line.

   b) It was not possible to determine the dust level in the return air to the workroom from the filtration and air conditioning plants. However, it is strongly suspected that the return air dust level is higher than that which would be obtained with a modern filtration plant.

   c) Emission from the cards is high. Only about 580 c.f.m. of air is used in the exhaust points on the card and the major portion is used for under card cleaning. Examination of the extraction system in the taker in region revealed at best only the presence of a weak suction. The web in the doffer region is also unenclosed.

   d) Dust emission in the drawframe area is caused by liberation at the creel and from the drafting system exhaust.

   e) In the roving frame area the higher dust levels obtained in positions 17 and 18 are due to the influence of air movement towards the exhaust duct in the wall adjacent to frame no. 31.

f) In the ring room the main problem is fly emission. Reducing the dust level of returned air by improvement of filtration plant will reduce room environmental levels.

g) From observations, it appeared that the standard of machine maintenance was high and that regular cleaning occured. However, this was done by brushing. This allowed microdust which had taken a considerable time to settle out of the air to be liberated into the environment.

9. Recommendations.

A significant dust emission reduction could be obtained by carrying out the following:

1. Improvement and modernisation of filtration plant.

2. Retrofitting of dust removal machinery to blowroom opening line.

3. Greater enclosure of the cards, particularly in the doffer area. Increasing the airflow on the card cleaning system and increasing its efficiency of operation.

4. Cleaning of all machinery and overhead areas using industrial vacuum cleaning equipment fitted with high efficiency dust filters.

FIG 1 DUST SAMPLING POSITIONS. BLOWROOM. BEIJING NO 2 COTTON TEXTILE MILL

S - DUST SAMPLING POSITIONS

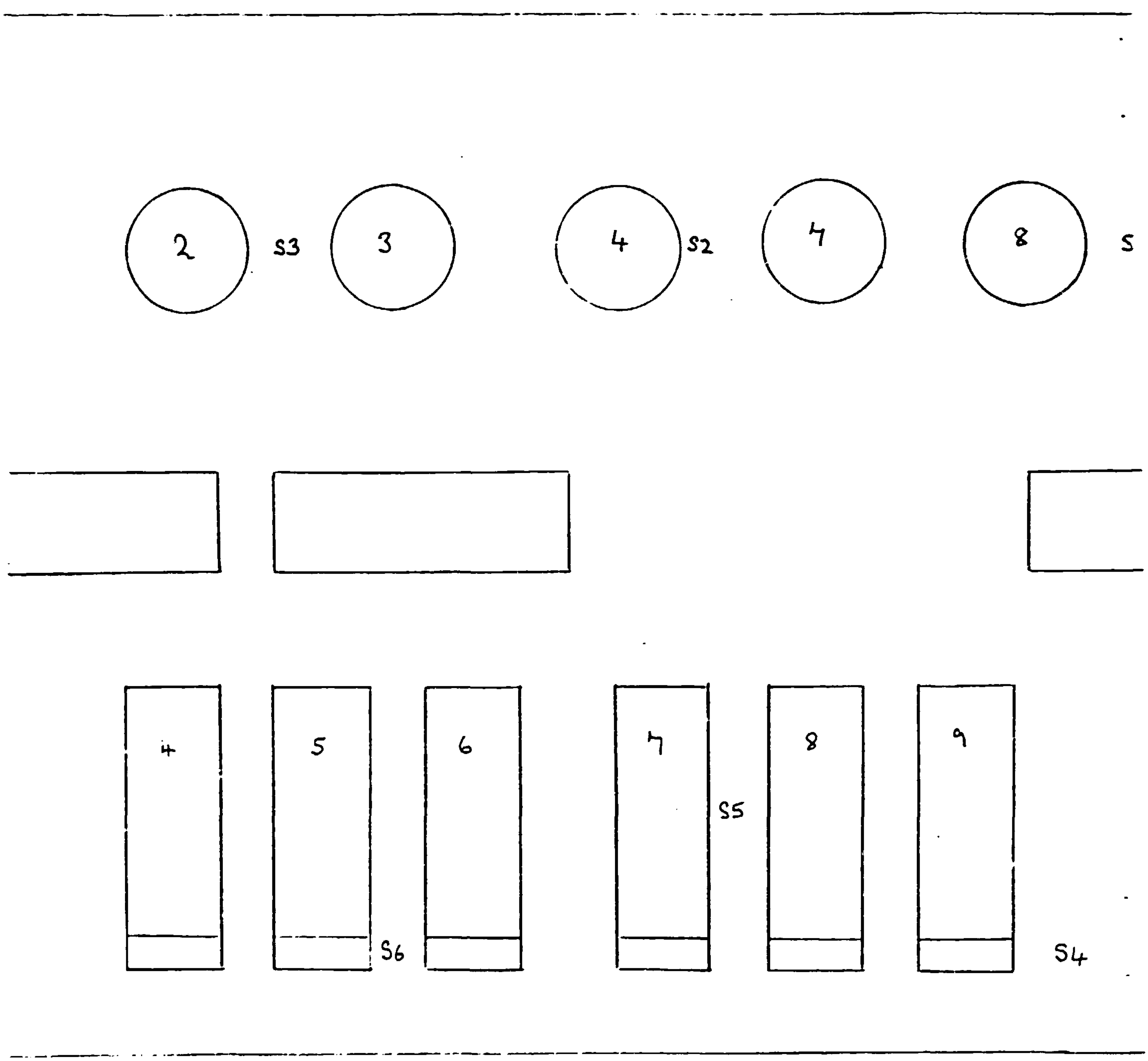


FIG 2 DUST SAMPLING POSITIONS. CARDROOM. BEIJING NO 2 COTTON TEXTILE MILL

S - DUST SAMPLING POSITIONS

-------- AREA ENCLOSED PROCESSING COUNT 27.8 TEX

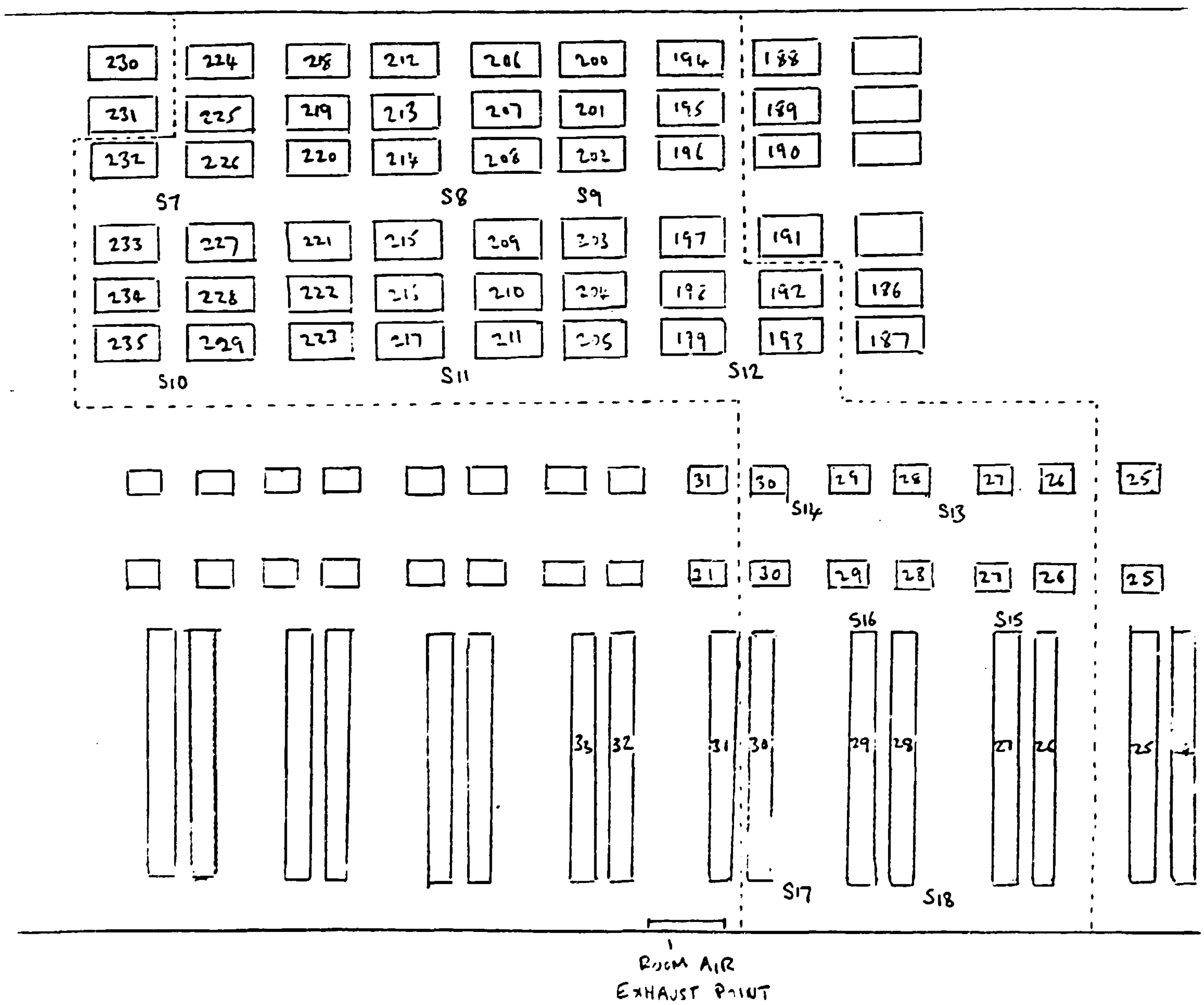


FIG 3. DUST SAMPLING POSITIONS. SPINNING ROOM BEIJING NO 2 COTTON TEXTILE MILL

S - DUST SAMPLING POSITIONS

----- AREA ENCLOSED SPINNING 27.8 TEX.

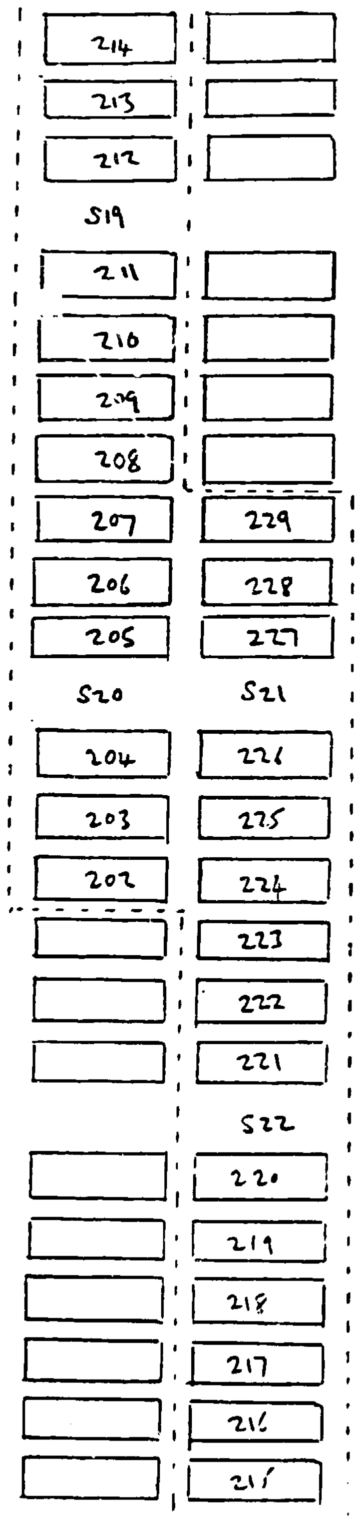


Table 1 **Environmental Dust Levels in Blowroom: Beijing No. 2 Cotton Textile Mill**

Sampling Position	Date	Time Started	Dust Level mg/m^3						
			Vertical Elutriator	Rotheroe & Mitchell	Shanghai DK60-2	Shanghai DK-2A	Tianjin 72	Honan 51-1111	Beijing 76
1. Right hand side of Bale opener No. 8	13.9.82	14.35	0.99	-	1.48	1.66	1.60	0.35	1.20
2. Right hand side of Bale opener No. 4	14.9.82	07.27	1.61	-	2.02	2.33	2.17	0.49	2.31
3. Between Bale openers Nos. 2 & 3	14.9.82	14.32	0.93	-	1.34	1.68	1.85	0.23	1.25
4. Right hand side of front of scutcher No 9	15.9.82	07.41	1.21	-	1.93	-	2.58	0.50	2.25
5. Centre middle between scutcher Nos. 7 & 8	15.9.82	14.34	1.38	2.11	2.69	-	2.63	0.59	2.68
6. Between front of scutcher Nos. 5 & 6	16.9.82	07.43	1.59	2.44	2.82	-	2.44	0.61	3.11

Table 2 <u>Environmental Dust Levels in Card Area: Beijing No. 2 Cotton Textile Mill</u>

Sampling Position	Date	Time Started	Dust Level mg/m^3					
			Vertical Elutriator	Rotheroe & Mitchell	Shanghai DK60-2	Tianjin 72	Honan 51-1111	Beijing 76
7. Between Cards 226, 227, 232 & 233	16.9.82	14.28	1.33	2.58	2.91	2.38	0.59	3.17
8. Between Cards 208, 209, 214 & 215	17.9.82	07.48	1.14	2.18	2.72	2.80	0.61	3.25
9. Between Cards 202 & 203	17.9.82	14.26	0.95	1.70	2.43	2.31	0.47	2.92
10. Between Cards 229 & 235	18.9.82	07.30	1.13	1.83*	2.75	2.84	0.54	3.10
11. Between Cards 211 & 217	20.9.82	07.30	1.82	3.04	3.81	3.94	0.85	3.08
12. Between Cards 193 & 199	20.9.82	14.21	1.17	2.12	3.29	4.06	0.68	3.83

NOTE: * Approximate value due to damage to filter.

Table 3 Environmental Dust Levels in Drawframe Area: Beijing No. 2 Cotton Textile Mill

Sampling Position	Date	Time Started	Dust Level mg/m^3	
			Using Vertical Elutriator	Using Rotheroe & Mitchell
13. Between headstocks of Drawframe Nos. 27 & 28	24.9.82	07.51	0.47	0.92
14. Between headstocks of Drawframe Nos. 29 & 30	24.9.82	14.25	0.52	0.91

Table 4 Environmental Dust Levels in Rovi[illegible] Frame Area: Beijing No. 2 Cotton Textile Mill

Sampling Position	Date	Time Started	Dust Level mg/m^3	
			Using Vertical Elutriator	Using Rotheroe & Mitchell
15. Near gearing end of roving frame No. 27	25.9.82	07.45	0.43	0.71
16. Near gearing end of Roving frame No. 29	25.9.82	14.19	0.32	0.96
17. Near off end of roving frame No. 30	27.9.82	07.46	1.46	1.91
18. Near off end of roving frame No. 28	27.9.82	15.18	0.76	0.99

Table 5 Environmental Dust Levels in Ring Room: Beijing No. 2 Cotton Textile Mill

Sampling Position	Date	Time Started	Dust Level mg/m^3	
			Using Vertical Elutriator	Using Rotheroe & Mitchell
19. Between ring frame Nos. 220 & 221	28.9.82	07.45	0.44	1.14
20. Between ring frame Nos. 226 & 227	28.9.82	14.39	0.55	1.24
21. Between ring frame Nos. 205 & 206	29.9.82	07.34	0.42	1.27
22. Between ring frame Nos. 211 & 212	29.9.82	14.40	0.32	1.11

ANNEX V

ENVIRONMENTAL DUST MEASUREMENTS TAKEN IN BEIJING NO. 3 COTTON TEXTILE MILL.

1. Introduction

An environmental dust survey was carried out in part of Beijing No. 3 Cotton Textile Mill. This mill, built in 1957, has 105,000 spindles and all the processing machinery is of Chinese manufacture.
Following discussions with Chinese counterparts and the mill, it was decided to concentrate testing in the 3 point suction card area, 1 point suction card area, spinning room and returned air system. Testing was carried out in carding and spinning using a Rotheroe & Mitchell L60 and vertical elutriator cotton dust sampler. Testing was also carried out by counterparts using a Beijing dust sampler. The returned air system was tested using Rotheroe & Mitchell sampler fitted with a remote sampling head.

2. Machine Details and Operating Conditions

All the processing machinery installed in the area tested is of Chinese manufacture.

2.1 3 Point Suction Cards

27 Lap feed cards (1956) modified in 1981 by fitting 3 point suction system in taker in, doffer and under card areas. Cover fitted over doffer.
The air flow for the taker in and doffer area operates continuously at approximately 210 c.f.m./card. The air flow for the under card cleaning operates intermittently on a twelve minute cycle at approximately 880 c.f.m. for 1.5 minutes.

Production rate: 15kg per hour
Sliver weight: 4.5g per metre
Processing for 30 Nec yarn.

2.2 1 Point Suction Cards

32 Lap feed cards (1956) fitted only with doffer exhaust point. No cover over doffer. Total airflow approximately 90 c.f.m./card.

Production rate:	15 kg per hour
Sliver weight:	4.5g per metre

Processing for 20 Nec yarn.

2.3 Ring frames

38 ring frames (1956) each of 400 spindles. Fitted with broken end collection system.

Spindle speed:	16,000 R.P.M.
Count span:	20 Nec.

2.4 Material Processed

100% cotton mix consisting of:	85% Chinese cotton
	15% Foreign cotton (Usually U.S.)

Staple length:	28 - 28.5 m.m.
Trash content:	1.5%
Short fibre content:	below 15%

3. Filtration and Air Conditioning System

3.1 Card area

Air from conditioning plant is returned to room via overhead ducts. Exhaust air from cards passes through a rotary waste separator, rotary drum covered with 100 mesh brass wire cloth and is returned to air conditioning system.

3.2 Spinning Room

Air from conditioning plant is returned to room via overhead ducts. Exhaust air is removed by underfloor ducting.

4. Test Equipment.

One Rotheroe & Mitchell L60 dust sampler fitted with a 12 inch cube of 2 m.m. wire mesh covering the sampling point in order to exclude fly.

One vertical elutriator cotton dust sampler.

In order to obtain comparative measurements, both samplers were placed on stands in close proximity to each other with the sampling inlets positioned at a height of 5 feet.

A remote sampling head was manufactured by Beijing No. 3 mill engineers to experts specifications. This was used in conjunction with the Rotheroe & Mitchell sampler to test the returned air system.

5. Test Procedure

5.1 For Carding and Spinning Areas.

The test procedure used for both the Rotheroe & Mitchell L60 dust sampler and the vertical elutriator cotton dust sampler is described in Annex II (5.1 and 5.2)

The sampling positions chosen are shown in figures 1, 2 and 3. They were chosen as being representative of positions where operatives would be likely to spend a majority of time in the room and also positions that would be likely to give the highest dust emission values.

5.2 Returned Air System

The remote sampling head was placed in an underfloor duct from rotary filter to air conditioning plant with the filter holder sideways on to the airflow. The sampling head was not covered with the wire mesh cage as is normal in environmental measurements. A plastic tube was connected to the remote head, passed out of the duct and connected to the Rotheroe & Mitchell L60 sampler. The test procedure used was similar to that described in Annex II (5.1) but the sampling time was reduced to one hour.
Tests were also carried out in a similar manner in the 3 point card area. The remote sampler head was placed approximately 2 feet below the overhead duct from the air conditioning plant in order to monitor the quality of the returned air to the workroom.

6. Test Results

The test results are shown in table 1 for the card areas, table 2 for the spinning room and in table 3 for the returned air supply.

7. Discussion of Results

The Rotheroe & Mitchell L60 results should be compared with the U.K. Health & Safety Executive recommended maximum dust level of 0.5mg/m^3.

The vertical elutriator results should be compared with the U.S. Occupational Safety & Health Administration (O.S.H.A.) cotton dust standard of 0.2 mg/m^3.

It can be seen from the tables that the environmental dust levels are significantly above both the U.K. and O.S.H.A. dust standards in all the areas tested.
Environmental dust levels in the 3 point area are approximately 70% lower than levels in the 1 point card area, thus proving the greater effectiveness of 3 point suction systems.

The high dust levels found in the spinning room appear to be mainly due to liberation of very short fibres in spinning.
Very high total dust levels were found in the returned air from the rotary filter to the air conditioning plant and slightly lower levels in the returned air to the workroom from the air conditioning plant.
The dust levels obtained are likely to be slightly lower than the actual levels which would be obtained by the use of isokinetic sampling techniques. However, the results obtained are of great value in monitoring the performance of filtration and air conditioning plants.

8. Conclusions

From the dust levels measured under the mill conditions prevailing at the time of testing and visual observations, the following conclusions can be made:

1. The environmental dust levels in the areas tested significantly exceed both the U.K. recommended maximum dust level and the O.S.H.A. dust standard.

2. The high dust levels result from a number of factors, these include:

   a) The dust level in the returned air to the workroom is very high. Even if no dust was emitted from the processing machinery, the environmental dust levels would continue to exceed both U.K. and U.S. dust standards.

   b) The high dust levels in the returned air are due to a low filtration efficiency in the rotary drum filters.

   c) The 3 point extraction cards environmental dust levels are significantly lower than the 1 point extraction cards. However, dust emission would be further reduced by increasing the suction airflows.

   d) In the ring room the main problem is short fibre emission. Reducing dust level of returned air by improvement of filtration plant will reduce environmental dust levels.

e) The standard of machine maintenance appeared to be high and regular cleaning occured. However, cleaning was carried out by brushing. This allowed microdust which had taken a considerable time to settle out of the air to be liberated once again.

9. Recommendations

A significant dust emission reduction could be obtained by carrying out the following:

1. Improvement of the filtration efficiency of the rotary drum filters by covering drum surface with more rententive coverings.

2. Continuing conversion of remaining 1 point extraction cards to 3 point extraction.

3. Increasing the suction airflows on the cleaning system and optimising its operating efficiency.

4. Cleaning of all machinery and overhead areas using industrial vacuum cleaning equipment fitted with high efficiency dust filters.

ANNEX V (Cont'd)

FIG 1 DUST SAMPLING POSITIONS 3 POINT SUCTION CARD AREA BEIJING NO3 COTTON TEXTILE MILL.

S - DUST SAMPLING POSITIONS

----- AREA ENCLOSED PROCESSING 30 NRC

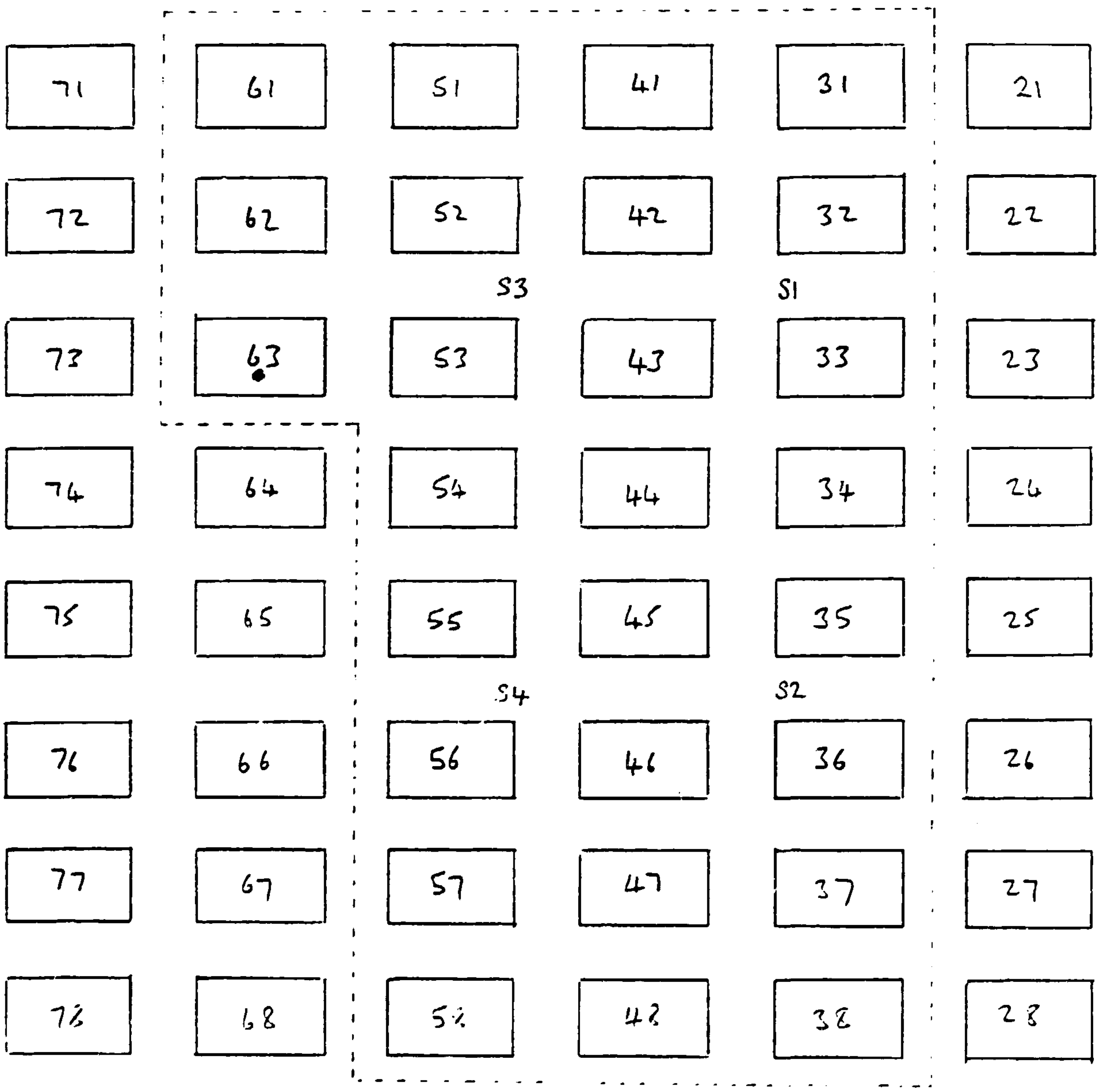
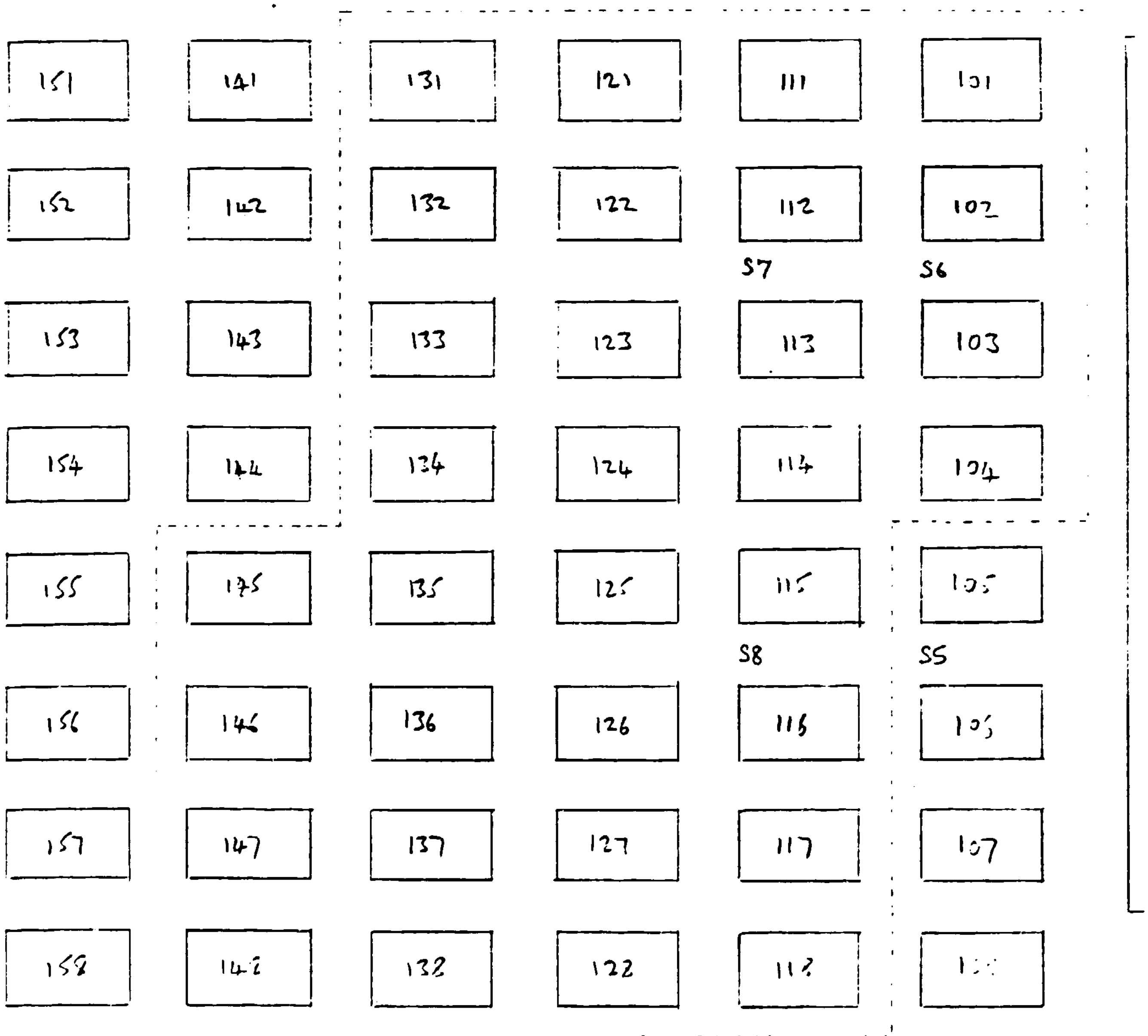


FIG 2 DUST SAMPLING POSITIONS. 1POINT SUCTION CARD AREA. BEIJING NO3 COTTON TEXTILE MILL

S - DUST SAMPLING POSITIONS

------ AREA ENCLOSED PROCESSING ZONE



NOTE S5 - MACHINE PROCESSING CONDITIONS IDENTICAL TO OTHER AREAS.

FIG 3 DUST SAMPLING POSITIONS. SPINNING ROOM. BEIJING NO2 COTTON TEXTILE MILL

S - DUST SAMPLING POSITIONS.

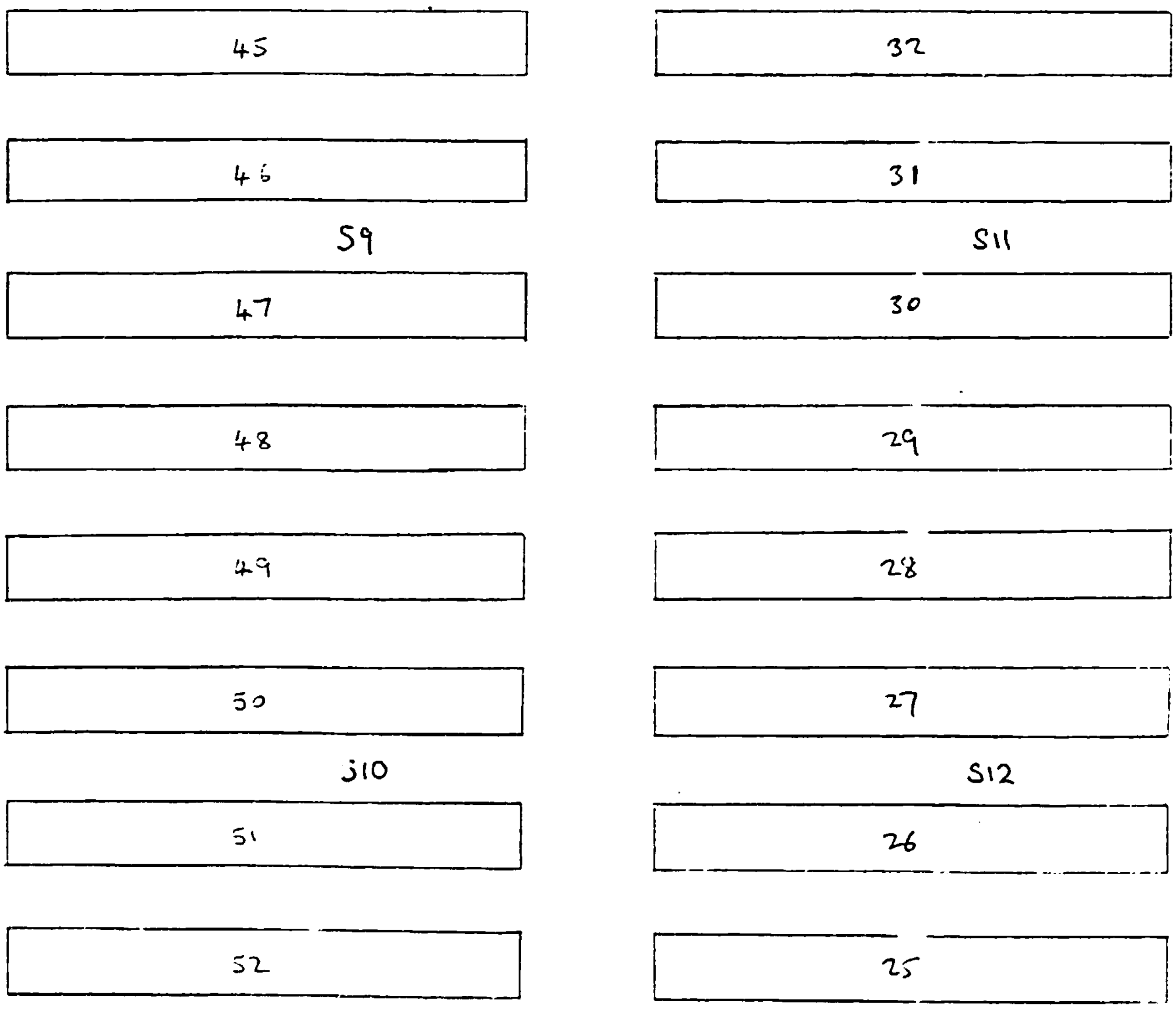


Table 1 Environmental Dust Levels in Card Areas: Beijing No. 3 Cotton Textile Mill

Sampling Position	Suction System Type	Date	Time Started	Dust Level mg/m^3	
				Using Vertical Elutriator	Using Rotheroe & Mitchell
1. Between cards 32 & 33	3 Point	6.10.82	14.22	0.71	1.60
2. Between cards 35 & 36	"	7.10.82	08.18	1.05	1.66
3. Between cards 52 & 53	"	7.10.82	14.10	0.90	1.51
4. Between cards 55 & 56	"	8.10.82	08.10	0.85	1.18
5. Between Cards 105 & 106	1 Point	8.10.82	14.18	1.17	1.92
6. Between cards 102 & 103	"	9.10.82	08.05	1.36	2.48
7. Between cards 112 & 113	"	11.10.82	08.10	1.40	2.69
8. Between cards 115 & 116	"	11.10.82	14.07	1.06	1.90

Table 2 Environmental Dust Levels in Spinning Room: Beijing No. 3 Cotton Textile Mill.

Sampling Position	Date	Time Started	Dust Level mg/m^3	
			Using Vertical Elutriator	Using Rotheroe & Mitchell
9. Between Frame Nos. 46 & 47	12.10.82	08.05	0.28	1.44
10. Between frame Nos. 50 & 51	12.10.82	14.03	0.39	1.46
11. Between frame Nos. 30 & 31	13.10.82	08.10	0.45	2.13
12. Between frame Nos. 26 & 27	13.10.82	14.20	0.40	1.97

Table 3 Dust Levels in Returned Air Supply: Beijing No. 3 Cotton Textile Mill, 14.10.82

Sampling Position	Test Number	Time Started	Sampling Time Mins.	Dust Level mg/m^3
In underfloor duct from rotary filter to air conditioning plant	1	08.22	63	2.28*
	2	10.13	64	1.18
	3	12.05	61	1.68
	4	13.08	60	1.59
In 3 point card area, 2 feet below return air duct from air conditioning plant	1	14.28	60	1.21
	2	15.33	60	0.98

NOTE: * The rotary drum filter was found to be operating under abnormal conditions during the period covered by the test.

ANNEX VI

LIST OF DUST SAMPLING EQUIPMENT PURCHASED BY UNIDO FOR PROJECT.

	Amount (Dollars)
One - Vertical elutriator cotton dust sampler Model GMW-4000 220V/50Hz/single phase	922
One - Rotheroe & Mitchell L60 portable air sampler fitted with 37 m.m. filter holder. 240V/50Hz	1062
One - Cahn 25 portable electro-microbalance	6005

The project equipment will be turned over to the Chinese Government for continued use after the project is completed.