S2C2

THE CLEANROOM MONITOR

The Scottish Society for Contamination Control

October 2006 Issue 56

ICCCS

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ICCCS SET UP INTERNATIONAL CLEANROOM CERTIFICATION BOARD

When cleanrooms first came into being about 50 years ago they were confined to specialised products such a bomb sights and gyroscopes. In the intervening years, cleanrooms have witnessed a phenomenal growth, both geographically and technically. Cleanrooms are now a major part of the global economy and, without cleanrooms, much of modern manufacturing industry would fail.

In the earlier years, there was insufficient knowledge about cleanrooms for the people associated with cleanrooms to understand that they were not always being designed, built, tested, and operated correctly. As knowledge has been gained in recent years, it has become obvious that all is not well in the cleanroom industry, and there are reasons for concern. However, little-by-little the cleanrooms issues have been addressed by experts from the many sectors of the industry working together to write standards of practice, such as found in the international standards ISO 14644 and ISO 14649. However, there remains the problem of how this information is passed over to those working in the cleanroom industry. Few universities and colleges offer courses in cleanroom technology and, where this occurs, it is not unusual to find that the lecturers have little or no experience of cleanrooms, and the course reflects this.

Cleanroom societies, such as S2C2, have been attempting to plug the education gap, and there has been steady progress. S2C2 has been at the vanguard with the Cleanroom Testing and Certification Board (CTCB) courses in Cleanroom Technology and Cleanroom Testing. These CTCB courses are a start in improving working practices in the cleanroom industry but other courses have to be devised, and other countries brought on board. To move forward in devising education courses with certification of the students through examination, the International Confederation of Contamination Control Societies (ICCCS) have recently agreed at a meeting of their Council of Delegates in Beijing to an educational initiative to set up an International Cleanroom Certification Board (ICCB) that will oversee the establishment of accredited cleanroom courses.

This Beijing Agreement marks an achievement at the end of 50 years. A need has been met; a goal achieved.

Read full details of the proposals on page 8.

THE REVISION OF ISO 14644 1 and 2

The two ISO standards on cleanrooms, ISO 14644-1 and ISO 14644-2, that deal with the classification of cleanrooms, and the testing and monitoring of cleanrooms to prove continued compliance were first published in 1999 and 2000, respectively. These two standards have been well accepted by the cleanroom industry, but it is thought that improvements could be made to them without causing any radical change.

Work started on revising the standards in November 2005 with a view to finishing around the end of 2008. There have been several meetings of the ISO Work Group involved (WG1) and the last meeting was in September, 2006.

There is still at lot of work to be done, but the following information was extracted from information supplied by Gordon Farquharson who is the convenor of the work group dealing with this. It should be understood that the possible changes are not final and it is highly likely that the final standard will contain information that differs from that given below.

Note: *The BSI committee concerned with these standards, as well as our representatives on the ISO Work Group dealing with these two standards, would welcome the help of statisticians working with a cleanroom company who are experienced with the statistical problems of sampling and evaluation of airborne particle count data in cleanrooms and available to give advice (even a telephone conversation might be helpful). If you know of such a person please contact the S2C2 office.*

The following are the changes being considered in the two standards.

[1] Possible changes to ISO 14644-1

Classification Table 1

The standard classification method may be changed to classification by table, with the formula that is given in the standard to be used for intermediate classes (like the old 209E). In the classification table, it is being considered whether to remove, or annotate, some of the low counts as they suggest unreliable limits that demand too large sample volumes. The counts that may be removed are coloured in the table.

ISO Classification number	Maximum concentration limits / m^3					
	≥ 0.1 µm	≥ 0.2 µm	≥ 0.3 µm	≥ 0.5 µm	≥ 1 µm	≥ 5 µm
ISO Class 1	10	2				
ISO Class 2	100	24	10	4		
ISO Class 3	1 000	237	102	35	8	
ISO Class 4	10 000	2 370	1 020	352	83	
ISO Class 5	100 000	23 700	10 200	3 520	832	29
ISO Class 6	1 000 000	237 000	102 000	35 200	8 320	293
ISO Class 7				352 000	83 200	2 930
ISO Class 8				3 520 000	832 000	29 300
ISO Class 9				35 200 000	8 320 000	293 000

THE REVISION OF ISO 14644 1 and 2

Informative Annex A

The graphical representation of the classes will be retained but the clarity improved. A new table will be added to illustrate the decimal classes e.g. 1 particles/m^3 = ISO 3.5; 20 particles/m^3 = ISO 4.8

Sample locations

In the present standard, the number of sample locations is not class sensitive but only area sensitive. This has been discussed and it is likely that the present method will be retained.

Collection and evaluation of particle count data

In Annex B5.2 of the present standard, it is considered that there are some problems with the statistical approach that is currently used in the 95% upper confidence level (95% UCL). An even distribution of contamination in a cleanroom is assumed. This is not always the case, particularly for non-unidirectional cleanrooms "in operation", which can cause classification problems. There is a view that a 95% level of statistical confidence can be achieved with 5 or more sample locations (not 10 as today). This is still to be resolved. Today, many testers prefer to take more sample locations to avoid the complexity of applying the Student t-test. They would prefer to find a simple way of increasing sample numbers at the smaller numbers of locations, and avoid the need to use the Student t-test.

The work group has to decide if they wish to have confidence in sampling for a **complete zone** or **individual locations**; the current standard generates confidence for a **complete zone.** The statistical issues have still to be resolved. The situation of uneven particle distribution has to be dealt with. This problem may lead to a different approach for "as built" and "at rest" compared to "operational" occupancy state.

Annex F: Sequential sampling

This procedure is considered still effective. The specification given in Annex F is difficult to follow and will be rewritten to improve the clarity of the presentation.

[2] Possible changes to 14644-2

Testing vs. monitoring

It is considered that the normative section is unclear and there is a need to improve its clarity. The link between increased monitoring and less testing has to be made clearer. It is also thought that terms that have different meanings in different countries such as 'qualification' 'validation', should be removed from the standard.

Tables of test frequencies

The present normative section is unclear and some parties do not agree with the required testing frequencies. It may be that this section will be expanded and placed in an informative annex.

Real-time monitoring systems

A possible new section (perhaps to an Annex) is required to specify the essential requirements of such systems.

Annex B: Risk assessment

This section is considered very poor and limited, and does not reflect current practice. It is likely that aspects of risk assessment, when they arise, should be dealt with in the main text and that Annex B removed.

THE FORUM

[1] ***Question:*** Clean room temperature

Can anybody tell me what is the temperature and humidity limits for clean rooms? We are maintaining 21+/-2 deg. and humidity 50 +/- 5 %. Here I have one doubt the temperature 20 to 25 deg. is favourable to fungui growth. Please clarify my doubt. [S] 07/06

Answer:

There are no temperature or humidity requirements for a cleanroom. It is your choice, many cleanrooms requiring high temperatures and humidity for manufacturing, whereas others require low conditions. With regards to your concern with fungi

Continued on page 5

AIRBORNE CHEMICAL CONTAMINATION

All manufacturing industries that use cleanrooms are concerned with particle contamination, and a large number are also concerned with microbial contamination. However, there is a significant group of manufacturers who are concerned with chemical airborne contamination - this is also known as airborne molecular contamination (AMC). In particular, the semiconductor industry has problems with this type of contamination, as it is known that it can damage semiconductors and reduce yield and reliability. This article looks at the sources of this type of contamination and how it can be reduced, as well as how a cleanroom can be classified with respect to this type of contamination.

Sources and means of minimising the dispersion of airborne chemical contamination

Airborne chemical contamination in a cleanroom comes mainly from the following sources of:

- Materials used to construct the cleanroom
- Operation of the cleanroom
- Air

Materials used to construct the cleanroom: The fabric used to build a cleanroom can be a major source of airborne chemical contamination, as volatile chemicals may 'outgas' (offgas) from construction materials which have, as part of their constituents, chemicals that evaporate. An example of this is the use of 'plasticisers' in PVC plastic. To make a pliable product from PVC, plasticisers are added. These are usually come from the chemical group known as phthalates, and these can be a considerable percentage of the chemical mix of the material. For example, PVC (vinyl) gloves may be manufactured from a chemical mix that has over 40 % of plasticisers. Although phthalates do not evaporate easily they do so slowly; this is the reason that soft PVC products become hard over a few years. PVC is used in vinyl flooring laid in cleanroom, and so if airborne chemical contamination is to be minimised, this type of flooring should be avoided.

Another example is silicon mastic, or caulking. Anyone who has used this material to caulk round baths etc. in the home will remember the strong smell that off-gasses from this material. During the construction of cleanrooms, this type of caulking should be avoided and more suitable types substituted.

Operation of the cleanroom: If someone who has been smoking comes into a room free of cigarette smoke, the smell of smoke is instantly noticed by those who do not smoke. Similarly, someone who has recently put on after-shave or perfume will also be noticed. It is undesirable that volatile chemicals should be found in the air in cleanrooms, and people who give off volatile chemicals because of cigarette smoke, cosmetics, perfumes etc. are a potential problem. Common observation of smells shows that some medications could also be a problem, as well as the consumption of certain foods.

Cleanroom clothing can be a problem. Some firms who process cleanroom clothing may use the dry-cleaning method i.e. use solvents. Most firms use water but chemical additives are used during the processing, and it is therefore necessary to check that nothing is used that may cause a problem. Packaging of the clothing may also be a problem.

Machines may cause difficulties, and the materials used to ensure their correct functioning should be assessed for 'off gassing', as should the process materials and the functioning of the machine to ascertain if they produce airborne chemical contamination.

Cleaning liquids and materials used in the cleaning of cleanrooms should also be assessed for risk.

Air: The air supplied to the room can be a source of airborne chemical contamination. Air will be mainly recirculated from the cleanroom, so when the air passes through the air conditioning plant there is an opportunity to remove some of the contamination produced within the cleanroom. A minority of the air supplied to a cleanroom will be drawn from the outside environment but this could be a significant source of airborne chemical contamination, especially if the factory containing the cleanroom is situated in an area of pollution. The air should be treated to remove airborne chemical contamination as part of the air conditioning system, and as much contamination removed as is required, or is possible.

Methods that are used are:

- Sorbtion onto materials such as activated carbon, ion exchange compounds etc.
- Photoelectron ionization and electrostatic ion removal
- Catalytical photo-oxidation.

It should be noted that the construction of the air conditioning plant and air distribution ducts should be treated in the same way as the cleanroom construction materials, and materials that can offgas should be avoided, e.g. caulking. Cabling should also be considered.

Types of Airborne Chemical Contamination

Airborne chemical contamination is considered to fall into broad classification groups such as:

1. acid(ac)
2. base (ba)
3. biotoxic (bt)
4. condensable (cd)
5. corrosive (cr)
6. dopant (dp)
7. total organic (or)
8. oxidant (ox)
9. any other group, or individual group of substances

AIRBORNE MEASURE cont.

Classification of cleanrooms with respect to airborne chemical contamination

An international classification scheme was recently introduced through the recent publication of ISO standard 14644-8 in 2006. This standard is called 'Cleanrooms and associated controlled environments - Part 8: Classification of airborne molecular contamination'. The method used to classify air in this standard is based on what is called an 'ISO –AMC descriptor format' and is determined in the following way:

ISO-AMC Class N(X)

Where, N is the ISO-AMC class, which is a logarithmic index of the measured concentration c_X of a group, or individual substance (known as X) that is measured in g/m^3. The index will fall within a limited range of 1 to -12.

Hence, $N=\log_{10} [c_X]$

The concentration of a given substance, or group of substances, is measured in the cleanroom to determine the classification.

If, for example, the concentration of organics in the air of a cleanroom was found to be 10^{-4}g/m^3, the classification of the room for organics would be 'ISO-AMC Class -4 (or)'.

If the concentration of condensables was 10^{-7}g/m^3, the classification would be 'ISO-AMC Class -7 (cd)'.

Further information

If further information is required, ISO standard 14644-8 should be consulted. This is available for purchase at the S2C2 office, or through the S2C2 website shop at

www.s2c2.org/shop

CLEANROOM TESTING COURSE

In June this year, S2C2 ran cleanroom testing courses.

- Thirty-eight people attended the S2C2 one day testing course.
- Sixteen people attended the CTCB (Cleanroom Testing and Certification Board) tesing course which was given over three days. The pass rate for this was 81% which is an improvement of previous years.

FORUM continued

(I assume that you are particularly concerned with moulds), I can tell you that you should have no concerns. Moulds will grow at the temperature you have but will need a very much higher humidity. As well as requiring water they require nutrition, and this usually missing in a cleanroom. [BW]

[2] ***Question:*** Class 100K max occupancy

Can anyone share their thoughts on the maximum no. of persons per sq meter or sq foot for a clenroom class 100K? ISO std manual 14644-5 does mention "control on occupancy", but does not show any figure as reference. [A] 09/06

Answer:

A good guide for the higher grade cleanrooms is 1 person per 10sq.m but I don't think it matters in a 100k so long as your air change rate is adequate. [CP]

[3] ***Question:*** EU Standards for the various filters

Please explain the EU standards for various filters like HEPA's (various sizes like 24" x 24" x 12", 24" x 24" x 6", 12" x 12" x 12", 12" x 12" x 6") velocity , CFM & ratings. [R] 06/06

Answer:

In my opinion, your question is too complicated to be treated in a few paragraphs. You should read a book or article on the subject. [BW]

[4] ***Question:*** WIP box information

Has anyone in the semiconductor industry ever done a study on the cleaning effectiveness of their cassette/WIP box washer? How about particle testing of the WIP boxes themselves? Has anyone proven the cleanliness of the wafer boxes? If anyone has any information on this issue please let me know. Thank you. [J] 07/06

Anwer: We had huge particle problems for a period of time, and eventually traced it back to the cassettes. The washers were not removing particles, and the particles were landing on the wafers. [E]

[5] ***Question:*** Clearnoom consumables validation

For the consumables used in clearnoom, such as wipers, facemasks, once qualified for cleanroom use, is it necessary to make validation everytime new batches arrive at warehouse? What's the usual practice? [M] 05/06

Answer:

No need, normally you check if the packaging is in good condition or not during transportation. [NX]

[6] ***Question:*** Cleaning Class 1 and 1000 cleanroom floor

Does anyone have suggestions on what to use to effectively clean scuff marks, photoresist and other marks from the cleanroom floor? Our safety group has prohibited the use of 100% acetone due to its flammability as this was the best at countering these stains. Any suggstions? [J] 09/06

Answer: ??

THE PROBLEM OF INCORRECT MEASUREMENT OF AIR VOLUMES USING A MEASURING HOOD IN CLEANROOMS

Readers of *The Monitor* may have read an article in the last edition about the inaccuracy of measuring air volumes supplied to cleanrooms. The most common way of measuring the air supply to a cleanroom is by means of a measuring hood, a typical one being shown in Figure 1. The hood gathers the air supplied, usually from a supply diffuser in the ceiling, and measures the volume as it exits from the hood.

Figure 1 Measuring hood being used to measure the air supply volume in a cleanroom

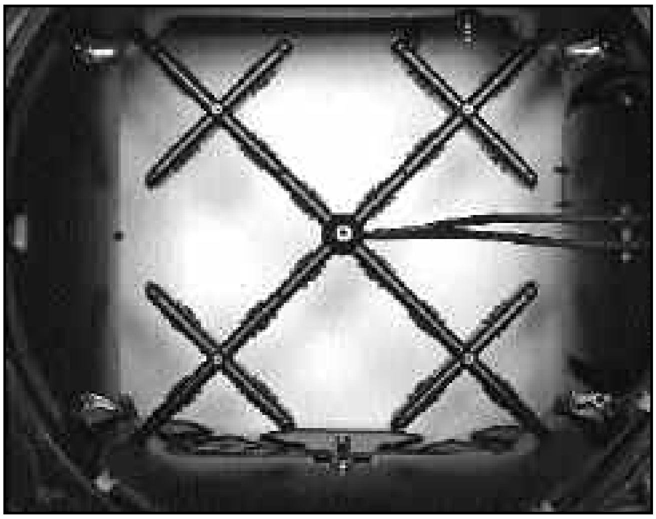

Figure 2 Measuring grid at exit of measuring hood

The measurement grid is at the exit of the hood (Figure 2) and has a set of holes facing the direction of air flow which measures the total pressure, and a set of holes facing away from the airflow that measures the static pressure. The difference between these two pressures, which is measured by a pressure micromanometer, is the velocity pressure, which can be easily converted to velocity. Knowing the surface area of the hood exit, the air volume being supplied can be calculated. However, the hood must still be calibrated and this is often done in a rig that either has no air diffuser, or perhaps one type of diffuser.

One of the observations in the article in the previous edition of *The Monitor* reported that the air volume measured by a hood can be inaccurate, and it has been observed year-after-year in the CTCB practical course that the air measuring hood gives values that are about 15% to 20% less that a fundamental measurement taken by means of a Pitot-static tube.

The observations found during the CTCB practical course were carried out when measuring the air supply volume from a HEPA filer without a diffuser. However, it might be expected that the worst problem is likely to be found with the swirl-type of diffusers, of the type shown in Figure 3.

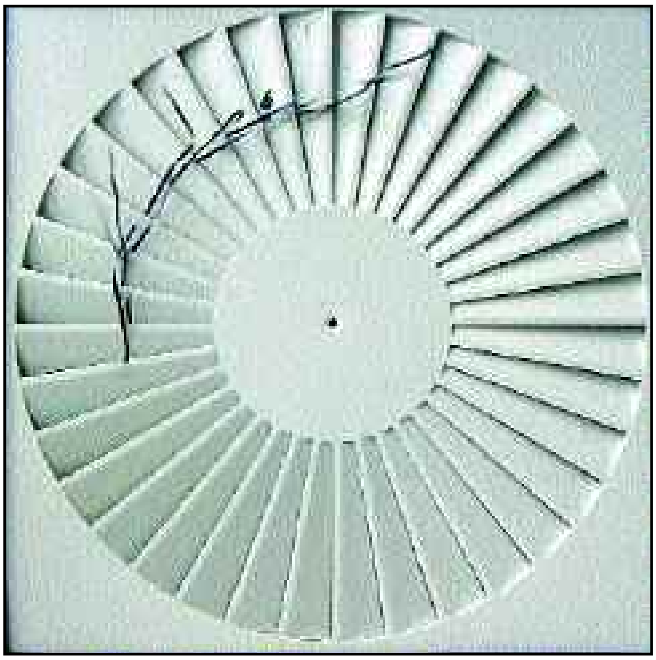

Figure 3 Swirl air diffuser with ribbons to show the air exiting

This type of diffuser induces the supply air to twist and hence will mix well with the air in the cleanroom. This is a desirable method of supplying air to a cleanroom, as it ensures that there is an reasonably even concentration of contamination in the cleanroom.

THE PROBLEM OF INCORRECT MEASUREMENT OF AIR VOLUMES USING A MEASURING HOOD IN CLEANROOMS

It was also reported in the previous edition of *The Monitor* that S2C2 had agreed to support research projects carried out by students at the Department of Mechanical Engineering at Glasgow University. Shown in Figure 4 is the flow streamlines of air from a HEPA air filter that passes through a measuring hood. These were obtained by Tomas Troncoso, one of the Department's students. The figures were obtained by use of Fluent software, which is a Computational Fluid Dynamics (CFD) method of analysis. For those who are familiar with CFD methods it should be noted that there were problems with meshing and convergence, and there was insufficient time to carry out an analysis on mesh interdependency. However, although more work is required, the drawings obtained of the flow lines will be accurate enough to predict the type of flow found in a measuring hood. It may be seen in Figure 4 the air flows evenly out of the hood from a filter with no diffuser.

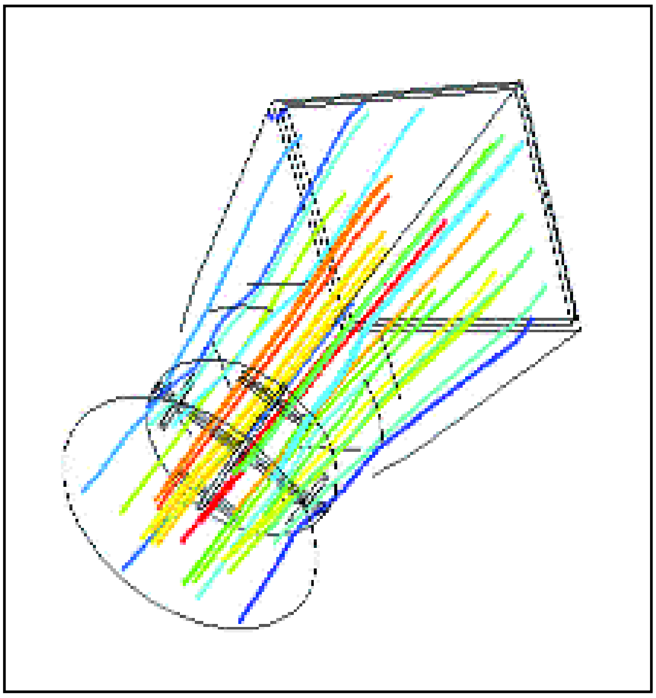

Figure 4 Air flow simulation through a hood. Air coning from a filter with no diffuser

Shown in Figure 5 is the simulated flow in a hood when the air is supplied from a swirl diffuser. In this case it can be seen that the air 'swirls' round the hood.

Figure 6 shows the air flow as viewed at the measuring grid at the exit of the hood, and shows the circulating movement of the air with a higher velocity around the outside. This demonstrates that the air will impact on the holes in the front of the measuring grid at an angle, and unevenness across the grid. It is therefore unlikely that the air volume measured will be the same as when used with no diffuser.

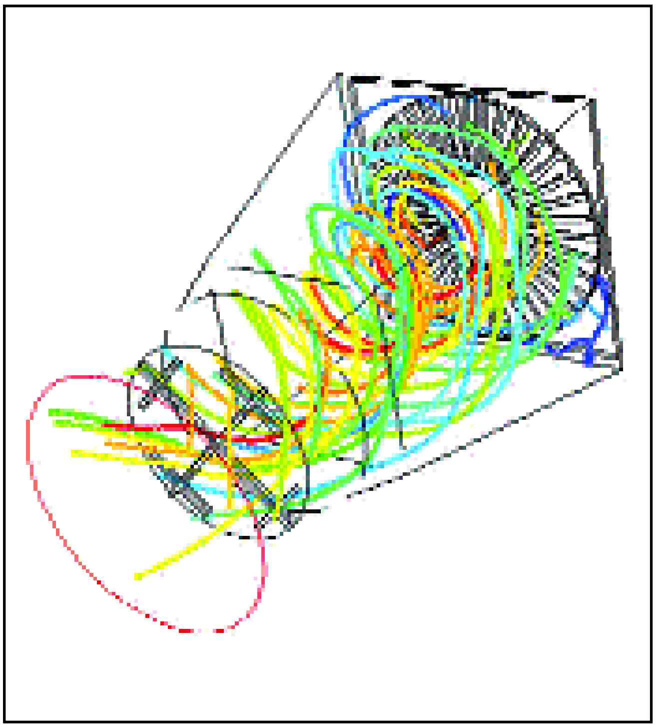

Figure 5 Air flow simulation through a hood. Air coming from a swirl diffuser

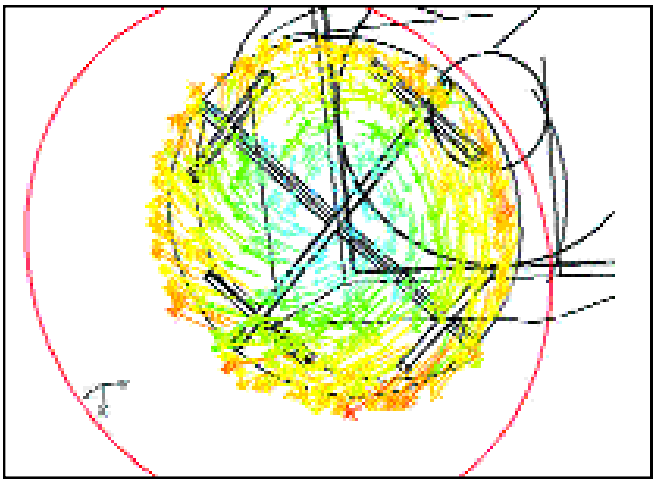

Figure 6 Air flow simulation through the exit hood. Air coming from a swirl diffuser

The air flows given in diagrams 5 and 6 show why the air hood will not accurately measure the air volume from a swirl diffuser if the hood has not been calibrated in a rig using that type of diffuser. The problem of uneven flow across the measuring grid must also exists with other types of diffusers, and therefore one can only be certain that the air volume is measured correctly if the hood is calibrated for each type of diffuser encountered.

ICCCS SET UP INTERNATIONAL CLEANROOM CERTIFICATION BOARD

At their meeting in Beijing in September 2006 the ICCCS Council of Delegates agreed to set up an International Cleanroom Certification Board (ICCB) to prepare and accredit internationally-recognised educational courses for people who design, test, operate, and work as operators in cleanrooms. An important part of this initiative is that people attending courses will be certified by examination.

Member societies of the ICCB will write and develop these educational courses which will be accredited within an 'Accreditation and Certification Framework' set down by the ICCB. Educational courses will be available for the use of other cleanroom societies.

Cleanroom educational courses will be accredited by the ICCCS if they conform to the following:

[1] The students must be issued with, or have access to, well written, relevant, and up-to-date, notes or text books. The course content should be given in the accreditation and certification submission.

[2] Students should have some experience in the subject they are being taught and examined. This will vary according to the subject.

[3] Expert lecturers should be used, with appropriate professional experience (more than 5 years) in the field in question and appropriate qualifications.

[4] Educational courses will be available for the use of other societies, and this should result in a wider variety of courses being available for people working in the field of cleanroom technology.

[5] People taking the courses should be examined. The examination can be set for different levels of competence according to level of difficulty and content of the course e.g. 'advanced and basic levels' or, alternatively, 'professional' for people who make the subject their career, and 'associate' for people who wish a working knowledge of the subject.

[6] A quality assurance system will be established to ensure a high standard of courses. Topics that achieve this may included:

- the setting of clear and unambiguous exam questions,
- secure examination supervision,
- suitable exam marking practices,
- an examination board,
- auditing of the course,
- an agreement from the student to be attentive and studious during all teaching periods, to study efficiently, and to accept the outcome of any appeals procedure,
- an appeals procedure for unsatisfied students.

Types of courses that would conform to the ICCB programme

Basic Courses

1. A basic cleanroom technology course with emphasis on the behaviour of cleanroom personnel. An example of this course is that described in VDI 2083-15.
2. A basic course in the execution and evaluation of cleaning activities.

Advanced Courses

1. An advanced general course in Cleanroom Technology. An example of this course is the 'Cleanroom Technology' course offered by the CTCB of the S2C2.
2. An advanced course in Cleanroom Design and Construction
3. An advanced course in Cleanroom Testing and Evaluation. An example of this course is the 'Cleanroom Testing' course offered by the CTCB of the S2C2.
4. An advanced course in Cleanroom Operations
5. An advanced course in Cleanroom Cleaning

It is clear that members of S2C2 will benefit from this initiative. It expected that the S2C2's two CTCB courses i.e. 'Cleanroom Technology' and 'Cleanroom Testing' courses are likely to receive early accreditation.

The ICCCS Sub Committee working in Amsterdam under the chairmanship of Bill Whyte (S2C2) to write the educational report approved in Beijing. Representatives from Germany, China, Holland, Ireland, Belgium, Italy, France and Japan were present.

UPDATE ON THE CURRENT STATUS OF THE ISO 14644 AND ISO 14698 STANDARDS

ISO 14644: 'Cleanrooms and Associated Controlled Environments'

This standard consists of several parts which are as follows:

ISO 14644-1: ***Classification of air cleanliness.***

This standard gives the airborne particle limits to classify cleanrooms. The standard was issued in 1999. Work has now started on a revision of this standard and should be completed around the end of 2008. The possible changes are discussed in another part of this Monitor.

ISO 14644-2: ***Specifications for testing and monitoring to prove continued compliance with ISO 14644-1.***

This gives information, including time intervals, for testing a cleanroom to demonstrate continual compliance with the ISO 14644-1. The standard was issued in 2000. Work has now started on a revision of this standard that should be completed around the end of 2008. The possible changes are discussed in another part of this Monitor.

ISO 14644-3: ***Test methods.***

This gives a description of the test methods that should be used to test the cleanroom to show that it is working correctly. This standard was published in December 2005.

ISO 14644-4: ***Design, construction, and startup.***

This standard was published in 2001 and has recently undergone its 5 year review. It was decided that to confirm the existing document and therefore, there are no revisions planned.

ISO 14644-5: ***Operations.***

This standard gives general advice on how to run a cleanroom. This standard was published in 2004.

ISO/FDIS 14644-6: ***Terms and definitions.*** This is a collection of all the definitions of terms used in the ISO cleanroom standards. This standard will be issued soon as a final draft.

ISO 14644-7: ***Separative devices (clean air hoods, gloveboxes, isolators, mini-environments).***

This gives information on clean air devices such as isolators and minienvironments. Standard published in 2004.

ISO 14644-8: ***Classification of airborne molecular contamination.***

This gives information on gaseous chemical contamination in cleanrooms. Standard published on August 2006.

Proposed new standards:

Two new standards are being worked on, but neither have been approved as new work items and no drafts are available. No date has therefore been set for a publication date. These proposed standards are

1) Surface chemical contamination.

2) Classification of surface particle cleanliness.

ISO 14698: 'Cleanrooms and Associated Controlled Environments–Biocontamination Control'

This standard consists of two parts:

ISO 14698-1: ***General principles and methods.***

This gives information on how to establish methods for measuring micro-organisms in the cleanroom. This standard was published in 2003.

ISO 14698-2: ***Evaluation and interpretation of biocontamination data.***

This gives information on how to deal with the results obtained from measuring micro-organisms in a cleanroom. This standard was published in 2003.

The above two standards need not be considered for revision until September 2008. However, it appears that they may benefit from an earlier review. The issues involved are being investigated and a decision will be made as to whether an early start in revising these standards is required.

Standards are available from the S2C2 office or from the website shop: www.s2c2.org/shop

CLEANROOM TECHNOLOGY COURSE

This course on 'Cleanroom Technology' is based on an S2C2 course that has been run for over 15 years, and on the book 'Cleanroom Technology - Fundamentals of Design, Testing and Operation' by Bill Whyte. The course covers all aspects of cleanroom technology in a way that is applicable to all types of cleanrooms and industries.

Attenance at this general course in cleanroom technology will result in either a "certificate of attendance", or after successfuly passing a written exam following the lecture course, a Cleanroom Testing and Certification Board (CTCB) certificate.

For complete details on the syllabus and an application form, either telephone the S2C2 office (0141 330 3699) or go the the website where the information and an application form can be downloaded from:

www.s2c2.co.uk/ctcb/ctcb1.html

The next Cleanroom Technology course is on

Thursday, 26th October, 2006,

Erskine Bridge Hotel,

Erskine, Near Glasgow.

(*The S2C2 AGM will also be held at this time*)

If you want to sit the exam:

Registration

To go on this course you need to register first. This is so that candidate suitability can be assessed.

The Cost of Registration

Registration is £110 +VAT. This includes (1) being entered as a candidate, (2) a copy of the book *Cleanroom Technology - Fundamentals of Design, Testing and Operation*, (3) sample questions and answers, (4) an example of exam paper, and (5) a CTCB certificate on successfully passing the exam.

The Revision Course and the Exam

This is over one day and includes a revision lecture course and a 2 hour written exam. The cost is £220 + VAT (incl. coffee & lunch).

The necessary revision course (and the opportunity to sit the exam) is October 26, 2006 (see right). This lecture course will be attended by two groups of people: those sitting for the exam and those who are not.

If you do not want to sit the exam:

The Cost of this Course

Price per delegate including lunch and tea/coffee:

Members: £160 (£188 incl. VAT)

Non-members: £177 (£207.98 incl. VAT)

This lecture course will be attended by two groups of people: those sitting for the exam and those who are not.

Certificate of Attendance

This will be issued on the day to all who attend the course.

BEIJING SEPTEMBER 2006

The 18th International Symposium on Contamination Control & China International Exhibition on Contamination Control 2006

It was reported that the 2006 Symposium, Beijing, China had a total of 106 (27 foreign) papers submitted. 46 lectures are given and divided in 3 categories: Design & Construction, Testing and Filtration. Approximately 80 people attend the Symposium, of which the large majority were Chinese.

I was also reported that the 2008 Symposium will be held in Ireland. The Symposium will be held in the second week of September 2008 in Dublin. It will be combined with an international pharmaceutical symposium. Expected are approx. 100 – 150 participants. The 2010 Symposium will be held in Tokyo, Japan. The Symposium will take place from October 6-8. An estimated 100 papers are expected and over 300 participants are expected. Lectures shall be translated into English.

Delegates at the Council of Delegates of the ICCCS meeting in Beijing.

Delegates shown in picture are (from left-to-right):

Dr. Berit Reinmuller R3-Nordic/Denmark, Finland, Norway, Sweden; Mrs. Laure Alloul-Marmor ASPEC/France; Mr Hans Zingre SRRT/ Switzerland; Dr. Fabien Squinazi ASPEC/France; Dr Myung-Do Oh KACA/ Korea; Mrs Eliane Bennett and Mrs Dirce Akamine SBCC/ Brazil; Mr. Paul A. van Rij, (Secretary); Dr. Wang Yao and Mr. Wang Daqian (Chairman), CCCS/People's Republic of China; Dr. Bill Whyte Chairman ICCB Subcommittee/ S2C2; Mr. Conor Murray ICS/Ireland; Dr Fedorovich Viatcheslav and Dr Ivanyuk Tatiana ASENMCO/Russia; Mr. Robert L. Mielke IEST/USA; Prof. Dr. Toshikatsu Asada JACA/Japan; Ir. Frans W. Saurwalt VCCN/Netherlands; Dr. Shuji Fujii, JACA/Japan, Prof. Gernod Dittel GAA-RR/Germany, and Mr. Kazuo Shimazu, JACA/Japan.

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