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The *F/PSJ* is published quarterly. The annual subscription is $35.00. Single copies are $10.00. Overseas surface postage charges are $10.00 for a total of $45.00. Airmail postage is $18.00 for a total of $53.00.

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MEMTEC AMERICA CORPORATION

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TIMONIUM, MD 21093
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THE AMERICAN FILTRATION & SEPARATIONS SOCIETY CORPORATE SPONSORS SPEAK OUT!

Here's why they support AFS

- Superb way to support the filtration industry and to get exposure in the U. S. Market.
- Broader understanding of our business and our customer's business.
- Conferences, exhibits, list of all members.
- Quality educational programs / short courses / seminars / conferences.
- As a filtration products manufacturer, it's in our interest. Also the overall cost is minor compared to the benefits and implications the membership has on our business.
- Conferences / consortiums / programs which advance overall knowledge of the state-of-the-art and are aimed at transferring technology across market boundaries.
- Environment of the Society.
- We became a corporate member to stay informed on the needs and changes in the filtration applications that our customers (OEMs) are experiencing.
- Membership offers a way to stay in touch with our industry.
- The opportunity to become recognized as a manufacturer of nonwoven filtration media, and ultimately increased business in the industry.
- The movement of filtration along a road from art toward science.
- Offers us a place to give papers in a respected forum.
- More technical attention to our area of filtration, namely porous metal elements in heavy-duty process applications.
- Our selfish interest in the better promotion of all filtration activities in the U.S. A healthy filter climate can only help all of us.
- Local and national meetings. Company name in AFS publications.
- To support a national organization willing to address the filtration industry's needs.
- The industry needs a strong common voice for benefit of all.
- We are responsible to support industry activities that help our business growth.
- Technical presentations on new and emerging filtration applications, mechanisms, etc.
- We feel major benefit of corporate membership in the attainment of goals of quality and service in a market often dominated by price.
- Acknowledgment by the industry and to the industry that our company is a player in the filtration game.
- To gain knowledge of filtration technology and advances before our competition.
- To gain recognition by the filtration community of the role our company intends to play as a leader in filtration. Also to make meaningful contributions to the Society where possible.
- As a supplier to the filtration industry, this offers us the best access to our customer base. In order to know what the industry needs we must keep informed and this society provides an excellent format for us.
- Our company expects to become a world leader in filtration. It is believed that involvement with the American Filtration & Separation Society will enhance the company's image of technical leadership.
- As an industry leader, we must participate / contribute to maintain that role and image.
- Annual publications of the latest techniques, materials and activities involved in the particle separation field.
- Technical and business seminars devoted specifically to particle separation.
- A clearing house of information involving filtration worldwide.
- As a corporate member, our company would like to see the American Filtration & Separations Society become the supporting organization for quality standards in the filtration industry. By this, I would **not** refer to specific test results *(i.e., removes 63% of A. C. fine dust...).* Rather, I refer to standards of production quality and consistency of product and service in the marketplace.

AFS EXECUTIVE SECRETARY'S REPORT

ARE WE ABOUT TO SOLVE THE CONTINUINGCRISIS IN SEPARATION TECHNOLOGY?

In 1973, twenty individuals, well known in the filtration world, developed a statement on "The Crisis in Solid-Fluid Separation technology" which was published in several technical journals and magazines worldwide. They expressed concern about the present state of the art in solid-fluid separation. It was felt to be inadequate for the needs related to improved industrial processing, growing environmental requirements, lower grade raw materials, increasing energy costs, and a "dearth of teachers, researchers, and specialists in solid-fluid technology." Furthermore, several fluid-solid separation areas of insufficient technology were emphasized, - filtration, centrifugation, dust collection, cycloning, scrubbing, electrostatic precipitation, thickening, flocculation, and deliquoring of solids. In 1991, a second new group *"some of whom signed the original declaration)* declared that, while advancements have been made in several areas, the needs still exist in theses categories and, in fact, new areas have been added. These new areas include membrane filtration, solid-solid separation in fluids, on-line measurement of solids, and solid-fluid separation under extreme and hazardous conditions.

The AFS is happy to report that its education committee is successfully addressing the problems discussed in 1973 and 1991 with the hope of applying the principles of interfacial engineering to such fields as: Ultrapurification, Energy, Microstructured Materials, Pollution control, Critical and Strategic Metals, Biotechnology, and Electronics.

This movement is tied to the four-course curriculum that AFS is preparing as the basis for university-level education in the field of fluid-particle science.

The progress required in the crucial separation technology is of two types. The first is new technology where an understanding is needed for physical separations of sub-micron solids of slightly different sizes in biological processing streams, solid-fluid separation under highly viscous conditions as in sol-gel processing, and flocculation and dispersion in non-aqueous media.

The second is the development of improved separations over present methods. Economics will unquestionably play a significant role in all of these areas. Separation technology is a large economic factor in most industrial processing and pollution control, and will play a large role in all of these areas. Separation technology is a large economic factor in most industrial processing and pollution control, and will play a large role in the development of biological processing and the development of new energy sources.

It should also be emphasized that a global marketplace is rapidly developing on planet earth. Export of products and / or raw materials are now essential to all countries. Obviously, improved solid-fluid separation technology to reduce the economic costs should be achieved for existing industrial processing as well. Removal of moisture by mechanical means, for example, carries a large potential for costs should be achieved for existing industrial processing as well. Removal of moisture by mechanical means, for example, carries a large potential for cost reduction over thermal methods as does the disposal of very fine solids with severe reduction of volume and recovery of water.

The public of all countries is demanding improved quality of air, water, and land. Practically all impurities and pollutants must be removed from effluents or they must be prevented from entering these sectors of the environment. This removal means in most cases producing a solid precipitate that can be recovered to an extremely high degree for eventual safe final disposal. This same public is just as concerned for health improvement by minimizing contamination by hazardous substances of air, water, and land as well as toxic metals like hexavalent chromium, arsenic, nickel and selenium. Protection from these pollutants is very important as reuse of water in agriculture and industry is gaining wider acceptance as an economical method of reducing consumption. Again, many of these solutions will necessarily involve fluid-particle separations.

Guy Weismantel, President
Weismantel International
Executive Secretary AFS

F / P S J EDITORIALS

PORTABLE HEALTH INSURANCE

At the January 5, 1994 Board meeting in Houston, a topic of great importance to the membership of our Society will be discussed. We need the input of every member to determine the degree of interest you have on this topic. The topic is PORTABLE HEALTH INSURANCE for AFS members. The following excerpt from a letter written by our Executive Secretary to our Chairman on the subject will give you some necessary background information. I urge each of you to let Guy know your feelings on the potential of such insurance so that he can report your feelings to the Board.

"This topic keeps raising its head, and was the basis of extensive discussion at the June 17, 1993 Texas chapter meeting. There, many members agreed that companies are not providing the benefits nor the job security that is needed by professionals. Those working for a university or government may find it hard to believe, but small firms *(like many who employ AFS members)* **do not** provide health insurance. This is true for some of our board members and is exacerbated by firings and layoff's quitting, or other reasons for job loss. *(At least a dozen AFS members had this happen to them.)*

Until recently I could not find an insurance company who wanted to work with a small organization, the size of AFS. This has changed. At our January 5 Board meeting, Tom Kistner of National Associates will explain the potential of a health insurance program that can be made available to members *(as individuals)* at a discount but without cost or liability to AFS."

LET'S HEAR FROM YOU!
Len Ortino, Your Editor

AFS PERSONALITIES

FRANK TILLER'S FIRST BRUSH WITH FILTRATION – 1936

It would be difficult if not impossible to explain why a unit operations examination I took as an undergraduate at the University of Louisville in 1936 was tucked away in a remote file. Remarkably it involved solid processing classification, and filtration - subjects in which I retain an interest. One might conclude that I had kept them because of my professional interests. However, it was several years later that I had kept them because of my professional interests. However, it was several years that filtration attracted my attention, and it was 1948 before Alberto Luis Coimbra, a Brazilian, and I started to investigate constant rate filtration. Coimbra later became the founding director of what is now one of the largest engineering graduate programs in the world. It carries the acronym COPPE and is part of the Federal University of Rio de Janeiro. As far as I know there are no other undergraduate exams of mine in existence. Perhaps retaining an exam on filtration was a "sign" that I would later enter the field.

On reading the answers, I begin to wonder if I have learned anything more about filtration than I learned 57 years ago. I am not sure which of three men was the instructor. Two came from Minnesota and may have known B.F. Ruth when he was a student.

In 1936, the instructor wrote the questions on the blackboard; and they long ago disappeared in heavenly archives. Perhaps you can deduce the questions from the following excerpts taken from the answers.

1. Ore is sent in at A in a stream of water. The compartments are cone shaped and each succeeding *(I spelled it with one c)* compartment is larger than the previous. The water's velocity becomes smaller as it enters each compartment. The largest lumps settle out in the first container: and as the velocity of the water becomes less, smaller particles settle out. In order to prevent stirring up the bottom when water is let out, the outlet B is brought up along the side so that there will be less head to shoot it out.

2. Dorr classifier is for large lumps. A Wilfley table is used for medium *(corrected by instructor to small)* lumps. *(Drawings and further explanation followed.)* A drawing similar to mine will be found on page 95 of the June 1992 issue of F / PSJ. In Dorr's words ". . .for the purpose of removing the quick settling material."

3. Free settling occurs when the particles settle independently of each other.

Hindered settling occurs when the settling of large particles is impeded by smaller ones. *(It is difficult to admit that with all of our studies of sedimentation with the CATSCAN we don't know much more).*

4. Filtration is for the recovery of sludge *(corrected to solid by the instructor)* from water or the recovery of the filtrate from the sludge *(solid again).* The instructor crossed out the following additional statement. It is for the purpose of washing solids.

5. This was a discussion of the function of one, two, and three button plates on a plate-and-frame press.

6. Initial pressure has a decided effect, because if it is too great, the sludge will be packed tightly against the cloth and will impede further filtration. The pressure throughout the cycle affects the rate. The greater the pressure, the greater the rate. The rate being inversely proportional to the thickness. The compressibility of the sludge affects the rate, because the more compressible the sludge the more compact a cake is formed, and the slower the filtration. The subdivision of the sludge also has some bearing as large particles fall off the cake. Gelatinous precipitates are hard to filter. Corrosive sludges attack the apparatus.

7. Oliver continuous and Sweetland leaf filters were the subject of question number 7.

That's all folks!

Frank Tiller

ANTHONY C. SHUCOSKY

Anthony C. Shucosky is Director, Product Development for Memtec America Corporation, in Timonium, Maryland 21093. He is responsible for managing R&D and Laboratory Services of Memtec's Timonium Technology Center, and has been employed by Filterite since 1981. Filterite was purchased by Memtec in 1990.

He began with Filterite in the position of Engineering Applications and Technical Training manager. Established the Technical Training Department of the company including the development of a five day technical training program and authored many technical-application bulletins. Later, as Applications Engineering Manager, he provided the primary source of direct technical support in the selection and use of cartridge filtration.

He has presented papers at many conferences, seminars and societies, and at dozens of companies in the U.S., Europe, and Southeast Asia, on topics of fine filtration and filter cartridge performance. These have included:

Society of Manufacturing Engineers *(SME)*
Internat'l Society of Pharmaceutical Engrs. *(ISPE)*
Federation of Societies for Coatings Technology
Membrane Technology / Planning Conference
Chemical Process Industries Exposition *(Chem Show)*
IBM DI Water Technical Workshop
Haus Der Technik Industrial Filtration Symposium
American Filtration Society
Two pending patents for innovative filter designs.

(continued on page 11)

ANTHONY C. SHUCOSKY *(continued from page 10)*

Papers have been published in professional journals including;

"Absolute efficiency depth filter cartridge advances", Filtration & Separation, 1993.

"High Flux Membrane Cartridge Filter", Filtration & Separation, 1992

"Select the Right Cartridge Filter", Chemical Engineering, 1988.

Professional Affiliations includes:

Member and past Taskgroup Chairman of ASTM D 19.08.03

Parenteral Drug Assoc., PDA,

International Society of Pharmaceutical Engineers, ISPE

Institute of Environmental Sciences, IES

American Water Works Assoc., AWWA,

American Filtration and Separation Society, AFS - since 1982; Currently President of the Mid-Atlantic Chapter of AFS

Community Service includes being a member and Past President of the Optimist Club of Timonium

Education includes a B.S., Biological Sciences and Secondary Education, Pennsylvania State University M.A.S., The Johns Hopkins University

Mr Shucosky says "my current position allows me to travel extensively on a global basis to interact directly with customers, suppliers, and field sales personnel. This personal interaction allows me to see first hand the problems, needs, and opportunities for new and improved filter designs, joint ventures, and partnerships.

To be successful today requires a thorough understanding of the markets we serve on a global basis, and the ability to rapidly develop high quality, environmentally friendly, and competitively priced products that meet the demanding filtration and separation requirements of our customers."

DR. ALI J. CHAMKHA

Dr. Ali J. Chamkha was born in 1964 in Beirut, Lebanon. He came to the United States of America on December 29, 1983, as an engineering student at Tennessee Technological University. There, Dr. Chamkha earned a B.S., an M.S., and a Ph.D. in Mechanical Engineering in a record time of five years. As a graduate assistant, a graduate instructor, and later as an assistant Professor he taught several undergraduate engineering courses. Among these are Fluid Mechanics, Thermodynamics, Mechanical Vibrations, Introductory Dynamics, and Fluid Mechanics Laboratory. In 1991, Dr. Chamkha was awarded the Student Choice Award for Best Mechanical Engineering Professor at Tennessee Tech University. This award event was sponsored by Pi Tau Sigma, the Mechanical Engineering Honor Fraternity. This award strengthened Dr. Chamkha's belief that hard work, commitment and dedication will always be rewarded.

In an effort to learn about the real world, Dr. Chamkha joined Fleetguard, Inc. in May of 1991. As a Staff Research Engineer, he was able to work on fluid flow and filtration research projects. He was focused on mathematical and computer modelling of fluid systems, porous media, and filter performance. His areas of expertise include Multiphase flows, Magnetohydrodynamics, Fluid / Particle Separation, Heat Transfer, and Non-Newtonian Fluid Dynamics. Dr. Chamkha has authored and co-authored over 45 publications in his areas of specialization.

Dr. Chamkha is a member of numerous honor and professional societies. Among these are AFS *(American Filtration and Separation Society)*, ASME *(American Society of Mechanical Engineers)*, AIAA *(American Institute of Aeronautics and Astronautics)*, NSPE *(National Society of Professional Engineers)*, Sigma Xi *(The Scientific Research Society)*, Phi Kappa Phi *(National Honor Society)* and Tau Beta Pi *(Engineering Honor Society)*. As a member of AFS, Dr. Chamkha co-chaired the **"Frank Tiller Fluid / Particle Separation Education Conference"** which was held in Reno, Nevada in January, 1993. In addition, he chaired sessions at AFS national meetings. Dr. Chamkhha is a reviewer and an associate editor for the Fluid / Particle Separation Journal and currently serves on the AFS Education Committee.

Dr. Chamkha believes that in today's highly technical and competitive global market universities can and should play a major role by restructuring its engineering curricula to become more relevant to industry needs. This is especially true in the area of fluid / particle sciences. AFS is taking the lead in trying to bridge the gap between academia and industry by sponsoring conferences on the subject.

Dr. Chamkha is grateful for AFS and its officers for their efforts, for giving him the opportunity to serve and for providing an excellent environment for professional development of young engineers.

CONFERENCES & MEETINGS ANNOUNCEMENTS

FLOTATION PROCESSES IN WATER AND SLUDGE TREATMENT

April 26-28, 1994
Orlando, Florida, USA

Dissolved air flotation (DAF) is gaining increased popularity in a number of applications. In raw water sources it is used to remove algae and slow-settling flocs. It has also been used to remove iron from groundwater. Europe and the USA are beginning to use DAF for clarification of drinking water, often replacing existing pretreatment facilities.

Electroflotation, dissolved air and dispersed air flotation processes are used to treat wastewaters and to thicken sludges. For industrial wastewaters the technology has been used to remove particles from paper making and recycling wastes, removal of precipitated metals from electroplating industry, removal of oily wastes, and treating hazardous waste materials.

Topics covered will include:

- dissolved air and dispersed air flotation; electroflotation; biofiltration; new developments
- colloid sciences: floc/particles-air bubble interaction /attachment
- theory of flotation: process simulation and modelling
- conceptual process design and process selection
- engineering and design of equipment
- flotation thickening of sludges
- integrated process optimization: pretreatment and down stream effects on further treatment
- opportunities for flotation in potable water treatment, in wastewater purification; in water pollution control; in sludge treatment.
- retrofitting DAF in existing installations.

The conference is being organized by the IAWQ/IWSA joint group on Coagulation, Flocculation, Sedimentation, Flotation & Filtration.

For further information: **Prof. K. J. Ives**, IAWQ, 1 Queen Anne's Gate, London SWIH 9BT, England, or to Prof. H. Bernhardt, Wahnbachtalsperrenverband, Siegelsknippen, D-5200 Siegburg, Germany.

1993 INTERNATIONAL CONFERENCE

October 19-21, 1993
Karlsruhe, Germany

International experts from 12 countries will present over 60 papers* at the Conference organized by The Filtration Society in conjunction with the **FILTECH EUROPA 93** exhibition in Karlsruhe, Germany, from 19-21 October 1993.

Speakers will cover all aspects of solid-liquid separation as well as the filtration of air, gas and dust. Themes will include **"Filtration Principles and Practices," "Filtration in the Water Industry"** *(a subject of world-wide importance)*, "Filters and Filter Testing," of both gases and liquids, and two sessions on the latest developments in "Filtration Processes and Machinery."

IN ADDITION:

A short, bi-lingual, pre-Conference course will take place in the KKA, Karlsruhe, on Monday, 18 October, 1993. Entitled **"Process Technology & Calculations in Solid Liquid Separation,"** the four well-known lecturers will be **R. J. Wakeman, A. S. Ward, D. B. Purchas** and **A. Rushton**. The programme for the day is: -

Introduction by the four speakers
Filterability of Suspended Particles:
Theoretical and Practical Aspects .... **R. J. Wakeman**
Sedimentation Principles and Practices .... **A. S. Ward**
Filter Media: Selection and Specification .... **D. B. Purchas**
Dewatering & Washing of Particulates .... **R. J. Wakeman**
Thickening & Clarification Processes .... **A. S. Ward**
Industrial Scale Pressure & VacuumFilters:
Specification & Application .... **A. Rushton**
Centrifugal Filters & Sedimentations:
Pilot to Full-Scale .... **A. Rushton**

FILTECH EUROPA 93

So that exhibitors and delegates from round the world can meet easily and discuss filtration matters of mutual interest the FILTECH EUROPA 93 exhibition takes place in the same building. Already nearly 60 exhibitors from 11 countries (Belgium, Finland, France, Germany, India, Italy, the Netherlands, Spain, Switzerland, the UK and the USA) have booked stands. **FILTECH EUROPA 93** will be open from 09.00 to 17.00 hours daily.

Karlsruhe is easily accessible by road, rail and air (through Frankfurt or Stuttgart airports). Accommodation can be reserved by contacting: Verkehsverein Karlsruhe eV, Bahnhofplatz 6, 76137 Karlsruhe 1, Germany. Tel: (0721) 3553-0 or Fax: (0721) 3553-43.

Full details of **FILTECH EUROPA 93** and the associated Filtration Society Conference are available from Filtech Exhibitions, 48 Springfield Road, Horsham RH12 2PD. England. Tel: +44 (0) 403 2594419 or Fax: +44 (0) 403 265005.

AFS ANNOUNCES 1994 NATIONAL FILTRATION WEEK

January 3, 1994 • Houston, Texas

The American Filtration & Separations Society (AFSS) will kick off 1994 on January 3, 1994 in Houston, Texas with a Rookie Course in Filtration and Separation as part of **NATIONAL FILTRATION WEEK**. This will be followed on January 5 with a 1994 Officers Installation Banquet and TABLE TOP DISCUSSIONS on all areas of filtration and separation.

Later in the week, fifty professors and industrial experts from around the world will meet at the **3rd Annual Frank M. Tiller Educational Conference** at the University of Houston. There they will develop four-course instruction books to teach fluid-particle science at the undergraduate level.

The Workshop *(which we are calling "The Rookie Course In Filtration And Separation Technology")* will be held for 1 ½ days on January 3 and 4, 1994, as part of National Filtration Week being held at the University of Houston Hilton Hotel on the University of Houston campus. The goal of this meeting is to provide you with two things:

1. A tutorial on basic filtration and separation technology.
2. An open forum for technology transfer where you can rub shoulders with leaders in the industry to ask questions and pick their brains.

PLUS

Workshop attendees are invited to all AFS committee meetings and Board meeting on Wednesday, January 5, 1994. AFS would value your input to these meetings. And ... at the banquet on Wednesday night *(which you will attend for free)* we will arrange for you to sit at "Topical Tables" *(each with a discussion leader)* where you can ASK THE EXPERT about your specific problems in a no-holds-barred exchange of information.

Finally, you are welcome to sit in and listen to the heated discussions on Thursday and Friday of 50 of the leading professors who teach filtration science as they hammer out the content of four new textbooks in the field of fluid-particle science and interfacial engineering.

The whole idea of this workshop is for AFS to **HELP YOU WITH YOUR REAL LIFE PROBLEMS.**

CONTAMINATION CONTROL & CLEANROOM

October 19-21, 1993
Birmingham, UK.

Products Exhibition: NEC,
Trident Exhibitions Ltd., West Devon Business Park, Tavistock, Devon PL19 9DP, UK.
+44 (0) 822 614671
+44 (0) 822 614818

AMERICAN FILTRATION & SEPARATION SOCIETY FUTURE MEETING DATES

ALL OFFICERS & DIRECTORS
ALL CHAPTER PRESIDENTS

The future National meeting dates for AFS are:

May 3-6, 1993	Chicago / Rosemont
May 9-12, 1994	Chicago / Rosemont
May 8-11, 1995	Chicago / Rosemont
May 6-9, 1996	Chicago / Rosemont
May 5-8, 1997	Chicago / Rosemont

The future Annual meeting dates for AFS are:

Nov. 18-19, 1993	Carlisle, PA
Nov. 17-18, 1994	Pittsburgh, PA
Nov. 15-17, 1995	Nashville, TN
Nov. 20-22, 1996	To be announced
Nov. 19-21, 1997	To be announced

The future Winter Educational Committee meeting dates are:

Jan. 6-8, 1994	Houston, TX
Jan. 7-8, 1995	Pittsburgh, PA
Jan. 6-7, 1996	San Francisco, CA
Jan. 7-8, 1997	To be announced

11th MEMBRANE TECHNOLOGY / PLANNING CONFERENCE

October 10-13, 1993
Boston, Massachusetts, USA

Mr. Wells Shoemaker, Filterex,
85 Burket Rd., Shippensburg, PA 17257, USA
Tel./Fax: + 1 717 423-6218
Or contact: Mr. Lou Naturman,
Business Communications Corp., 25 Van Norwalk, CT 06855, USA
+ 1 203 853-4266 • + 1 203 853/0348

AMERICAN FILTRATION SOCIETY SEMINAR & EXPO

Annual Meeting

FILTRATION AND SEPARATION PROCESSES AND EQUIPMENT

Chicago, Illinois USA • May 10-13, 1994

Meeting Chairman:
Mr. Sandeep K. Sharma
U. S. Bureau of Mines
P. O. Box L • Tuscaloosa, AL 35486
TEL: (205) 759-9455 • FAX:(205) 759-9444

For Further Information Call or Fax
American Filtration Society
TEL: (713) 441-7789 • FAX:(713) 441-8228

CALL-FOR-PAPERS

Send original abstract to Meeting Chairman at address shown above. Final Program will be published in February 1994. Please send in abstracts immediately!

MONDAY

(Continuing education units given)
A-1 Hydrocyclone/Centrifuge Workshop
A-2 Hydrocyclone/Centrifuge Workshop
A-3 Hydrocyclone/Centrifuge Workshop
A-4 Hydrocyclone/Centrifuge Workshop

(Bag, leaf, filter press, other)
B-1 Pressure Filtration Symposium
B-2 Pressure Filtration Symposium
B-3 Pressure Filtration Symposium
B-4 Pressure Filtration Symposium

(Systems design, media and equipment selection, etc.)
C-1 Membrane Technology
C-2 Membrane Technology
C-3 Membrane Technology
C-4 Membrane Technology

D-1 Flotation
D-2 Flotation
D-3 Clarification and Thickening
D-4 Clarification and Thickening

(Screens and screening, deep bed filtration, etc.)
E-1 Filters for Wastewater Treatment
E-2 Filters for Wastewater Treatment
E-3 Filters for Wastewater Treatment
E-4 Filters for Wastewater Treatment

(Perlite, diatoms, plastic, cellulose, other)
F-1 Filter Aids
F-2 Filter Aids
F-3 Filter Aids
F-4 Filter Aids

TUESDAY

(Bags, cyclones, EPT, cartridge, other)
A-5 Air and Gas Filtration
A-6 Air and Gas Filtration
A-7 Air and Gas Filtration

(Paper, glass, cloth, felt, metal, nonwovens)
B-5 Porous Media
B-6 Porous Media
B-7 Porous Media

(Continued)
C-5 Membrane Technology
C-6 Membrane Technology (continued)
C-7 Membrane Technology (continued)

D-5 Oil-Water-Particulate Separations
D-6 Oil-Water-Particulate Separations
D-7 Oil-Water-Particulate Separations

E-5 Ion Exchange Separations Technology
E-6 Fluid-Particle Separations in Crystallization Systems
E-7 Fluid-Particle Separations in Crystallization Systems

F-5 Fine Particle Symposium
F-6 Fine Particle Symposium
F-7 Fine Particle Symposium

WEDNESDAY

(Continued)
A-8 Air and Gas Filtration
A-9 Air and Gas Filtration

B-8 Instrumentation and Sensors for Filtration Systems
B-9 Tests and Testing

(Continued)
C-8 Membrane Technology
C-9 Membrane Technology

(Continued)
D-8 Oil-Water-Particulate Separations
D-9 Oil-Water-Particulate Separations

E-8 Filtration Theory and Practice
E-9 Filtration Theory and Practice

(Continued)
F-8 Fine Particle Symposium
F-9 Fine Particle Symposium

WATER ENVIRONMENT FEDERATION CONFERENCE

June 19-22, 1994 • Washington, DC

The IAWQ Sludge Management Specialist Group is to be a cooperating organization for the upcoming International specialty conference entitled "The Management of Water and Wastewater Solids for the 21st Century: A Global Perspective." The conference is being organized by the Water Environment Federation (formerly the Water Pollution Control Federation), and will be held at the Washington Hilton Hotel, Washington, DC, June 19-22, 1994.

The conference is aimed at assisting in the development of a global community alliance for transferring technology. It will provide an international perspective on residuals management experiences concerning international strategies; management technologies; regulations; minimization technologies; processing technologies; stabilization; product strategies, distribution, and marketing; water plant residuals; septage management; and chemical analytical techniques.

Management, technical, and operational information is all encompassed within the conference theme. Such subject areas will be included as developing of public acceptance; regulating and permitting activities; land application programs; distribution and marketing; thermal technologies; landfills, monofills, and co-disposal; non-municipal residuals management; case histories and research.

Papers will be presented on the following topics:

- technical support for the certainties and uncertainties in volved in risk assessment leading to risk management decisions;
- case histories relating to "make or break" factors, such as odors and public acceptance; and
- comparison of approaches in the U. S. and elsewhere.

For information write: Conference Chair Jane Forste, c/o BioGro Systems, Inc., 180 Admiral Cochrane Drive, Suite 305, Annapolis, Maryland 21401, USA

CONFERENCES & MEETINGS REPORTS

REPORT ON 1993 AFS CHICAGO MEETING

The American Filtration and Separation Society held its 6th annual meeting at the Hyatt Regency Hotel by the Rosemont Exposition Center in Chicago, May 3-5, 1993. As with last year, the meeting was run concurrently with the Powder and Bulk Solids Show in the Rosemont Exposition Center, May 4-6. The show was well attended with 8,000 to 10,000 people, and featured an "Environmental Show-Case" where AFS corporate members exhibited their products with pride.

We had an excellent meeting with nice compliment and feedback from the attendees. The Society as a whole should be proud of this success which came out of a group effort from all those who were involved. Part of this success can be measured by a number of new records being set by the meeting, which are listed below:

(1) number of technical papers (176 scheduled, 171 physi cally presented at the meeting with a drop-out rate of 3%).
(2) number of technical sessions (32 sessions).
(3) number of session chairmen (56 experts).
(4) number of technical papers from overseas (27 out of 176 papers, 15%).
(5) proceeding book available at the meeting for the first time. (The book is over 700 pages in length including 140 proceeding papers and 34 abstracts.)
(6) number of attendees (330 people).
(7) number of new attendees who have not participated in AFS meeting in the past (about 90 people, 27% of total attendees).

These statistics are rather impressive! While category (1)-(5) are related to the program, the last two categories are consequences of the program. Also, the financial outcome is extremely favorable.

About a year and a half ago, we started laying out the program with several objectives in mind. The primary objective is "quality" and a secondary objective is "visibility". Both of these virtues will lead to "healthy growth" of our Society. We want to strengthen the quality of the technical papers in our meeting and at the same time offer a variety of focused topics to fulfill the diverse interest of our members. All the abstracts submitted to us have been prescreened by our session chairmen to ensure the technical value of the presentation. Given the quality presentations, they deserve proper exposure, not only to our peers in the States, but also to an international audience. To this end, we invited a number of authorities from the States as well as from overseas to chair different topics on F&S. Some of these chairmen are new to our society while others have been with us for some time serving as corner stones for the Society.

They have outreached and brought in speakers, and directly or indirectly, audiences from Australia, Austria, Belgium, Brazil, Denmark, England, France, Germany, Japan, Korea, The Netherlands, Russia, Sweden, and Switzerland. We also have a strong participation from our Canadian experts.

We are fully aware of the practical issues on financial limitation in recruiting foreign experts, especially the academics and independents. We have worked out successfully this year via corporate/individual sponsorship in bringing three notable experts from overseas to chair and give papers in some of the sessions. In return, two of these experts gave lectures/consultation at the sponsor's corporate location. It worked out perfectly with mutual benefits for both parties. In upcoming meetings, we want to extend the sponsorship program to experts not only from overseas but also from this country. This requires more active participation from our corporate members. Indeed, this is one of the many perks offered by the Society for our corporate members.

Recognizing the importance of membrane separation technology, we have devoted a strong plug to this technology. A number of membrane experts took the responsibility of chairing a full sequence of membrane separation sessions. In conjunction with this, we have also invited the North American Filtration Society to cosponsor our meeting. We are very pleased with the outcome of the joint effort from members of the two societies. There were nearly 50 technical papers on membrane separation presented in nine technical sessions from general applications, design, membrane materials and morphology, commercialization, gas separation, inorganic membrane, ... to fundamentals related to fouling and concentration polarization of membrane surface.

Biomedical and biotechnology are extremely important areas. The filtration and separation technologies which go along with this branch of science and engineering need to be addressed. We have experts in this field chairing a nine-paper special session in this area. The interest from the audience was just overwhelming.

Another point to measure the interest / response from our audience was to sit in the last paper at the last session of the 3-day meeting to find that about 30 of the audience stayed behind till 5:30 pm to gather information from experts discussing the environmental issues related to choice of F&S equipment. This was unusual but the fact speaks for itself.

We recognized a large number of topics were presented at the meeting, yet in a relatively short time period. Also, four papers were presented concurrently during the meeting. The audience appreciated having the technical papers on hand so that they were not burdened in taking notes during presentation, or missing some presentations due to time conflict. For the first time, this proceeding book which typically takes 10 months of preparation subsequent to the meeting, was made available at the meeting. It is quite a remarkable achievement from the authors with the help of the session chair, who took great effort in meeting deadline for their proceeding papers.

At the Monday dinner, **Mr. Derek Purchas** of Filtration Specialists shared with us "A Filtration Odyssey." At the Tuesday luncheon **Mr. Mark Sniderman** of Federal Reserve Bank of Cleveland spoke on "Economic Outlook." At the Wednesday luncheon, the prestigious Tiller Award was presented for the first time by the Society. The recipient, **Professor Shiao-Huang Chiang** of University of Pittsburgh, is recognized for his role and contribution in the area of F&S. Congratulations to Dr. Chiang for this well-deserving honor. This award is in honor of **Dr. Frank Tiller** for his lifetime contribution in the same field. In addition, we have two entries in the student poster session. After a careful critique by the six qualified judges, they came to a tie. Each student will receive $500. Thanks go to 3M, Epoc, and the Houston AFS Chapter for their additional donations to the students awards.

We are saddened by the fact that one of our speakers, **Bob Steward,** passed away before he could deliver his four papers. The Society's heartfelt sympathy goes out to his family and his colleagues who are continuing their support of AFS by delivering two of his four papers as a tribute to his devotion to all aspects of fluid-particle separation.

A number of people have expressed interest in giving papers or chairing sessions for the next year's AFS annual meetings. They should contact the meeting chairman, **Dr. Sandeep Sharma**, of U. S. Bureau of Mines at (205) 759-9455 (tel.) and (205) 759-9440 (fax).

On behalf of the American Filtration and Separation Society, I thank all the audience, speakers, the 56 session chairmen, and all the supporting staff for their participation in turning this meeting to a grand success. This success is the reward on a team effort in striving towards a common goal - a high degree of excellence.

Wallace W. F. Leung
Meeting Chairman

CHAPTER NEWS

MID -ATLANTIC CHAPTER

For the benefit of our new members reading about us for the first time, the following members of the Mid-Atlantic Chapter are instrumental in the workings of our national society:

Lew Osterhout, Chairman of AFS
Larry Avery, Director, By-Laws Chairman, Long Range Planning Co-Chairman
Ernie Mayer, Director, Users Committee Chairman, New Product Award Chairman
Tim Butts, Director, and Chapter Affairs Chairman, and Users Committee Co-Chairman
Ed Gregor, Corporate Sponsor Chairman
Sonja Haggert, Associate Editor ***Fluid / Particle Separation Journal***
Wells Shoemaker, I'm not sure but their must be something, Chairman

Does this list look familiar? Add **Frank Mangravite, Bill Sutton, Rob Preston,** and **Ernie Riegler** and we have a complete list of the Officers and Directors of our Mid-Atlantic Chapter! When we have a chapter meeting, we may be close to having a quorum to hold a national meeting as well!

Isn't it time for some of our other talented members to stepup and be counted?

APRIL MEETING

Over 35 members attended our Spring Meeting at the Hoiday Inn in Wayne, a New Jersey. A full agenda of talented speakers provided interesting, professional, and relevant information on a wide variety of filtration and separation topics.

• **Lew Osterhoudt** explained the basics of Ion-exchange Technology and some interesting product development that his company, Purolite, is doing to make drinking water safe for developing countries.

• **Larry Avery** presented an overview on the state of filtration and separation practices in a number of industries and applications,. Larry used many examples gleaned from his experience as head of Avery Filter Company, Inc.

• **Frank Mangravite** gave a timely and knowledgeable presentation on concerns and methods of dealing with harmful chemicals in our drinking and waste water. Frank's company, CMF Environmental, has developed an expertise in designing systems to solve water treatment problems.

• **Ed Gregor** also gave us a basic understanding of screen filtration principles and the the many uses of the broad product offerings of Tetko.

The dinner was great and included a wine punch starter and a delicious desert. Hat's off to **Steve Wolfe** for coordinating things with the Inn. Thanks to everyone for their kind comments. I add my thanks and praise to our speakers.

OUR NEXT MEETING

The meeting format was a successful one, and one that we will repeat in the future. Our next meeting however returns to another favorite format of our members, the company tour . . . and this is a real hot one. A tour of the Limerick Power Plant, will highlight the many filtration and separation applications found in a working nuclear power station., it is located East of Pottstown, PA. Dinner will follow at a nearby restaurant, the Lakeside.

GOLDEN STATES CHAPTER
CALL FOR PAPERS

"Industrial Wastewater Filtration & Separation: Meeting the Environmental Challenge"

The annual chapter meeting of the Golden State Chapter will include a one-day seminar considering all aspects of filtration and separation as applied to minimizing industrial waste. Oil and grease, toxic organics, heavy metals and their removal and concentraiton from industrial liquid wastes are key buzz words which will attract manufacturers, industrial users, researchers and, regulatory officials and their consultants.

Last year's AFS meeting at the Burbank Hilton on oil / water separation was an outstanding success with representatives from food, oil and gas, industrial laundries, transportation, mining and government in attendance.

This year we have set **December 3** for our event and it will be held at the **Huntington Beach Waterfront Hilton**, a terrific location for our one-day seminar with a lead into a great seaside weekend.

Golden State Chapter members and potential members or guests are invited to submit an abstract of up to 1 page for consideration.

Papers should be technical with actual results as apply to the conference theme. Presentations should be limited to a total of 30 minutes including discussion.

There will also be table top displays presented by manufacturers and their representatives.

Send Abstracts to:**Gary H. Bartman,** *Epoc Water, Inc.* 3065 N. Sunnyside, Fresno, CA 93727

PITTSBURGH / OHIO VALLEY CHAPTER

A. J. Brajdic, President of the Pittsburgh / Ohio Valley Chapter announced that the Chapter toured the Allegheny Brewery in Pittsburgh on June 22, 1993. Allegheny Brewery is the first micro-brewing company in Pennsylvania producing Penn Pilsner and nine other distinctive German beers. Included in the tour directed by Allegheny Brewery's Tom Pastorius were members' spouses and several college students. The beer making process was described with special emphasis on the filtration steps. The tour was followed by a German style buffet dinner served in the outdoor Biergarten on a beautiful Pittsburgh evening.

ECONOMIC NEWS

THE ECONOMY IN PERSPECTIVE

Judging from reports on economic activity in the first several months of the year, we will be hearing more about the role of government in managing economic performance. Though the U. S. economy continues to operate at a relatively high level of resource utilization, output is likely to fall short of capacity. Real final sales actually fell in the first quarter, and any advances are expected to remain fairly moderate throughout the year. Employment growth has been even slower than gains in output. This is a legitimate concern, not the least to an administration that campaigned on a jobs platform.

It will not be surprising, then, to hear more discussion about how government policies can lift the economy to its potential. And, whether we realize it or not, this encompasses more than just the economy and government today. At least part of the debate must recognize the strengths and weaknesses of market economies, and what is reasonable to expect despite our aspirations for more.

Market systems depend on the uncoordinated, individual decisions of many people, and market economies flourish in climates where ruling cliques and strongmen are driven out. Free people embrace the market concept because its operation is so consistent with personal freedom and with a reduced role for the state. Moveover, time has proven that individual freedoms and economic prosperity go hand in hand. But the progress toward more democratic rule and the evolution of market economies often resemble the pace of a glacier. The world has been democratizing for nearly a millenium, retreating at times, but still moving slowly down an inevitable slope.

The dramatic political and economic upheaval in eastern Europe during the last three years is a vivid reminder that even though progress may move glacially, the dynamics of political and economic change can be more revolutionary than evolutionary. These nations' move toward free commerce is fraught with social unrest, the shifting of political power, and the emergence of new privileged classes. Even our own experience with capitalism for more than 200 years underscores that market-based economies are not social nirvanas; income distribution can be skewed, people can become homeless, discrimination can be practiced, and violence can escalate.

Moreover, a market economy bears no resemblance to the plodding, almost imperceptible movement observed high above a glacier. Instead, it is more analogous to the grinding and churning underneath, where dirt and rock are constantly being turned over by ice, leaving behind valleys and peaks. Companies can close or shrink, putting people out of work and throwing investors for a loss; inflation can accelerate, arbitrarily benefiting some at the expense of others; and whole industries can be eclipsed by others, often crippling the vitalilty of cities and regions.

Despite the scars, the inherent turbulence of competition, and the inequitable outcomes of human endeavors, history constantly reminds us that alternatives to market economies are far worse. Even so, nations from time to time attempt to identify areas where markets fail and to create government programs or policies to remedy the deficiencies. Our nation currently appears poised for another round of intervention in the economy to compensate various groups who believe that market forces have turned against them. During the 1980s, we achieved one of the longest economic expansions on record. But many Americans felt unfulfilled, left out, or afraid for their futures because the country's gains came amid rapid economic transformation and consolidation. Many are now looking to government for security from that relentless, glacial change.

We, as a nation, have gone through these cycles of government intervention before. But what have we learned in the past several decades from these episodes? Overall, government policies have probably done little to smooth the peaks and valleys. Income in the United States follows roughly the same distribution today as it did 40 years ago. Industrialized, market economies are still vulnerable to the vicissitudes of business cycles, which in turn are facilitated by the free flow of capital into ventures that become overextended in a classic "boom-bust" pattern. Governments occasionally resort to inflation either as a source of revenue or in the vain pursuit of job creation, or both. Government policies, to the extent that they matter in this process, tend to promote the interests of some domestic players over others, without advancing the national standard of living for all.

Economics is called the dismal science, but for an outdated (and incorrect) reason. The science is dismal only to those who cannot abide by its quiet onslaught, its grinding out of feasible solutions to the human problem. Over the centuries, people have been irritated by the pace of progress and unhappy about its uneven distribution. But even though market systems may not be the path to nirvana, neither are they the road to serfdom.

The above article was re-printed from the May 1993 Report of the Federal Reserve Bank of Cleveland.

STOP, LOOK & READ

THE DEBATE ON A NATIONAL SCIENCE AND TECHNOLOGY POLICY

Philip M. Stone
Director, Science and Technology Affairs Staff

"The House Committee Task Force on the Health of Research suggested that the criteria for setting science priorities are not appropriate in a new era of technology development. But the criteria it criticizes are exactly right for science."

Development of a new science and technology policy is currently a major topic of discussion in Washington. Position papers from the President's Office of Science and Technology Policy, by Congress, and numerous technical and professional organizations form a framework for the discussion. It can be difficult to wade through the wide-ranging views of what the problem is and what the solutions are, but some facts seem clear.

It is clear that the U. S. has established a first-class basic research and science capability that is the envy of the world. Our universities attract the best students worldwide, and their involvement in research is a model for other nations. We have more scientists snd engineers engaged in research and development per 10,000 people in the work force than all other countries. Our research output as measured by publications and patents remains at all-time high levels.

The current policy, which is the foundation for this strong scientific capability, was crafted in the days following World War II. It was articulated in a 1945 report, *Science - The Endless Frontier*, by Vannevar Bush, and it led to federal funding of research at universities and institutions outside the government and to the establishment of the National Science Foundation in 1950. The report spelled out that scientific excellence is the best criterion for determining which projects should receive funding, and that research should be carried out, as much as possible, without political constraints or regard for applications.

It is also clear, however, that the U. S. has fallen behind other countries in using our science for our nation's economic benefit; that is, in turning scientific knowledge and capability into commercial technologies, products and services. Japan and Germany in particular have done better in focusing technology development for the economic benefit of their countries.

Our federal support for technology has been driven by defense and space needs, and we have relied on industry to turn the defense and space technologies into more commercial applications. However, many U. S. corporations faced with increasing domestic and international competition have been reluctant to commit the large funds often required to develop technology. The result is that our ratio of exports to imports in high-technology areas is dropping, our share of patents worldwide is down, our expenditures for civilian R&D as a percentage of the Gross National Product are lower than those of Japan and Germany and we have lost world leadership in development of key technologies.

Representative George Brown, Chairman of the House Committee on Science, Space, and Technology, has questioned many features of our science policy. In a recent report, his committee's Task Force on the Health of Research suggested that the criteria for setting science priorities are not appropriate in a new era of technology development. But the criteria it criticizes are exactly right for science: basic research projects should be funded based on scientific excellence, research projects by individuals and small groups do produce new ideas; universities are excellent premises for basic research, and is needed for technology development. These aspects of our science policy must be maintained if we expect to remain a world leader in scientific achievement.

Our nation's poor performance in technology in recent years is not a failing of our science policy. Rather, the criteria for selection of technology programs must differ from those used to select programs of fundamental science. In addition to high quality, R&D to spur technology should be judged by relevance, urgency, our needs as established by national goals and the degree to which the program supports development of products and services. Goals for energy development, environmental protection, waste cleanup, transportation, health care and defense, among others, should all be considered in funding technology programs. Managers who administer technology programs must be aware of these greater considerations. The programs themselves must increasingly be part of government-industrial partnerships that help ensure the project will be used in the private sector.

As we develop a national policy for technology, we must be careful not to lose basic science - the scientists, educators, laboratories, and facilities that make technology possible. There are indications of this danger. Industry has reduced spending on basic research in the past decade. Congress has reduced the research portion of the NSF budget for FY 1993.

Do we need to change an effective science policy that has evolved and been refined over the 48 years since World War II? Or instead, do we need to better define a separate, emerging technology policy and establish criteria to select technology programs that meet our national needs? Cannot a policy for science and another for technology fit together? Properly done, a science policy combined with a technology policy will give the high standard of living and productivity that U. S. citizens have every right to expect.

NOTE: This article was reprinted from the ER News, Published by the Pacific Northwest Laboratory, Richland, WA.

AMERICAN FILTRATION AND SEPARATIONS SOCIETY GIVES 1992 NEW PRODUCT AWARD TO PALL CORPORATION

The **AMERICAN FILTRATION AND SEPARATION SOCIETY (AFS)** has announced that the Pall Corporation is the recipient of the 1992 New Product Award for technical innovation for the company's **UNI LOC™** filter cartridges. This prestigious award, selected by user members of AFS, is considered to be the highest award given annually for state-of-the-art developments in the field of fluid-particle separation.

According to **Guy Weismantel**, President of Weismantel International and Executive Secretary for AFS, "the Society is proud to announce Pall Corporation as the 1992 winner. Pall has been an outstanding Corporate sponsor of AFS since the Society's inception, in all programs from education to technology transfer. It is quite fitting that the unique new design of Pall's pleated filter elements *(UNI LOC™)* receives the recognition it deserves."

Weismantel, a chemical engineer himself, explained the **UNI LOC™** cartridge in the following manner:

"These cartridges are manufactured in 10 inch lengths, but are suitable for multilength installations by snapping the units together by means of proprietary male / female end caps. This eliminates the need for couplers, spacer rings or similar joining techniques, thereby reducing flow restriction and lowering initial clean pressure drop or increasing flow capacity for a specified pressure. Sealing between modules is accomplished by elastomeric gaskets *(ethylene propylene seals are standard)* installed in each end cap. These seal surfaces are compressed by tightening the seal nut on the tie rod or by the compression of a spring for that purpose."

FILTRATION & SEPARATION MAGAZINE SPECIAL AFS RATES

Steve Barrett, Editor of ***Filtration & Separation*** has advised the AFS that AFS members are eligible for special subscription rates. The following exerpt from his letter to Guy Weismantel on the subject is self explanatory. "AFS Society members get a 20% discount on the full price of the subscription, which this year means about $83 *(subscription is 69 pounds = $104)*, but people do need to tell us that they are members to qualify. Note that our management has decided to increase the price to 75 pounds for 1994, which would mean that the AFS discount price would rise to $90.

If any AFS members would like to take advantange of this offer, they should contact **Steve Barrett** directly at Elsevier Advanced Technology, Mayfield House, 256 Banbury Road,

SHIAO-HUNG CHIANG NAMED WINNER OF AFS 1993 TILLER AWARD

Shiao-Hung Chiang, Professsor of Chemical Engineering at the University of Pittsburgh and Director of the University's Pittsburgh Energy Center was named the winner of the **AMERICAN FILTRATION & SEPARATION SOCIETY'S** (AFS) **Frank M. Tiller Award** for technological achievement. The award is presented annually to an individual who has made an outstanding contribution in the field of fluid-particle science and interfacial engineering. Dr. Chiang was honored at the AFS Awards luncheon held at the AFS National Meeting in Chicago on May 7, 1993. The award carries the prestige of being named the top educator and scientist of the year in the filtration and separation technology field.

Chiang is being recognized for his outstanding contributions and leadership in more than 20 separate programs dealing with separation sciences, especially his contributions to education and to the advances he has promulgated in the area of coal preparation and environmental technology tied to fuels preparation and waste remediation.

According to **Guy E. Weismantel**, President of Weismantel International and Executive Secretary of AFS: "The Award Committee of AFS and its member sponsors are proud to give this award to Dr. Chiang whose tireless efforts on behalf of the Society have led to curriculum advances in fluid/particle processing and separation in many parts of the United States. We give our congratulations to him and to the University of Pittsburgh for demonstrating a high standard of professional and technical excellence."

Chiang, whose life and leadership ... even as a small boy in China ... is one of accepting challenge and meeting goals, is a recognized leader in the area of separations technology. This AFS award can be added to his trophies that acknowledge his achievements.

FGDPRISM FOR OPTIMUM EMISSIONS CONTROL

Since its release, FGDPRISM – the Flue Gas Desulfurization Process Intergration and Simulation Model – has been widely praised by utilities as a valuable tool for helping them comply with the 1990 Clean Air Act Amendments. With this model, users can optimize the design and operation of flue gas desulfurization systems. Engineers can use it either to design and evaluate new FGD systems or to troubleshoot and investigate process or equipment modifications to existing systems. The model features the user-friendly EPRIGEMS interface. Attendance at an FGDPRISM training workshop is required before the program can be obtained. *For more information, contact Robert Moser, (415) 855-2277.*

STOP, LOOK & READ

The following article was published in the July 1993 issue of Chicago Fed Letter of the Federal Reserve Bank of Chicago

URBAN OZONE REGULATIONS

The 1990 Amendments to the federal Clean Air Act required that metropolitan areas exceeding allowed levels of ozone must take corrective action to come into compliance.

The Chicago area, for example, must reduce its ozone-causing emissions by 15% before 1996 and make further reductions of 3% per year through the year 2007.

The 1990 Amendments specify a variety of actions that all nonattainment areas must take towards compliance. Additionally, by November 1994, states with nonattainment areas must design their own plans for achieving further ozone reductions, if necessary to come into compliance. In developing these plans, states have considerable latitude to decide which sources and activities to control.

By the year 2010, all urban areas in the country must meet air quality standards as set by the U.S. Environmental Protection Agency. Because compliance can be costly, the task of meeting these standards may significantly affect the economic well-being of an urban area or region.

The Ozone Problem

Urban ozone, an important ingredient in smog, is created by a photochemical reaction in the lower atmosphere involving nitrogen oxide (NO_x) and volatile organic compounds (VOC_s). Most NO_x is the product of burning fossil fuels (coal, oil, or gas) – a process that occurs regularly in electric utilities, industrial furnaces, and automobiles. VOC_s are produced by auto emissions, vapors released during auto refueling, paints, thinners, and cleaning solvents. When heat and sunlight are present, the combination of NO_x and VOC_s produces ozone. Ozone is the most ubiquitous air pollutant, plaguing scores of urban areas throughout the world. Among other effects, high levels of ozone are known to impair breathing and to reduce the yields of several major cash crops.

The federal government first addressed the problem of urban air pollution in 1970 with passage of the Clean Air Act (CAA). Since that time, the nation has made great strides in air improvement. Of the six common air pollutants regulated by the CAA *(sulfur diozide, nitrogen oxides, carbon monoxide, particulates, lead, and ozone)*, only ozone remains a problem shared by most urban areas.

Congress referred to the health effects of air pollution in explaining the rationale behind the CAA. That law mandates a standard of air quality that would provide a margin of safety for the most health-sensitive individuals. Some argue that such a standard is too stringent. Expenditures for environmental cleanup may be wastful if the costs of abatement are greater than the benefits produced. Once some level of air purity has been attained, it may be more economical to pursue alternatives to additional pollution abatement, such as public health programs.

Regardless of the continuing debate over air quality standards metropolitan areas must now address three basic questions regarding ozone control. The first is whether to comply with the law's stringent deadlines and standards. Second, once areas decide to comply, they must make tough and highly risky choices as to which type of emission to control–NO_x or VOC_s– and which firms and activities to target in order to achieve the required emission reductions. Finally, policymakers must decide *how* to control emissions, whether by applying tried-and-true technology requirements to all industrial processes, or by trying innovative programs involving market-based methods such as emission allowance trading.

Which Sources toTarget

The 1990 Amendments specify a variety of technologies and processes that emission sources must adopt in order to reduce emissions of NO_x and VOC_s. in "severe" nonattainment areas like metropolitan Chicago, sources emitting as few as 25 tons of NO_x and VOC_s per year will now be regulated; previously, only sources of 100 tons or more were targeted. Businesses such as commercial dry cleaners, large housepainting companies, and some auto body shops will thus be included and will face the complex maze of environmental regulations for the first time.

Federally required technology controls, along with mandated measures on mobile sources such as automotive fuels and tailpipe standards, will presumably reduce urban ozone over time. As metropolitan areas continue to grow, these remedies alone will probably not reduce emissions enough to achieve target air quality standards in many urban areas. That is why the 1990 Amendments require states with nonattainment areas to develop their own plans for achieving additional reductions. The rationale is that a customized plan can best address local conditions such as industry composition and expected growth rates.

To produce these plans, states must make their own decision about which sources and activities to control. One recent study indicates that the choices can carry widely differing price tags. For instance, controlling VOC_s would cost $3,600 per ton emitted at small dry cleaners, but only $230 per ton at large dry cleaners. By comparison, the technology that has been mandated for vapor recovery at auto gas pumps will cost an estimated $1,000 per ton of VOC_s. In targeting sources, states will naturally want to choose those where abatement costs are lowest, or marketplace pressures are least intense.

A related set of issues stems from the complexity of atmospheric transport and chemistry. An urban area's ozone problem is affected by the geographic distribution of facilities. High NO_x emission in a remote location, for example, may contribute little to the area's problem. Sources upwind from a city may cause more urban ozone than downwind sources. To plan effectively for air quality, we need to learn more about the role of these factors, for example, by using atmospheric models of the urban air shed. The states surrounding Lake Michigan have formed a consortium to produce such a model, and the results are to be made available in the near future.

How to Comply–Flexibility Preferred?

High environmental standards form the underpinning for the CAA and the 1990 Amendments. Given the magnitude of the mandated task, state and regional policymakers will need all possible flexibility. One of the criticisms of national pollution control policy in the past was that it imposed the same regulatory conditions on areas with varying industrial conditions and hence different costs of complying. The 1990 Amendments responded to this criticism by allowing some flexibility. Presumably, if allowed to choose among a variety of methods for achieving a given environmental goal, areas will pursue the least burdensome and most promising ones.

Despite the flexibility of the 1990 Amendments, some wonder whether they grant enough local discretion. In Chicago and other areas, for instance, ozone excesses typically occur in spells of one to three days during the late spring or summer. Yet the law still does not allow temporal controls that would prohibit emission activities only during ozone-sensitive days. Such schemes have not yet been fully studied, but they seem very likely to yield considerable savings in cost.

Mobile Source Options

Air quality improvements of the past have largely been achieved through technological solutions imposed nationally. This is especially true for transportation emission sources. For example, as a result of federally imposed mileage requirements on auto fleets and technology such as catalytic converters to reduce emissions per gallon, autos have become much more fuel-efficient *(as much as 80% since 1970).* Similarly, most vehicles now on the highway run on lead-free gasoline. Other flexible programs allow choosing between mobile sources such as automobiles and stationary sources such as factories in order to reduce emissions. Unocal Co. of California reportedly spent $5 million in Los Angeles to purchase 8,376 old autos *("clunkers"),* scrap them, and thereby eliminate 13 million pounds of VOC and NO_x emissions annually. It would have cost the company an estimated $150 million to realize the same reduction at its refinery. Illionois has conducted a pilot study to explore a similar program.

Conclusion

The question of whether to comply with ozone regulations has been largely foreclosed; states and companies now face stiff penalties and foregone rewards if they do not comply. At the same time, states and cities now have greater latitude to chart their own course for achieving mandated clean air standards. This latitude does not imply a lessening of responsibility.

Rather, it requires local policy makers to gather much information, develop many ideas, and build the consensus they will need in order to implement cost-effective enviromental controls.

William A. Testa
Donald A. Hanson

AMERICAN FILTRATION AND SEPARATION SOCIETY ANNOUNCES BUYERS GUIDE

Mr. Guy Weismantel, Executive Secretary, American Filtration and Separation Society announced plans today for the first comprehensive filtration and separation industry buyer's guide. The guide is in response to numerous inquiries to the Society for an in-depth industry source reference manual.

The guide will incorporate information targeted to the interests of specifiers, purchasers and users of filtration and separation products and equipment. Rather than simply including source name and location information, it will contain 8-10 page catalogs from the Society's corporate sponsors. This includes products such as filter media, elements, equipment, systems and services. Each guide will have a detailed introduction including a simplified training course and glossary to educate the novice and serve as a reference source for the expert. According to **Edward C. Gregor**, Corporate Sponsor Chairman, *"Individuals, libraries, engineering firms, academia and user companies will finally have a substantive and easy to understand manual, from the industries leading and most respected suppliers. The guide will offer a wide cross section of filtration choices for those individuals who have the responsibility to make selections in preparation for purchases."*

The guide will be available at a nominal charge of 25-30 dollars to cover the cost of material assembly and shipping. The guide will be available early in 1994.

Reservations for the guide can be made by FAX to:

Guy Weismantel, Executive Secretary
AFS FAX 713 / 441-8228

Information for Corporate Sponsorship can be obtained using the same FAX number.

The American Filtration and Separation Society is the world's largest organization devoted exclusively to the science and education of filtration and separation technology.

AFS EXECUTIVE SECRETARY ADDESSES NAFA

Guy E. Weismantel, President of Weismantel International, and Executive Secretary, American Filtration & Seperations Society spoke at the annnual meeting of the National Air Filtration Association on October 4, 1993 at the Hilton Hotel in San Antonio, Texas. Title of this talk was *"Our Future Depends Upon Educating Ourselves and Others"* Weismantel addressed the topics of:

- Filtration --- The Forgotten Technology
- The White Paper of Twenty years ago which was a call to action to solve thenation's filtration problems.
- Today's filtration problems *(process, environmental, HVAC, other)*

The need for courses in basic filtration and in detailed engineering at the university level, outline what AFS is doing in this area, and finally,

How AFS and NAFA can work together to solve some of the U.S. filter problems through our synergy,serendipity, and symbiosis.

LONG RANGE PLANNING COMMITTEE PRODUCES FINAL VISION STATEMENT

During February's meeting in Phoenix, Ariz., the Water Environment Federation's (WEF) Long Range Planning Committee produced the final version of the Vision statement that will be submitted to the Board of Control for approval during the Federation's 66th Annual Conference and Exposition, to be held October 3-7, 1993, in Anaheim, Calif.

Pending approval by the Board of Control in Anaheim, the Water Environment Federation Vision statement will be:

The Water Environment Federation will be the pre-eminent organization dedicated to the preservation and enhancement of the global water environment.

As we pursue this Vision, we are committed to the following principles:

- Providing technical information to a worldwide audience;
- Expanding quality services to our members; and
- Building alliances with other organizations.

The committee developed the final Vision statement after incorporating input from the six Regional Meetings held during 1992. "The committee considered the comments received during last year's regional meetings along with input and comments from others, including an international member visioning session at the Annual Conference & Exposition in New Orleans, and then melded them with those expressed to Federation officers during their MA visits," said **Jim Abbott**, committee chair and 1988-89 WEF president. "This yielded a consensus view of what WEF should strive to be at the end of the coming decade or early in the next decade - the WEF Vision."

The Phoenix meeting marked the conclusion of two years of intensive work by the Long Range Planning Committee that aimed to develop a Vision based on a number of factors, including where the Federation is, where it came from, what it does, and where it hopes to go.

The proposed Vision statement has been sent to members of the Board of Control in a special edition of the Board Bulletin, and will be previewed during the 1993 Regional Meetings. During these meetings, the MA Officers and Directors will be shown the results of their input and asked to discuss the Vision's implications and how it might be implemented.

AIR FILTER TEST STANDARD 52.1-1992 APPROVED BY ASHRAE BOARD

Air filter test standard 52.1-1992 superseding Standard 52-76 was approved by the ASHRAE Board of Directors on January 25, 1992. Some of the differences between the old and new versions of the standard include test duct configurations and final filter options. Certain test equipment checks are now mandated and some equipment types have been updated. Also included in the new standard is an appendix to clarify the intent of the Standard for air filter specifiers. However, the major difference is that the new standard outlines an alternate procedure for dust-spot efficiency testing, which is a key part of any filter evaluation procedure.

The Standard 52-76 dust-spot efficiency test measures the ability of an air filter to remove wall-blackening fine dust from an air stream. Samples of dust upstream and downstream of the filter are captured on small glassfiber paper targets, and the relative rate of blackening of these targets is measured. Blackening is not proportional to the amount of dust on the targets, and to correct for this non-linearity, the upstream sampler flow is cycled on and off, with the "on" fraction of the sampling time adjusted to maintain equal blackening rates on both targets. Filter efficiency is then calculated from the ratio of total air quantities sampled. This procedure (called the "intermittent flow" method) requires tests on high-efficiency filters to be very long, often two hours or more. Since three to five such tests must be run to characterize each filter, development and qualification is slow and expensive. The new Standard 52.1-1992 allows this method to be used if desired.

A new alternate procedure, part of Standard 52.1-1992 and called ***"...the new standard outlines an alternate procedure for dust spot efficiency testing...the "continuous flow" method.."*** the "continuous flow" method, specified equal, continuous sampler air flows upstream and downstream. Non-linearity of blackening is corrected by the use of a standard calibration curve. This procedure can reduce test time to 10 to 15 minutes regardless of filter efficiency, and avoids the need to pre-estimate filter efficiency and match blackening rates. The method has been used for filter development by some laboratories for years, and it is now permitted for filter qualification under the ASHRAE Standard.

Comparison testing has demonstrated that the two methods produce equally accurate results on filters of the entire range of efficiencies for which the dust-spot method of the standard is applicable.

Copies are available from the ASHRAE publications department; to order them call (404) 636-8400.

The following article was taken from the announcement of the World Congress on Emulsions for October 19-22, 1993 to be held in Paris, France.

A GOLDEN SUBJECT

The simple necessity of two-way exchanges seems to go back a long way. **Professor Pierre Bothorel**, researcher at CNRS, illustrates this need by recalling the oil-crisis of 1973. "In soliciting fundamental research in the field of micro-emulsions, the oil industry provided researchers with a golden subject on a silver platter! Until then the subject had not triggered much enthusiasm: due to the aspects of energy saving, it unexpectedly became an issue of great interest. In France the problem was of national concern, soon supported by public financing, thus permitting a significant surge of research in this field. In a certain way, it is thanks to the industrialists that the French laboratories are ranked among the world leaders in the matter of colloids.

Certainly the priorities of researchers and industrialists merge around one major preoccupation: the environment. It is true that this subject is at the heart of all debates: "Today an industrialist must know how to manage his product from its creation to its destruction. Therefore, one tries to find emulsions which will be more and more environmentally compatible," said Professor **Stenius** from the Helsinki University of Technology in Finland. For him, as well as for Professor **Lyklema**, the most important evolution of these past years is the transition from dispersions in non-aqueous phase to emulsions in aqueous phase, which reduce environmental and health hazards and facilitate recycling. Controlling the stability of these new emulsions provided the basis for many interesting studies of the molecular forces between surfaces which are at the heart of emulsions properties. These studies find a direct and concrete application in oil-spill treatment.

In the field of road building, still in the context of improving the environment, Professor **Bothorel** quotes in particular studies on products freed during breaking and the progression of the emulsion based cold-mixes which limits energy consumption, and the spraying of emulsion which avoids the heat induced release of aromatic substances found in certain fluxes used for hot bituminous binder spray.

Professor **Leutner** from the Stuttgart University in Germany stresses that this friendly environmental aspect of emulsion is a key to the development of bituminous technologies. Professor **Tadros** from the ICI Agrochemical Research Center in the United Kingdom, stresses on his part the research on the implementation of emulsion efficiency. Today one tries to adapt in the strictest possible way each emulsion's formula to the specific needs of its sector of application. The efficiency of medication in the form of emulsion (as more and more anaesthetics are), depends upon the size of the droplets, which must become smaller and smaller. Due to the variable structure of the skin, the formulations of beauty-creams are varied according to the body parts their use in intended for...To succeed in this research for maximal profit, a permanent diologue with the industrialists is simply inevitable.

The industry knows perfectly well that the field of emulsions has arrived at such a hyper-specific stage that the smallest scientific progress in the heart of a laboratory may be sufficient to sweep the competitor from the market...or to be swept away yourself.

PLANT WATER MANAGEMENT TOOL

Specifically designed to meet the needs of today's environment-conscious utilities, the WATERMAN code is a critical element of the progressive utility toolbox. With WATERMAN, utilities can develop more-sophisticated water management options, such as recycling strategies, to comply with increasingly stringent wastewater discharge regulations and beat the rising costs of high-quality makeup water. Users can create comprehensive simulations of existing or planned plant water systems, calculate the impact of water system modifications on stream flows and compositions, and determine the capital and operating costs associated with these changes. Added benefits include the ability to identify operating problems or potential noncompliance discharge. *For more information, contact **Michael Miller**, (415) 855-2455. To order, call the Electric Power Software Center, (214) 655-8883.*

AND THE WINNERS ARE JOE ARCONTI AND NAVEEN ARORA!

At the AFS annual meeting in May, 1993, two students presented poster papers. **Naveen Arora**, from the University of Colorado, presented his paper on "Deadend Microfiltration of Bovine Serum Albumin Suspension Through Yeast Cake Layers and Asymmetrical Polymeric Membranes" and **Joe Arconti,** from the University of Akron, presented his paper on "Use of Local Measurements to Analyze the Drag Force and Stress-Strain Relation for Compressive Packed Beds."

The six judges reviewing the papers decided that both papers were excellent and deserving of an award. The AFS Student Poster Paper competition awards the author of the best paper with a $500 scholarship. This year the AFS awarded both authors $300. Also the 3M Corporation, EPOC, and the Texas AFS Chapter donated $200, $100 and $100 respectively to make the total awards of $500 for each student. Many thanks to the judges and companies that contributed their time and money.

The AFS strongly believes in supporting the education of our future engineers and scientists. A Student Poster Paper is planned again for the 1994 annual meeting. Professors are encouraged to have their students participate. For further information, you can contact **George Chase** at (216) 972-7943, University of Akron, Department of Chemical Engineering.

INDUSTRY NEWS

CLARCOR ACQUISITION

The acquisition of Louisville-based Airguard was completed on April 30. Airguard manufactures environmental air filtration products in four manufacturing facilities in the U.S. and one in Mexico. Annual sales of $40 million are largely attributable to the U.S. industry's broadest line of air filters, marketed through more than 500 distributors worldwide.

The acquisition is especially important for three reasons. First, it gives **CLARCOR** a firm position in air filtration, a $500 million environmental market that is expected to grow 10-15% annually. Second, it significantly expands filter offerings in the industrial and commercial areas. Third, it redeploys funds from the Precision Products sale.

Long term, Airguard sales and earnings can be major contributors to **CLARCOR** objectives. While its markets produce lower margins than present filter operations there are opportunities to significantly boost profitability over the next five years.

Airguard is similar in size to Baldwin Filters when acquired in 1981. Sales at Baldwin have increased by 85% and operating profits have expanded by 227%. It has become **CLARCOR's** largest and most profitable operation.

Reflecting the Airguard and Guardian acquisitions, Filtration Products are expected to increase to 69% of total sales in 1993 and approximately 75% in 1994 vs. 63% in 1992.

AIRMAZE BROCHURE FEATURES EXPANDED MICROMAZE PRODUCT OFFERING

AirMaze is offering a new two-color brochure which describes the recently expanded MicroMaze product offering. In addition to describing the compressed air coalescers, particulates and adsorber filters, the brochure graphically illustrates the six different types of media now available and details general and specific application considerations.

MicroMaze filters use UltraMaze media to provide a complete selection of filter grades. This selection allows AirMaze to customize the filters to individual requirements while providing "off-the-shelf" pricing and delivery.

The brochure includes an alternate sizing chart for pressures other than 100 PSIG and a complete listing of optional, factory-installed accessories, including auto drain valves, differential pressure indicators and air gauges, brackets and special seals.

The AirMaze Corporation designs and produces filtration products for the aircraft, agricultural, railroad, construction, trucking, air conditioning and power industries.

For more information on the expanded line of MicroMaze products or to obtain a copy of the MicroMaze brochure, contact AirMaze Corporation, 25000 Miles Road, Cleveland Ohio, 44146. Or Call (216) 292-6800.

AVERY FILTER COMPANY INTRODUCES NEW MEMBRANE FILTER PRESS

Avery Filter Company has introduced a new two stage Lock Squeeze pressure filter press for liquid /solids separation. The unit produces cake with up to 65 - 75% solids content in half the cycle time of conventional chamber filter presses. The Model L /S uses membrane / diaphragm technology to reduce liquid content of the filter cake without having to remove it for further processing.

Compressed air or pressurized water applied to a flexible impermeable diaphragm on the filter plates expands and squeezes the cake within the filter chamber. The cake is " locked" in place and "squeezed" to remove further moisture and therefore produces a cake of higher density. The system operates well at low pressure 100 psi and avoids the need for high pressure press design, pumps and piping. Where required, 225 psi designs are available. The combination of plate design and low moisture cake provides instantaneous cake release.

The Model L / S is especially suited to chemical, pharmaceutical, food processing, precious metals, or wherever either the filter cake or a valuable liquid is the end product. Quentin Avery, president of Avery Filter says the new L / S filter press provides users with cake dryness previously achieved only with costly secondary drying, It produces highest cake solids available and dramatically reduces cycle times, and therefore process times. The units avoid the need for costly drying equipment and the time-consuming air blowdown associated with many processes.

Units are available from 1/2 to 200 cubic feet capacity and are suitable for new installation or retrofit.

For further information, contact **Quentin D. Avery,** President Avery Filter Company, 99 Kinderkamack Road, Westwood, N.J.07675, Phone (201) 666-9664, Fax (201) 666-3802.

MEMTEC AMERICA CORPORATION

Memtec America Corporation announced that its quality systems have been registered to ISO 9001 by Underwriters Laboratories and JMI Institute of Japan. The ISO 9001 Quality standard defines a comprehensive quality management system for those companies involved in the design / development, production, installation, and servicing of goods. The system is maintained through the company's on-going quality programs and continuous value improvement process.

Further Memtec America Corporation announced the purchase of the assets and inventory of the Facetweb product line from Facet International. Memtec America now distributes this product line as the Memtec MICRO-WEB™ Series filter cartridge and the FILTERITE® POLY-MATRIX® Series.

REEMAY, INC. FILTRATION MEDIA

Reemay, Inc. has recently organized a Filtration Business Unit, with the direction to expand and build on its worldwide Filtration Media offering. Significant resources have been added to the Filtration Technical and Product Development sections. The new Business Unit and support personnel will focus on enhancing the core businesses with new products while working with specific clients and engineering media to meet new applications.

You may have seen our Filtration Media exhibit at the AFS in Chicago -- As an AFS Corporate Sponsor, we feel that we should communicate to AFS members the products and services we offer.

Please call (615) 847-7000, or in the U.S. and Canada call 1-800-321-6271 and ask for anyone on the Filtration Business Team for information or brochures on our products.

NEW LIQUID-SAMPLING DEVICE FROM MICROPURE FILTATION

The **Simplex Sampler™** from **MicroPure Filtration** improves the quality control of your liquid product by automatically and consistently sampling fluids at critical stages of the production process.

By taking the guesswork out of product sampling, the electronically controlled liquid-sampling device provides early, pin-point detection of potential contamination areas in process applications where bacterial and submicron particle control is critical.

By isolating the source of contamination, the Simplex Sampler minimizes the time required to find problem areas, resulting in less downtime. And by quickly stopping the spread of contamination to uninfected areas, production processes will suffer less product loss.

Used as a portable sampling device or as a permanent fixture along a processing line, the programmable Simplex Sampler allows the user to pre-set sampling intervals, draw times and liquid volumes to provide consistent product samples for inspection.

MicroPure Filtration offers a complete line of advanced stainless steel segmented filters, cartridge filters and ancillary filtration equipment. For more information, contact the Customer Service Department, MicroPure Filtration, P.O. Box 7007, Rockford, IL 61125. Phone: (815) 962-7020.

LAROX INC. INTRODUCES NEW HYDRAULIC SERIES OF PRESSURE FILTERS

Larox Inc. has introduced a new hydraulic series of pressure filters, Larox PF-H, which combines the unique technology of the Larox PF with the added advantages of higher capacity, faster cycling time and lower maintenance. Single end discharge of cake is also available.

The Larox pressure filtration technique produces up to 94% dry cake from slurry without additional processing and performs all operations automatically.

First, a feed pump forces slurry into horizontal chambers. *(A PF-H filter may contain from one to 20 of these chambers with filtration areas of 0.4 m2 to 144 m2.)* As the chambers fill, flitrate flow begins. As dewatering continues, a flat, uniform cake is formed. Next, water comes in at high pressure behind diaphragms in each chamber. The diaphragms press the cake, reducing its volume and moisture content.

If cake washing is desired, wash water is pumped into each chamber after which the diaphragms press the cake a second time.

In the final step, maximum dryness is achieved by blowing pressurized air through the cake. The cake is then discharged and the filter cloth is washed, all automatically. The entire filtration cycle is accomplished in as little as six minutes, depending upon the material being dewatered.

The new hydraulic system means a significant increase in the speed of the plate pack mechanism which increases the hourly capacity by up to 10 percent compared to the mechanical filter.

The hydraulic closing mechanism takes up relatively little vertical space, which means that the filtration area of one filter may be as much as 20 percent higher than before. Thus, machine capacity increases by 20 percent without any additional height. The new Larox PF-H also offers single end discharge of cake.

The new control panel design is user-friendly, providing instructions and information to the operator in easy to read text format.

For further information on Larox PF-H automatic pressure filters, contact **Mr. Steve Walters,** Larox Inc., 9730 Patuxent Woods Drive, Columbia, Maryland 21046, (410) 381-3314.

3M FILTRATION PRODUCTS INTRODUCES NEW RADIAL-PLEATED FILTER CARTRIDGE

3M Filtration Products introduced a new liquid filter cartridge featuring a patented Compound Radial Pleat that provides up to 40 times more surface area for particle removal than standard 10-inch-length pleated cartridges. The cartridge is designed for profiltration and final filtration of particles at high flow rates in a wide range of environmental, water treatment, and oil and gas applications. It is also designed for single or multiple cartridge vessels.

Because of this larger surface area, the 3M brand Series 700B High Capacity Liquid Filter Cartridge has a large loading capacity at flow rates as high as 40 gallons per minute per cartridge. The larger loading capacity extends filter life and reduces filtration costs associated with changeouts and disposal.

The cartridge has more than 200 square feet of melt-blown polypropylene microfiber media, a filter media that is highly efficient at removing particles as small as 1 micron. The unique Compound Radial Pleat design stacks the pleats of the filter media horizontally, which provides more media surface area than filter cartridges with traditional vertical pleats. This design allows the entire filter cartridge, which is 40-inch-length and 7 inches in diameter, to be filled with filter media, giving it higher loading capacity and longer life.

With the larger diameter and horizontal pleating, one Series 700B cartridge provides as much media as 10 traditional 40" length pleated cartridges. At the same time, fewer inner cores, outer sleeves and end caps reduce labor and disposal costs.

To illustrate cost savings for disposal, removal of 100 pounds of dirt would require 27 pounds of Series 700B filters, compared to mere than 600 pounds of traditional string-wound cartridges.

The Series 700B cartridge has double O-ring seals in a variety of material options. The seals simplify installation and significantly reduce the risk of contaminant bypass compared to common knife-edge seals.

The cartridge has heavy-duty, built-in handles for easier changeouts, and all loose parts, such as threaded rods, caps and springs, have been eliminated from the design. At replacement, the used cartridge can be incinerated, subject to state and local regulations regarding disposal of the liquid or contaminant involved.

The Series 700B consists of four micron ratings, offering 99 percent efficiency for particle sizes of 2, 5, 10 and 15 microns.

For more information about 3M brand liquid filtration products, contact 3M at Building 76-1W-04, 3M Center, St. Paul, MN 55144-1000, or call 1-800-648-3550.

HOESCH INDUSTRIES, INC. INTRODUCES NEW OVERHEAD FILTER PRESS

The new Hoesch System 47 automatic, overhead filter press combines the large filtration volume and filtration area of a horizontal filter press with the proven advantages of overhead plate suspension. With filtration areas of up to 7500 sq. ft., the System 47 is the most sophisticated press now available for large scale processing of municipal and industrial waste.

The new press introduces an increased level of automation and reliability to 100 / 225 psig filter press design. A fully automated overhead plate shifting mechanism and an integrated high pressure filter cloth cleaning system top the list of automation features. System 47's hydraulically driven plate shifting mechanism allows smooth, uniform shifting speed adjustment. The entire filter package pivots from the overhead beam, allowing the operator to conveniently access the plates during the cloth cleaning cycle.

Additional features of the exclusive System 47 design include: fully automated, individual plate shifting with interlocking devices for reliability; a patented three-point suspension system with stable, center-of-gravity support of each plate; automatic control of plate stability during plate shifting and cake discharge; and digital control of the cloth cleaning device for accurate positioning and thorough, efficient washing.

A welded steel frame, resistant to corrosive chemicals, supports System 47's overhead plate suspension beam and completely absorbs the high lateral thrust generated during press closing and the initial hydraulic squeeze. No force is therefore transmitted to the foundation of the building which houses the press. The unique System 47 frame design, customized for each application, insures uniform plate clamping forces to provide an optimum seal between each chamber and prevent plate deformation.

System 47 Press complements Hoesch's product line of horizontal side-bar and vertical filter presses for liquid-solid separation. Hoesch filter presses are used in such applications as dewatering of industrial and municipal waste, processing of pigments such as TiO_2, chemicals, foods, beverages, hydrometallurgy and the processing of coal and ores. Hoesch manufactures its complete line of filter presses at their manufacturing facility in Landing, New Jersey.

For further information, contact Paul Scholtyssek, President, Hoesch Industries, 12 Orben Drive, Landing, NJ 07850, Telephone: (201) 398-9000, Fax: (201) 398-9115

PUBLICATIONS & BOOKS

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AUTHORS
David Jenkins, University of California at Berkeley
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Catalog no. L873LBHV
1993, 224 pp., ISBN: 0-87371-873-9
U.S. $49.95/Outside U. S. $59.95

THICKENING AND CLARIFICATION

Associate Editor's Comments:
The following paper discusses the mechanism of sedimentation and the operation guidelines and design features of thickeners / clarifiers. This information was presented at the annual meeting of the American Filtration and Separation Society which was held in Chicago on May 10-14, 1992.

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INTRODUCTION

Gravitational settling of solids in liquids is done to produce a clear liquid phase, to concentrate suspended solids into a denser slurry, or to classify solids particles. Such operations are accomplished continuously by thickeners and clarifiers.

A. Mechanism of Sedimentation/Clarification

In a thickener, the high concentration of feed solids leads the particles to crowd together as they settle. If they have any tendency to cohere, or flocculate, they link into a plastic structure. Particles held in the structure are constrained to settle as the same rate. Interparticle cohesion is large compared to the settling force. Fines likewise drop out of suspension, so the solids settle with a sharp interface between pulp like slurry and supernatant liquid. The particles descending within the slurry pass through a "zone settling" regime often called line settling. Here the solids actually start piling up from the bottom of the vessel, and each layer of sludge solids provides some support to the layers above. Thus the weight of the solids is no longer totally supported by hydraulic forces, and the solids are no longer completely in suspension.

Due to this compressive stress or squeezing, the descending material finally enters a "compression" regime where each layer of flocculated structure is compacted or thickened. Often the settled solids also go through "phase" settling, characterized by intermittent channeling of liquor through the concentrated slurry, which allows more dewatering. Generally any material will reach a maximum concentration referred to as final dilution, that for all practical purposes is optimum under the ambient conditions.

In clarifiers, particle behavior is more straightforward. Because of the diluteness of the feed, the particles tend to behave independently of each other. This is characterized as either a classification regime where each particle settles separately and at its own rate, or a clarification regime in which particles first agglomerate into separated floccules, which then settle out.

B. Criteria for Sizing

To specify a system determine:

1. The characteristics of the feedstream with respect to flow, solids loading, particle-size distribution and pH. 2. The test results for underflow concentration and overflow clarity. 3. Tank size. Area is controlled by either the solids loading or settling rate. The required detention time will set the tank depth for the area selected. Tank sizing is basing on experience or lab/pilot testing. 4. The required power or torque. 5. The setup best suited for fluid handling, power loads, size and construction economics. 6. The capability of the rakes to adequately remove settled solids from the unit. 7. The materials of construction. 8. A control scheme compatible with the accessories selected and the type of operation desired.

The torque requirement of the drive is based on the force necessary to move the rake mechanism through the thickened slurry. All other mechanical parts must also be designed for this same load.

A "rule of thumb" method has been used to tie in experience to selection. The maximum running torque (T) requirement has been expressed as

$$T = 14.6\,KD2 \qquad (1)$$

The constant 14.6 is used in Equation (1) to keep K the same in the English and Metric System. D is the diameter of machine.

Table A shows some typical operating conditions. Values for overflow rate indicate that this rate controls; blanks mean the thickening unit area rate often controls.

C. Operation Guidelines

The sedimentation device and the means for carrying away the thickened material must be considered an integral unit. Many well-designed thickeners have presented operating problems due to improper techniques for pumping the sludge. The underflow density or concentration for any material being withdrawn from the thickener is a function solely of the pumping rate. Sustained higher pumping rate will eventually lower the concentration of the underflow sludge.

However, even under conditions of high sludge inventory, too high a pumping rate can result in very thin underflows well before the sludge inventory has been depleted. This behavior is caused by "ratholing". An operator can make a simple check to determine if the pumping rate is right. It consists of sampling the underflow being pumped and letting it sit in a graduated cylinder or jar for an hour or two. After settling, the amount of clear water developed is a measure of the excess water pumped with the sludge.

Recirculation of the underflow back to the thickener feed is a common practice, but the practice should be carried out with care to avoid overload and underflow line plugging.

Some materials display a tendency to cling to the rake-arm structure and build upon themselves, eventually creating a large mass. This mass will continue to grow until it falls from the rake-arm under its own weight. However, it will generally remain intact and form what is called an island. Two operating procedures prevent island formation. One is the addition of a flocculating chemical that produces a large, stable floc and remains somewhat flocculant even in compression. However, care must be exercised in adding flocculants, since over-flocculation will produce a gel-like structure that is just as hard to remove from the thickener.

The other is to periodically raise and lower the rakes through their full travel with the automatic lifting device. Doing this once or twice a shift proves sufficient to dislodge any solids that have begun to accumulate on the arms.

D. Design Features

In relatively small sedimentation units, the submerged-rake mechanism can be supported and driven by a gear-reduction unit that in turn is supported from a bridge spanning the tank. An alternative, a center-column support with precision contact bearings has proved economic for basins from 40 to 500 ft. in diameter.

For very big units, usually over 400 ft. in diameter, a variation called the Superthickener or Caisson thickener uses a large-diameter central column in which the underflow pumps are incorporated. This allows the underflow to be withdrawn into the column and pumped up and back to the periphery through a pipe supported by the access bridge. The large drives for these units are designed to employ hydrostatic bearings.

Traction units are an economical variation of the center-column-support approach. These have a pivot supported on the center column, about which the rake rotates. Power is supplied by motors mounted to drive traction wheels on a rail around the periphery of the tank.

Another significant design variant is the cable-controlled unit, in which the rake-arm experiences only limited exposure to the settled solids, so that torque and scale loads are minimized. A selflift feature is provided, governed by the relationship between the weight of the rake-arm and the torque load.

There are other versions as well. They include high-rate or high-capacity units designed to take best advantage of organic-polyelectrolyte flocculants; dual-function units such as Clarifier Flocculators®; and stacked machines that save space because a single tank is divided by internal trays into multiple compartments for series, parallel, or combined series-parallel operation.

Summary

Scarcity of water resources, environmental control requirements, the cost of reusing water, or a combination of these factors, makes the need for reliable, efficient equipment imperative.

The use of thickeners/clarifiers reduces the cost of land, construction, monitoring, maintenance and pumping of tailings dams or holding ponds. Many plants and/or communities rely on thickeners/clarifiers for their entire water supply or entire production.

Table A - A wide variety of operating conditions are encountered in commercial thickeners and clarifiers

Slurry	*Solids, %*		*Unit area, ft2 / ton / d*	*Overflow rate, ft / h*	*K Value*
	Feed	*Discharge*			
Alumina-hydrate	5-6	30-40	25-30	-	<20
Alumina-red mud	3-9	14-45	7-40	-	713
Coal-clean fines	4-6	40-50	3-10	1-6	7-15
Coal-refuse	2-6	25-40	5-15	1-5	10-20
Copper-floation tails	15-35	45-50	3-20	-	10-20
Copper-flotation concentration	15-30	45-65	3-20	-	13- < 20
FGD* waste	5-12	25-50	3-20	-	7-15
Magnetite tails	2-8	40-50	12-15	-	10-20
Phosphate slimes	0.5-1.0	3-6	270-400	1-2	10-15
Pulp & paper waste	0.1-0.3	1-5	70-600	3-4	7-15
Sanitary waste	1-5	3-12	70-400	4-6	2-13
Taconite tails	1-5	40-50	10-20	3-7	10-20
Water Softening	3-10	15-45	15-50	5-12	7-13
Uranium leach	12-20	40-65	1-15	-	13-<20

*Flue-gas Desulfurization

WASTEWATER SLUDGE DEWATERING

Proceedings

The first Specialist Group On Sludge Management conference on Wastewater / Sludge Dewatering and held June 29 - July 1, 1992, in Rebild, near Aalborg, Denmark, was a significant manifestation of our specialist group. The edited and revised proceedings will be available as a Vol. 28, issue no 1 of Water Science and Technology. Be sure to get a copy for bringing yourself up to date on this important aspect of sludge management. The list of contents is as follows:

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FILTERS AND FILTRATION HANDBOOK

Third Edition
Editor: *Christopher Dickenson*
Publishers: *Elsevier Advanced Technology, Copyright 1992 Mayfield House, 256 Banbury Road, Oxford OX2-7DH UK*
Reviewed by: *Guy E. Weismantel, President Weismantel International and Executive Secretary of the American Filtration and Separations Society*

GENERAL INFORMATION:

Now in its eleventh year, the ***FILTERS AND FILTRATION HANDBOOK*** is in its third edition. The 780 page book is a compilation of scientific and technical information presented in eight chapters *(called sections)*. These are:

1.	Basic Principles	62 pages
2.	Filter Media	54 pages
3.	Types of Filters	118 pages
4.	Types of Separations	68 pages
5.	Liquids and Solids	97 pages
6.	Air Filtration	108 pages
7.	Oils	83 pages
8.	Filter Selection	66 pages

These sections are followed by a fourteen page editorial index and an index to 66 advertisers, two of which are bookmarks. Some of the companies who advertise have no sales effort in the U.S.

REVIEW OF CONTENT:

People who are reading this review are asking themselves whether they should spend the money to buy this book. To those that are trying to develop a complete library of filtration and separation topics, this book should be a part of that collection, although the price of $165.00 is very high given the content. Still, its strong points outweigh the weak, and being one of the latest compilation of data and technology, the information proves to be a useful reference.

The idea of advertising in a handbook is not one that will sit well with many U.S. handbook users *(who normally don't see advertising in reference works of this type)*. Some may consider ads as bothersome and interfering with generic technology. Indeed, many of the ads in the handbook are simple identification of companies and what they sell as opposed to having educational or reference value. Also, from a U.S. point of view, most of the ads have only European addresses, telephone and fax numbers which is not convenient to U.S. users. I do not consider this as a problem in the written text because technology is not based on geography.

The book contains over three hundred and fifty illustration and tables (data is mostly in SI units) that are quite helpful in supporting written words. This is particularly true for cutaway views.

REVIEW OF TEXT:

Section 1: Basic Principles: This section covers filters and separators, contaminants, filter ratings, filter tests and surface and depth filtration. Key figures cover particulate sizes from the submicron range upward. Definitions and tests covered in this chapter (such as Beta Ratio, test dust and bubble point) are important to understanding other aspects of filtration and fluid-particle separation.

Section 2: Filter Media: This section covers ad and absorbent media, general types of media, membranes, woven wire, and expanded sheet and mesh. Space limitations preclude in-depth coverage of paper, fabrics, felt and filaments; and, there is nothing on the newer nonwovens. Definitions and applications of various types of membranes are identified to include some information on gas-gas and liquid-liquid separations. These are really homogeneous separations with fluid-particle separations generally considered heterogeneous. Here, "fluid" is used in the engineering sense as being either a gas or liquid.

Section 3: Types of Filters: This section covers strainers, screens, cartridges, electrostatic precipitators, candles, magnetic, sintered, bag, precoat, filter presses, rotary (drums and discs), leaf and tipping pan filters. There is not great detail on each type of equipment, and, some filters, like Nutsche, are not covered.

Section 4: Types of Separators: This section covers separators, centrifuges, hydrostatic precipitators, wet scrubbers, coalescers and mist eliminators. Some equations for separating rates and efficiencies are presented, but in this chapter, as well as throughout the book, there is limited emphasis on theory. There is no mention of Darcy's work or his equations. The empirical equations used in unit operations are not really the focus of this handbook.

Section 5: Liquids and Solids: This section covers water and wastewater filters, process filters (to include basic RO), oil/water separators, and other industrial filters and separators. The focus is on applications and systems with several flowsheets. Pretreatment is mentioned, but chemical usage for flocculation, precipitation and other preparations for filtration are limited. The oil/water separation is very short.

Section 6: Air Filtration: This section on air filtration discusses dust collectors; fumes and hot gases; plus machine, compressed respiratory and sterile air. This includes basics on HEPA (high efficiency particulates air) filters and Eurovent classifications including some coverage of aerosols.

Section 7: Oils: This section on oils covers hydraulic and engine filters, homogenization and oil cleaning. The text is

(Continued on page 34)

FILTERS AND FILTRATION HANDBOOK *(cont. from page 33)*

focused on fuel filters plus lubrication and hydraulic systems, and centrifugation applications.

Section 8: Filter Selection: This section covers selection data to include tables and graphs and a buyer's guide which gives addresses of companies who advertised. The latter is a strange addition to a technical handbook, but it is useful information. There is also a classified index in this section that cross references equipment to advertisers. Keep in mind that this is not a complete buyer's guide and only covers advertisers. The section on definitions covers four pages; there is also a reference to standards and codes in Europe, the UK, Germany, Japan, USA, USSR, and International ISO.

PRICE AND PURCHASE:

The price of the ***FILTERS AND FILTRATION HANDBOOK*** is $165.00. It can be ordered by special order through your local bookstore or directly from Elsevier by calling Pergamon Press, Books Customer Service Dept., 660 White Plains Road, Tarrytown, NY 10591-5153. Telephone: 914-524-9200; fax: 914-333-2444.

AIR FILTRATION

SUBJECT

An Intergrated Approach to the Theory and Applications of Fibrous Filters

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Pergamon Press Inc., 660 White Plains Rd., Tarrytown, NY 10591 • phone: (914) 524-9200

PRICE

$88.00

Chapter headings and main section headings:
Introduction Symbolic notation.

Macroscopic Description of Filter Behaviour. Surface Filtration and depth filtration. Types of filter. Method of filtration and assessment of efficiency. Layer efficiency. Single fibre efficiency.

Filter Structure. Introduction. Paper filters, Carded filters. Porous foam. Model filters.

Flow Patterns and Pressure Drop. Nature of airflow through a filter. General fluid dynamics theory. Microscopic airflow patterns in filters. Filters of irregular or imperfect structure. Filters in conditions other than simple Stokes flow. Macropscopic flow patterns. Flow through filters of non-uniform structures

Particle Capture by Mechanical Means. Introduction. Generalized theory of single fibre efficiency. Particle capture by direct interception. Particle capture by inertial impaction. Capture of particles by gravity. Capture of particles by diffusional deposition. Capture of non-spherical particles by fibrous filters. Combined effect of two or more capture mechanisms. Variation of deposition site with capture process. Effect of leakage on filter performance. Potential problems with model filters.

Electrically Charged Filter Material. Introduction Basic mechanisms of action. Classification of material. The importance of electric charge configuration. Measurement of filter charge. Charge stability and the effect of storage on filter performance.

Particle Capture by Electric Forces. Introduction. Capture by permanently charged fibres. Capture by image forces. Experimental observation of electrostatic capture. Augmentation of filtration efficiency by external electric fields. Augmentation of filtration efficiency by charging of particles.

Particle Adhesion and Particle Bounce. Introduction. Adhesion forces between particles and fibres. Dynamics of impact.

Effect of Loading. Introduction. Qualitative description of filter clogging. The influence of aerosol properties on clogging rate. Macroscopic theory of filter clogging. Airflow pattern and drag force acting on particle complexes. Theoretical description of clogging. Experimental observation of dendrite structure on a single fibre. Experimental observations on model and real fibrous filters. Fractal structure of particle deposits. Effect of loading with liquid aerosols. Time-dependent effects in filter clogging. The effect of dust loading on the performance of electrically charged filters.

Filter Testing. Introduction. Pressure drop measurement. Area weight measurement. General problems of aerosol penetration measurement. Aerosol detectors. Testing with monodisperse aerosols. Size selective testing with poly disperse aerosols. Non size-selective testing with poly disperse aerosols. Testing of high efficiency filters. Tests with electrically-charged aerosols. Worst possible case testing. Realistic prediction of filter performance. Standard filters, Index.

250pp 150 illus approx August 1993
0 08 041274 2 (H)

SEPARATION TECHNOLOGY APPLICATIONS

SELECTING FILTER MEDIA FOR COOLANT FILTRATION

Associate Editor's Comments: *The following paper presents a procedure for evaluating and selecting filter media for Coolant filters. This paper appeared in Filtration News, Volume 9, May, 1991 and was slightly condensed by the associate editor.*

AUTHOR
Philip Z. Chrys

Quality and productivity are closely associated with coolant clarity. Part quality characteristics such as surface finish and conformance to dimensional tolerances, and manufacturing productivity indicators such as tool wear and coolant system maintenance are correlated with the amount and size of contaminants in the coolant. For filter systems using nonwoven roll media *(example shown in Figure 1)*, it is the nonwoven media that does the actual filtering.

The filter media is therefore a primary determinant of the operating efficiency and cost of the filtration system(s) and the resulting quality and productivity of the manufacturing operation(s) serviced by the filter(s). Yet, because of a lack of understanding and/or engineering time constraints, the selection of filter media may not be receiving the proper attention needed to optimize results. The "if it ain't broke don't fix it" syndrome may be endemic to an organization, which runs contrary to the philosophy of continual process improvement and world-class manufacturing competitiveness. The purpose of this article is to provide a logical, statistically sound, quantitative approach to the comparative evaluation and selection of filter media for metalworking coolants to optimize manufacturing performance and reduce operating costs.

SELECTION CRITERIA

In coolant filtration, the end user is generally interested in five primary criteria when selecting filter media: continuity and quality of supply, durability, efficiency, capacity, and cost. These selection criteria may be defined as follows: Continuity and Quality of Supply: The experience, technical expertise and long-term commitment of the manufacturer of the nonwoven filter media in this market application.

Durability: Sufficient media strength to withstand the physical rigors of the filter system without tearing or rupturing in the filter bed, or causing difficulty in extracting from the system.

Efficiency: The retention of particles of a certain size and the rate of their removal.

Capacity: The amount of contaminants removed per unit area of filter media, before the media's permeability reaches the end of its useful life.

Cost: Unit price times usage, plus maintenance and disposal.

PRELIMINARY EVALUATION

(1) **Process Assessment**: Understanding the nature of the manufacturing process(es) and filtration system(s) helps define filter media requirements preliminary to in-operation evaluation. Some key considerations are:

(a) Does the filter equipment and / or sharp nature of machining chips produced require special resistance to tearing? If so, a strong, heavy basis weight media *(1.5oz / yd² or heavier)* may be appropriate.

(b) What is the quantity and size of particulates to be filtered? Operations that create a fine, narrow distribution of particulates *(e.g. honing or a relatively small quantity of contaminants (e.g. parts washing)*, by their nature will not produce a thick filter cake, and therefore the filter media is the major determinant of filtrate clarity. In these operations a heavier weight, tighter media such as 1.8 oz / yd² or heavier may be appropriate. In operations that create a large quantity of contaminant with a wide particle size distribution *(e.g. rough grinding)*, a thick cake can be produced, given that the initial filtration efficiency and flow characteristics of the media are adequate. In these operations a lighter weight media, perhaps 1.0 oz / yd² may be appropriate— a rule of economy being the selection of the lightest weight media with sufficient strength, acceptable initial efficiency, and good resistance to premature blinding.

(c) **Is tramp oil present**? Filter media will not solve a major tramp oil problem. However, certain compositions, most notably nylon and polypropylene, have more of a tendency to prematurely blind in the presence of tramp oil, resulting in greater media usage and cost. End user experience has demonstrated that a polyester blend filter media *(polyester with a small percentage of cellulose)* can be effective in removing a percentage of tramp oil while better resisting blinding, to promote filtration efficiency and prevent excessive media usage.

(2) **Media Manufacturer Assessment**: In recent years a proliferation of available roll media for coolant filtration has been introduced to the marketplace. Frequently, these materials may have been designed for other primary uses or by companies not focused in filtration technology, and may be underpriced as part of a short-term strategy to fill manufacturing capacity. Before spending time and effort considering a filter media, the specifying engineer should ask his supplier what this material was designed for, what is the manufacturer's business history and stability, what is the manufacturer's experience and long-term resource commitment to coolant filtration, and what is the quality system employed to assure consistent performance and continuity of supply.

(3) **Physical Properties of Filter Media**: The typical physical properties of the filter media, originating with the media manufacturer, provide a means for screening the appropriateness of different filter media to meet the above selection criteria for a specific application. The physical

properties generally considered important in the selection of nonwoven filter media are: basis weight, thickness, tensile, tear, Mullen *(burst)*, and porosity. Basis weight is usually expressed in ounces per square yard and, given the same composition, is directly correlated with the initial efficiency *(tightness)* and physical strength of the filter media. Thickness, sometimes referred to as caliper or loft, depending on the media composition and manufacturing process, is an indicator of the depth filtration capability of the nonwoven media. Tensile, tear, and Mullen (burst) are measures of physical strength. Porosity, expressed in cubic feet per minute, can be directly correlated with the flow capability and initial filtration efficiency of the media.

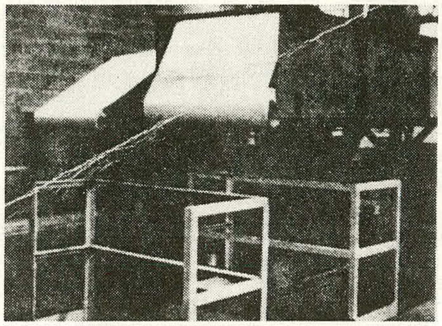

Figure 1

Notably absent from this list of physical properties is the so-called *"nominal"* micron rating of the filter media. That is because there is no universally accepted standard method for testing and interpreting liquid filtration efficiency data to determine such a numerical value. As a result, these micron ratings can be misleading, and additional information regarding the test method used is necessary for such a rating to have any value.

Note: To properly compare any physical properties, it is important to check that the same test methods were used to generate the respective data.

(4) **Media Composition and Manufacturing Process:** The physical properties of the filter media and its ability to meet the application requirements are determined by the media composition and manufacturing process. Figure 2 shows the visual differences, at the same magnification, among similar basis weight filter media produced by the four predominant nonwoven processes used to manufacture roll media for coolant filtration: wet laid, dry laid, and point-bonded. It is evident from visual examination that the wet laid process creates a more uniform web. This translates into a more consistent pore size distribution which is a major determining factor for dependable filtration efficiency. By comparison, spunbonded and dry laid filter media are typically less uniform due to the inherent nature of these manufacturing processes. The uniformity of wet laid media also lends itself to multidirectional strength which is especially desirable in vacuum and pressure filters, as compared to the unidirectional formation / strength created by the dry laid process. Filter media manufactured by the point-bonded process exhibits exceptional physical strength characteristics, however as much as 25%-30% of the surface area may be impermeable due to thermal sealing, which can result in increased media usage and associated purchase and disposal costs.

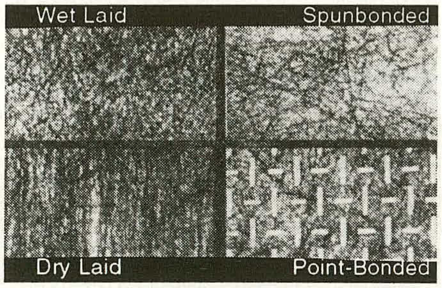

Figure 2

A major determinant of filtration efficiency and capacity is the ability of the filter media to mechanically entrap contaminants while maintaining an operationally sufficient flow rate, thereby promoting the formation of a filter cake. The loft *(thickness and softness)* of the filter media promotes the mechanical entrapment of contaminants within its fibrous structure. The filter media is thereby able to retain a larger quantity of contaminants without impeding flow as readily as if the particulates were captured only on the surface of the media.

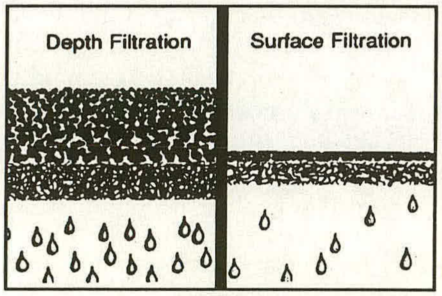

Figure 3

This characteristic, which provides some depth filtration advantages, is graphically shown in Figure 3. Figure 4 shows the difference in loft evident in cross-sections of filter media *(at the same basis weight and magnification)* manufactured by the wet laid and spunbonded processes.

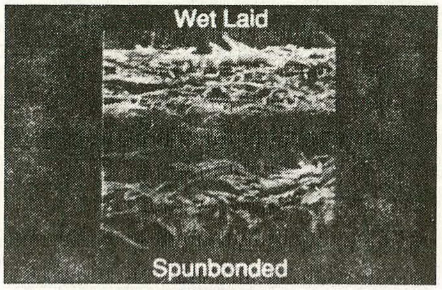

Figure 4

The type of fiber(s) of which the filter media is composed contributes to its performance characteristics. Polyester has been found to be most versatile and appropriate for metalworking coolant filtration. Polyester does not have an affinity to oil as do polypropylene and nylon fibers, which can cause the filter media to blind over and prematurely index. Premature blinding results in suboptimal filtration and increased media usage and costs. Polyester is less likely to swell, and is better able to withstand the physical rigors of extended submersion, especially under pressure or vacuum, when compared to rayon or other cellulosic fibers. For metalworking coolant applications, a small percentage of cellulose in a polyester blend composition helps the media absorb and remove some tramp oil from the filter system without adversely impacting coolant flow rate. Polyester has also shown the ability to withstand the range of temperature and pH operating conditions typical of metalworking coolants and washer solutions.

Fiber Diameter and Filtration Characteristics

FIBER DIAMETER vs. MICRON EFFICIENCY

Fiber Dia. (denier)	Fiber Len. (mm)	Micron Efficiency (10μm)	(20μm)	(30μm)
.1	3.0	99.76	99.96	99.94
.5	5.0	37.91	76.50	99.13
1.5	12.7	26.11	52.40	81.04
3.0	19.0	20.53	23.07	39.91
6.0	25.4	21.27	9.50	23.46
15.0	38.1	5.84	16.41	21.41

Figure 5

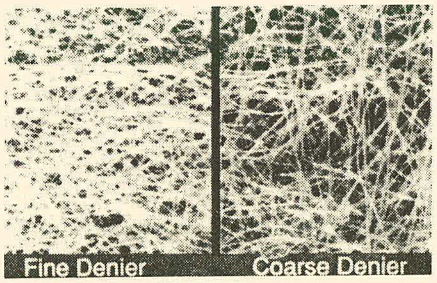

Figure 6

Fiber diameter *(denier)* is a major determinant of the flow characteristics *(poros-ity)*, pore size distribution, and formation uniformity of the filter media, which correlate with filtration efficiency as shown in Figure 5. Figure 6 shows how small diameter *(fine denier)* fibers produce a visually tighter and more uniform filter media at the same basis weight, compared to large diameter *(coarse denier)* fibers which produce a more free-flowing media.

The wet laid manufacturing process is most versatile in its capability to manufacture nonwoven filter media with different sizes and types of fibers to optimize media appropriateness for the intended application.

IN-OPERATION EVALUATION:

Given the important criteria of durability, efficiency, capability, and cost in selecting the optimal filter media for an operation, quantitative methods for comparative evaluation are desirable. This discussion will focus on a logical, sequential approach that uses common lab apparatus and requires minimal training, to enable a technician to perform adequately discriminating evaluations in-house, on a timely and regular basis, and at minimal cost. The collection of all data assumes that the accuracy, repeatability, and reproducibility of the measurement system has been verified.

Durability may be assessed through visual observation of the filter media at the system discharge. No holes or tears at the discharge indicates the physical strength of the media is sufficient. Should holes or tears be evident here, it is necessary to determine whether these voids are occurring on the filter bed (detrimental) or during discharge *(inconsequential unless hindering the discharge mechanism).* Observing the media along the discharge ramp, noting a typically low vacuum or pressure gauge readings or fluid levels, or measuring high solids in the filtrate can serve to determine if the tearing is detrimental to the operation. Systematic tearing *(same location and/or distance apart)* usually indicates corrective action needs to be taken on the filter system. Random tearing may indicate insufficient media strength. Identifying and eliminating the root cause(s) of the tearing, rather than just addressing the symptom with a higher strength media, will enable filter media selection to optimize filtrate clarity and reduce operating costs.

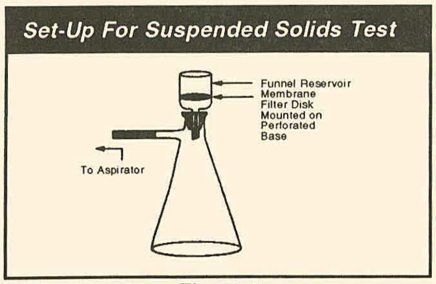

Figure 7

Efficiency may be evaluated by measuring filtrate clarity. This can be done simply by using gravimetric analysis for determining the quantity of suspended solids in the coolant after it has passed through the filter *(see set-up in Figure 7)*. Since tramp oil is also detrimental to filtration efficiency and coolant life, the percentage of tramp oil per sample volume of the filtrate can be measured using a centrifuge method *(typical results are shown in Figure 8).*

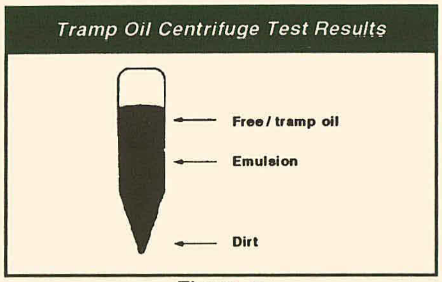

Figure 8

The capacity as well as the efficiency of the filter media are influenced by the thickness of the filter cake *(refer to Figure 3).* Thickness can be measured by penet-rating a steel rule through the cake on a hard, flat surface. Comparisons of filter cake thickness are only appropriate on the same filter system, as the quantity and particle size distribution of particulates created by the manufacturing process also determine filter cake characteristics. A thick, relatively dry filter cake is a good indicator of a well operating filter system.

Cost of the filter media is determined by usage rate as well as price per square yard. Usage rates are determined by measuring index cycle times. Other related costs such as solids disposal, tool wear, coolant usage, and filtration-related rework or scrap *(e.g. surface finish or dimensional nonconformance)* may also be measured and correlated to filter media selection.

A recommended sequence for in-operation evaluation is as follows:

(1) **Establish Baseline Data**: Obtain filtrate samples, measure filter cake thickness, and record index cycle times with the existing filter media operating under a production load (equilibrium assumed).

A minimum of 3 to 5 filtrate samples should be drawn at different times, ideally at the same recorded vacuum or pressure gauge reading. It is important that the production equipment that the production equipment that the filter is supporting be operating steadily, and that the filter system is properly operating. Filtrate samples should be taken at either the cutting tool / work interface, and appropriate plumbing juncture, or from the flow stream into the clean tank—assuring that all samples are taken from the same location with a clean sample vessel. Filtrate clarity is assessed for suspended solids and tramp oil as described above.

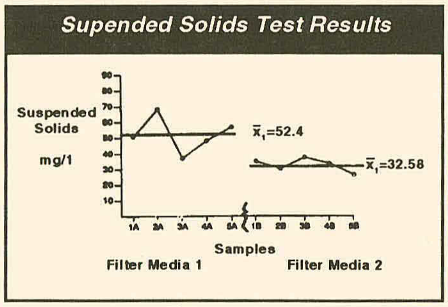

Figure 9

Filter cake thickness should be measured on repeated occasions using a steel rule. Index cycle times can be recorded using a stopwatch if observing, or by noting the difference in the index cycle counter over set time intervals (if the filter is so equipped), or by repeatedly measuring the length of filter media used over set periods of time, preferably starting and ending with an observed system index.

(2) **Install the Proposed Alternative Media Roll:** Manually index the splice through the filter. Allow sufficient time to pass to allow the system to approach equilibrium—a minimum of one day, prior to taking samples or recording numerical data. The durability of the filter media may be evaluated at this time through visual observations described above. Record any noteworthy observations. It is not unusual for a more efficient filter media to initially experience shorter index cycles while the system is being cleaned during this transition phase.

(3) **Collect New Data:** Obtain filtrate samples, measure filter cake thickness, and record index cycle times following the same methodology and under the same system conditions as in Step (1) above, with the proposed alternative media in operation.

(4) **Determine the Significance of Results:** Because of time constraints typical in evaluating filter media, assumptions are necessary which apply results from a short-term evaluation to long-term expectations for the filter system(s) studied and other similarly designed and applied systems in the manufacturing facility. It is therefore important to determine if the results achieved in the short-term comparative evaluation are significant enough to justify a change in filter media. Statistical methods can be appropriately applied for this purpose. The use of the t-statistic for determining statistical significance can be applied to quantitative data collected. Graphing numerical data in time-ordered sequence can readily highlight shifts or trends as shown in Figure 9. The operational significance of these results also requires engineering judgment and knowledge of application requirements.

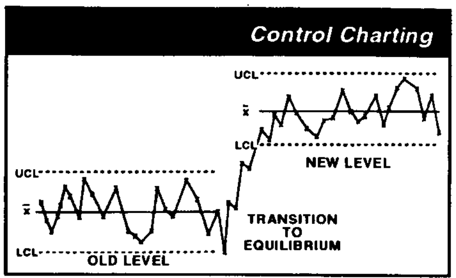

Figure 10

CASE STUDY

FILTER SYSTEM: Hydraulic Vacuum
COOLANT: Water Soluble Oil
OPERATION: Steel Grinding

	TEST #1	TEST #2
MEDIA	Existing Media	1.5 oz / yd² Manniweb 5190
LENGTH OF TEST	10 Days	10 Days
DAILY MEDIA USAGE	100 yds	17.7 yds
DAILY MEDIA COST	$24.02	$7.16
DURATION OF MEDIA ROLL	10 Days	28 Days
AVG. CONTAMINATION LEVEL	4.9 mg / 1	0.4 mg / 1

COST SAVINGS: Daily Systems Cost Savings = $16.86
Reduction of roll change labor
Improved Surface Finish

NOTE: Significant **operating** cost savings were achieved despite the fact themedia in Test # 2 had a higher price per square yard than the existing media in Test # 1.

Figure 11

(5) **Make the Filter Media Decision:** The selection is based on the above comparative evaluation results.

(6) **Assure Results and Control the Process:** The use of control charts / SPC enables the plant to confirm over time the improvements expected based on the short-term evaluation and subsequent filter media selection (an example for index cycle times is shown in Figure 10). The control chart becomes a tool for on-going monitoring, troubleshooting and controlling the filtration process. This process data also becomes a baseline for future evaluations as part of the continual improvement of manufacturing quality, productivity, and cost position.

CONCLUSION

The selection of filter media is a primary determinant of the operating efficiency and cost of the filtration system(s) and the resulting quality and productivity of the manufacturing operation(s) serviced. Using simply understood and implemented, logical, quantitative methods for filter media comparative evaluation and selection can produce significant operating cost savings that can be measured *(see Case Study in Figure 11)*. Cost savings related to improved filtration can be improved parts quality (less rework/ scrap), improved productivity, less fluid/ chemical consumption, longer filter system efficient life, reduced media usage, less system maintenance, less downtime, and lower solid and coolant waste disposal costs.

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INTERPRETING THE RATING OF CARTRIDGE FILTERS

Associate Editor's Comments:
The following paper discusses the different filter ratings currently used in the filtration industry and their inadequacies.

AUTHORS
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ABSTRACT

Cartridge filtration of water is used in many industries. It is often the case that the required purity of the water being filtered is extremely high and that the presence of even very low concentrations of fine particles can have a potentially devastating effect on the process for which the water is needed.

In such situations it is important for the user to be aware how the available filters will perform. At present there are cartridge filters available with ratings of less than 0.1μm but there is some confusion as to what these ratings represent.

In this paper the rating of filters is considered and the inadequacies of the ratings discussed with reference to recent studies by the authors and other workers.

INTRODUCTION

One of the most poorly understood terms in cartridge filtration is the filter rating[1]. The confusion arises partly because there are "absolute" and "nominal" ratings in use. An absolute filter is one which is said to remove virtually all particles (> 99.99999999%) larger than the rated pore size[2,3]. These tend to be screen filters which remove particles whose dimensions are too large for them to pass through the opening of the filter.

A nominally rated filter is one for which it is not possible to assign an absolute rating on the basis of pore size because the pore size is not well defined. Depth filters fall into this category. A nominally rated filter may be said to remove 90-95% of particles larger than the nominal rating[2]. The distinction between the two types of filter is based on how accurately the pore size distribution of the filter media can be defined and measured rather than on the retention efficiency for given particle sizes.

As the nominal ratings do not make any specific claim regarding filter performance it is not appropriate to devote too much time to an analysis of such ratings; they simply serve as a guide to the user. However, the extent to which nominal ratings can be used as a guide is limited[4]. On the other hand, absolute rated filters are often used in situations where complete removal of all particles above a certain size is desired. Examples are the pharmaceutical industry where organisms must be removed to allow the liquid stream to be "cold sterilized" and the semiconductor industry where particles one tenth of the minimum device feature size are thought to be critical to the process[5]. It is therefore important to know whether absolute rated filters perform according to their rating.

ABSOLUTE RATING OF CARTRIDGE FILTERS

Absolute ratings of membrane filters were developed according to the requirements of the pharmaceutical industry[6]. Membrane filters were rated according to their ability to retain bacteria. Filters which produced sterile effluent when challenged with 10^7 Pseudomonas diminuta per square centrimetre of filter surface area under standard conditions were considered absolute rated sterilizing filters. These filters were accepted as 0.2 μm absolute rated, although it is known that the organism is larger than 0.2 μm. Although this method of rating filters is absolute with respect to removal of the Pseudomonas diminuta organism, it is clearly unacceptable as a method of rating a filter as absolute for 0.2 μm particles[7].

In order to determine by a non-destructive test the retention level of every filter manufactured, the bubble point integrity test is used. The pressure required to overcome the capillary forces in the pores of a fully wetted membrane is inversely proportional to the pore diameter. When pressure is applied to the pores of a wetted membrane the liquid from the largest pores will evacuate first. The pressure at which the capillary forces are first overcome is the bubble point value, and this indicates the size of the largest pore.

If the bubble point value is known for a membrane which is known to be absolute for Pseudomonas diminuta, other membranes with the same bubble point value may be assigned the same rating. However, when such a membrane is assigned a rating of 0.2 μm and, even worse, when a membrane with a bubble point value twice that of the membrane absolute for Pseudomonas diminuta is assigned a rating of 0.1 μm, it is not possible to say that the absolute rating is equal to the diameter of the largest pore.

DISCUSSION OF RECENT WORK

In their work concerned with rating of membrane filters Roberts et al[6] challenged membranes with latex spheres under conditions designed to maximize penetration by adding surfactant, and found that the efficiency of several membranes at the rated size was considerably less than 100%. They quote results for one 0.1 μm rated membrane showing a retention efficiency of 33% with 0.106 μm latex spheres, less than 80% with 0.215 μm spheres and 100% with 0.222 μm spheres. In fact, of the three 0.1 μm rated membranes tested none of them retained as much as 10% of the challenge with 0.110 μm spheres.

Whilst these results do not represent the performance of such membranes in ultra pure water, they do indicate the presence of pores in the membrane which are significantly larger than the rated size.

Recent work by Grant[3] has shown that the retention efficiency of membrane filters varies with filter loading. A 0.45 μm rated membrane filter was found to have an initial log reduction value (LRV) of 2 when challenged with 0.442 μm particles, falling to less than 1 as the loading on the filter increased. This was carried out under conditions where sieving was the dominant capture mechanism. With 0.527 μm particles the same filter had an initial LRV of 4.5 falling to 2 with loading. There were even measurable concentrations of particles as large as 0.66 μm penetrating the filter.

There are two points of interest regarding filter ratings.

Note: the log reduction value is given by:

$L\,RV = \log_{10}(C_1 / C_0)$

where C_1 = concentration of particles at filter inlet

C_0 = concentration of particles at filter outlet

Table 1 shows the relationship between LRV and retention efficiency

Retention efficiency (%)	LRV
90	1
99	2
99.9	3
99.99	4
99.999	5

Table 1
Relationship between retention efficiency and LRV

Figure 1 shows the kind of response reported by Grant for different particle sizes on a 0.45 μm rated filter.

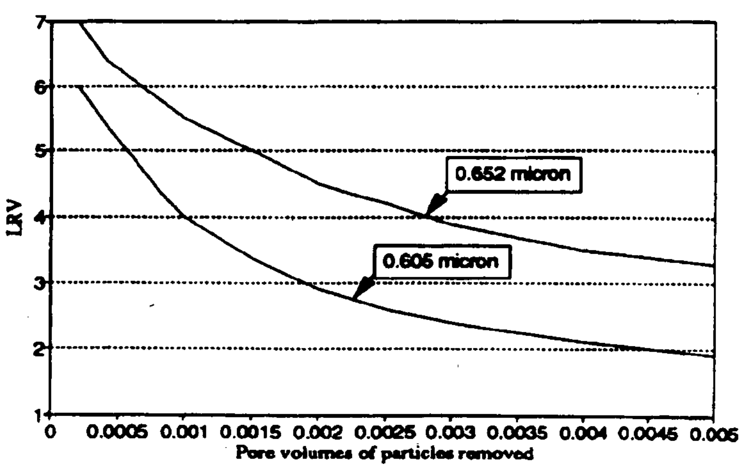

Figure 1
Typical responses of a membrane filter challenged with different particle sizes (from Grant[3])

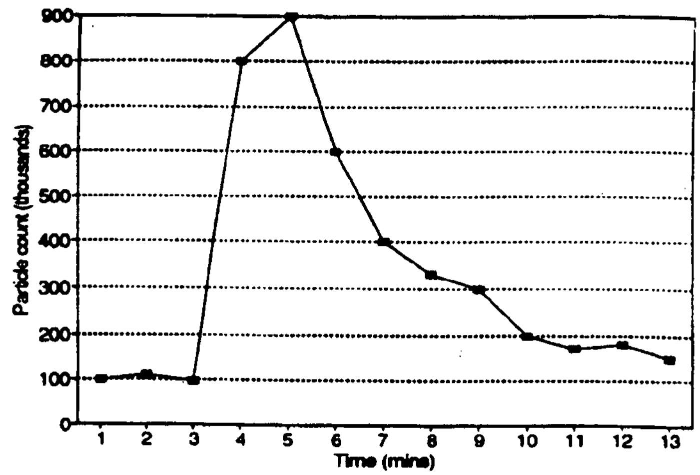

Figure 2
Impulse in upstream concentration

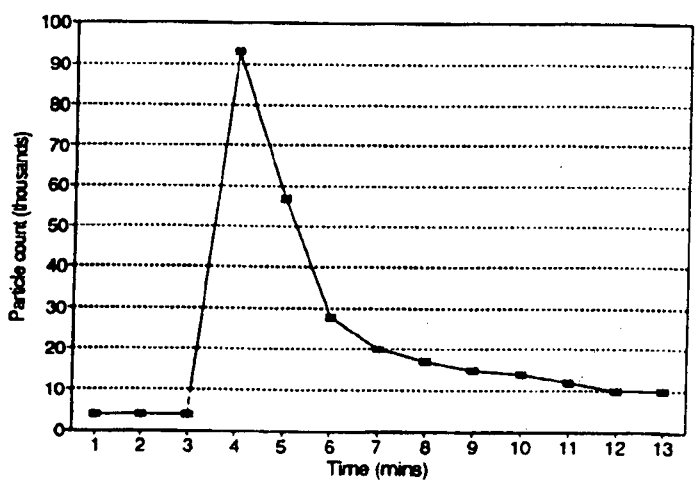

Table 3
Downstream response to upstream impulse

Firstly, particles significantly larger than the rating of the filter are allowed to pass in measurable quantities, showing that there are pores larger than the rated size. In fact, for particles of similar size to the filter rating the retention efficiency is between 99% and 99.9%, well below what would be expected if there were no pores larger than the rated size.

Secondly, as the loading on the filter increases the efficiency falls. A model has been developed by Grant describing the change in efficiency with loading. As the loading on the filter increases the smaller pores block resulting in a redistribution of the flow through larger pores for which the capture efficiency is less. The model and the experimental data are in reasonable agreement. The fall in efficiency is noticed for particles as large as 0.66μm challenging a 0.45μm rated membrane filter, showing that there are pores significantly larger than the rating.

Similar results have been noticed by the authors in their work on the transient nature of cartridge filtration[7,8]. One filter with a nominal rating of 0.45 μm was challenged with a range of particle sizes. In the event of impulses in the upstream concentration it was found that there was a temporary increase in penetration for particles in the range 0.46 µm to 0.65 µm. A typical response for the filters are shown in Figures 2 to 4.

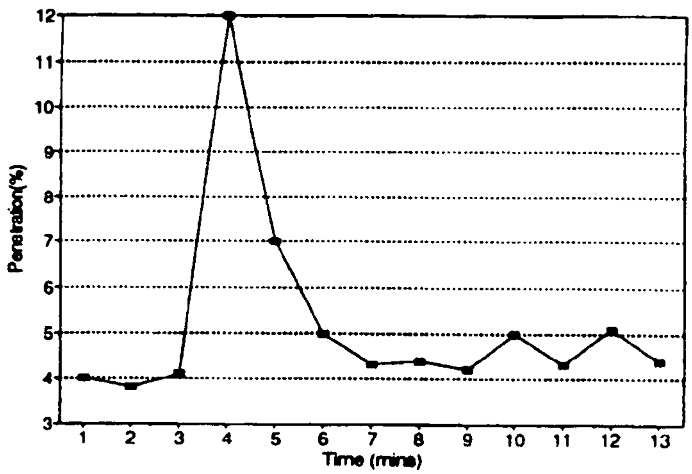

Figure 4
Penetration in the event of an upstream impulse

The response has been described in terms of a temporary blocking of smaller pores in the event of the very high concentration impulse and a resulting redistribution of flow through the larger pores. It would be expected that a nominally rated filter would have a wide size distribution with pores significantly larger than the rated size, but the same effect was observed for two membrane filters which were absolute rated 0.4 µm and 0.45 µm. Both membrane filters showed increased penetration at high challenge concentration with 0.46 µm particles, suggesting that there are pores larger than this in the filter media.

The above work was carried out using 18 MΩ-cm water at a constant flowrate of 10 1/min..

CONCLUSIONS

There are inadequacies in the ways in which filters are assigned absolute ratings. Despite the fact that the absolute rating is intended to represent the largest pore size in the filter media, work described by three independent groups in this paper shows that there are pores significantly larger than the rated size in absolute rated filters. It is clear that some changes to the rating system are required, either to more accurately measure the pore size or to base rating on penetration of known sized particles under standard conditions.

If pore size is to be used as the basis of a rating system this will not represent the performance of the filter but will be a measure of a physical property of the filter which will indicate the size of particle which is too large to penetrate under any conditions unless the pores are enlarged by some means such as pulsating flows. Such a system would give rise to a "worst case" rating. If efficiency under standard conditions is to be used then the user must be aware that under different conditions the filter performance may not match the rating. Either way, some standardization is needed to make the ratings more meaningful.

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SELECTION OF CARTRIDGE FILTERS FOR CLARIFICATION OF LIQUIDS

Associate Editor's Comments:
The following paper offers information on how an appropriate cartridge filter can be selected for clarification of liquids. This paper was presented at a meeting on "Cartridge Filters" which was organized by The Filtration Society and was held at the Forte Posthouse, Birmingham Airport on March 17, 1992.

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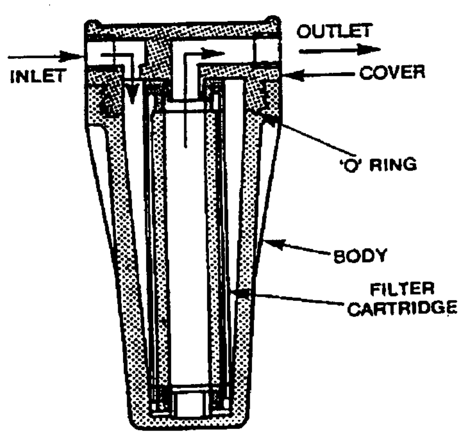
SUMMARY

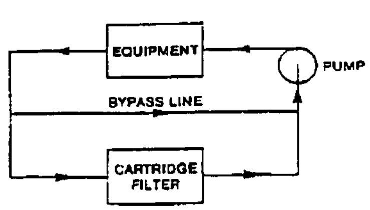
The selection of cartridge filters for clarification of a wide range of liquids is discussed with reference to the removal of particulates ranging in size from sub-micron to around 50 micron at contaminant levels below 100 ppm. The mechanisms of filtration and the types of filter available are described. The influence of a series of selection factors on cartridge filter selection is reviewed.



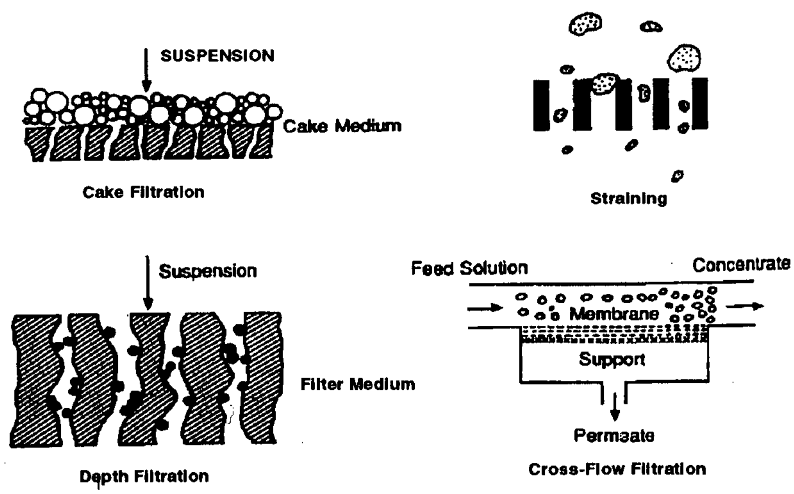
SINGLE ELEMENT CARTRIDGE FILTER

FULL FLOW CARTRIDGE FILTRATION

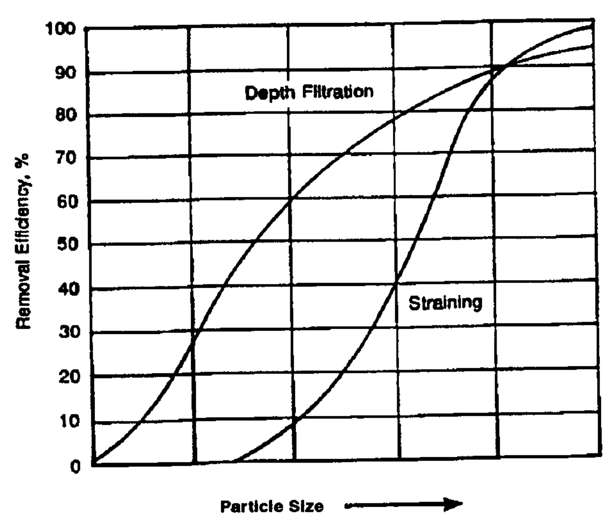
USE OF PRE-FILTER IN STERILISING FILTRATION



CARTRIDGE FILTER IN A BYPASS SITUATION



Filtration Mechanisms

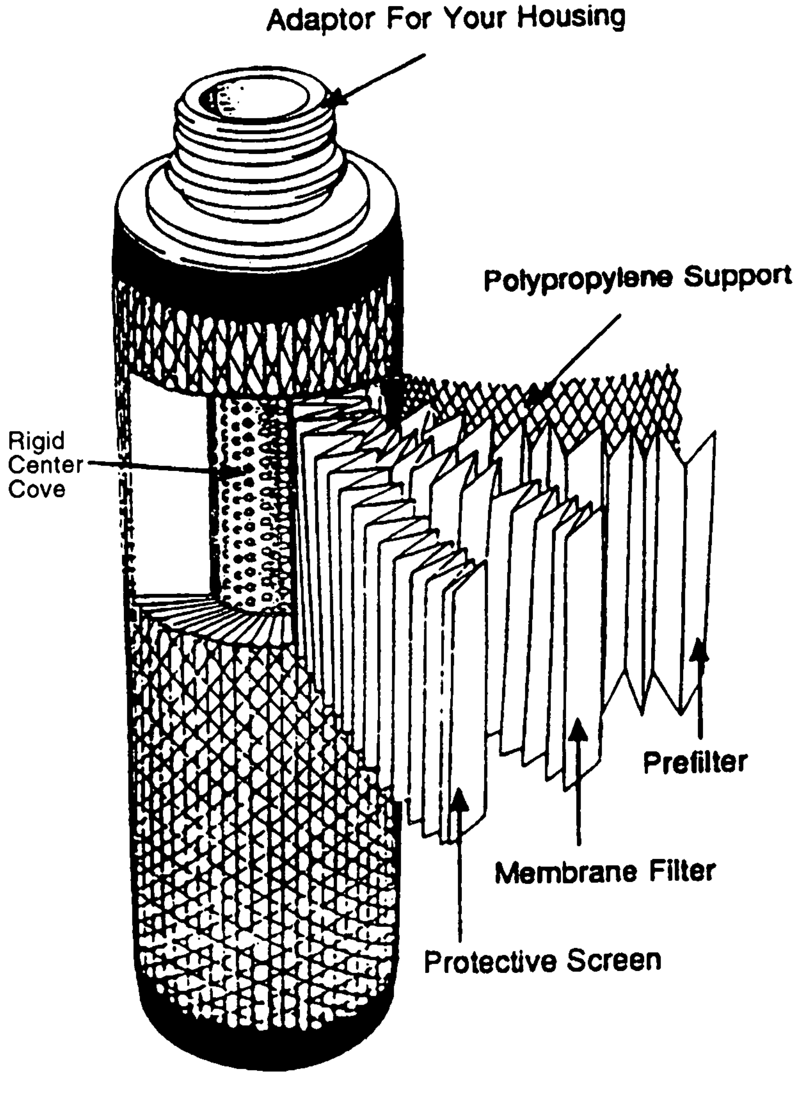


TYPES

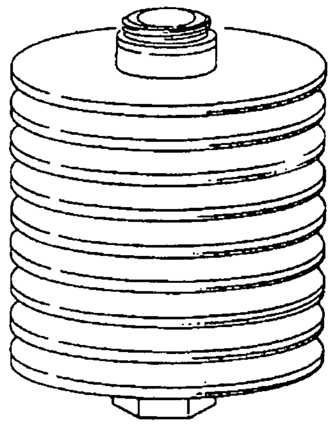
- sheets - homogeneous, asymmetric, track etch
- sintered powder
- wound fibre - graded density
- bonded fibre
- wound felt
- edge filter

SELECTION PROCEDURE

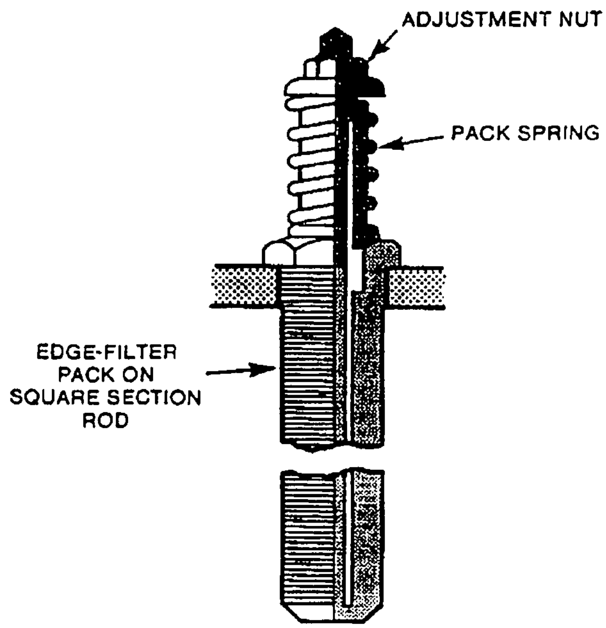
- select types
- consult manufacturer's catalogues
- obtain further advice from manufacturers / consultants
- testing - on a sample of feed or in plant



Multi-layered Pleated Membrane Cartridge



SINTERED METAL DISC CARTRIDGE ELEMENT



MATERIALS

CARTRIDGE

- metals, plastics, cellulosic, glass fibre, ceramic
- sealing / bonding / surface modification seals

HOUSING

- pressure, temperature, surface finish

OTHER FUNCTIONS

- shearing
- removal of colour or odour
- bacterial control

SELECTION FACTORS

- compatibility with feed
- (pressure, temperature, corrosion swelling)
- compatibility with sterilisation / sanitisation
- particle size captured
- release of particles
- contamination of filtrate with soluble components (pre-flush)
- dirt holding capacity
- pressure drop - flowrate
- disposable or cleanable
- quality control in manufacture