First International Congress On Ultraviolet Technologies

Washington, DC -- June 14-16, 2001
Hyatt Regency on Capitol Hill

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A Revised Directory of Ultraviolet Companies*

* See pages 35 -- 41
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Dual wavelength UV lamp reactor and method for cleaning/ashing semiconductor wafers, RHIEU, Ji Hyo (Amtech Systems, Inc.). U.S. Patent No. 6,143,477, Nov. 7, 2000. Abstract unavailable. Do any of our readers have a copy of this patent and can send it or the abstract to the Editor??
Dear Friends:

On June 16, 2001 at the First IUVA Congress during the General Assembly Meeting, I will have the pleasure of turning over the reigns of this great, young organization to Dr. Jennifer L. Clancy our president-elect. Jen is an outstanding scientist, businesswoman and professional leader as well as a dear friend. I cannot think of a better person to hand an organization, which I very much regard as 'my baby'. Many of my associates have commented to me as June approaches that 'the end is near'. Actually, it is merely the end of the beginning and what a great beginning it has been. I wish to thank all of the founding members of the IUVA for countless hours of help and for their support and trust. It has been an honor to serve the IUVA. I also need to thank my family: Joyce, Brian, Shannon; my graduate students and the University of New Hampshire for allowing me to spend hundreds of hours away from their needs in the hopes of helping the IUVA. Many of you know that I love numbers and that I have a passion for UV so I thought I would share with you all the finally tallies - between April 21, 1999 and June 16, 2001, I have traveled 365,900 air miles to six countries and delivered 142 talks on behalf of and at no cost to the IUVA. It has been a chance to professionally serve people in my career that I had only prayed for and will cherish always.

After much reflection, I want to share a few of my hopes for the future of the IUVA:

Embracing True Diversity: The IUVA was founded on the premise that anyone can play. The IUVA must continue to work hard to be a truly diverse and International Organization. I believe we have the correct model with one board of directors to which anyone within our association can be nominated and one International office. We must work hard to keep aware of the International needs of the association. Where possible, we must encourage and support IUVA meetings in all quarters of our world. It is also essential that IUVA embrace our youth. Age diversity is often overlooked in an association, and we must work daily to strike that powerful balance between the wisdom of our senior members and the spirit and enthusiasm of our younger members. One of my first steps after finishing my term as president will be to ask the IUVA Board to allow me to chair an IUVA Student Activities Committee.

Slow and Measured Growth: From the time the IUVA began there were immediate and numerous discussions about how fast the IUVA should grow or what organizations the IUVA should merge with. In my view the IUVA has no need to rush nor strive for some sort of exponential growth. IUVA is not a publicly traded investment beholdings to demanding stockholders -- we are simply a small group of professionals dedicated to advancing the knowledge of UV for the benefit of people. Slow and carefully evaluated moves to allow IUVA to grow into areas where we are needed are the intelligent and sustainable approach. Similarly, it is my view that the IUVA has much to offer and should strive to be on good terms with all related associations, but we should not surrender our individuality by merging for the sake of some potential financial or administrative benefit. Whenever asked by other associations to collaborate on joint conferences or other events, it is extremely wise for IUVA to negotiate in good faith and proceed with such collaborations.

Information Technology: The contributions of IUVA are measured by how well we communicate information to our membership. As a young association we have been truly blessed with the daily contributions of five talented individuals: Rip Rice, Editor and Jim Bolton, Associate Editor for IUVA News; Bryan Townsend, Founding Webmaster and Laurel Passantino, Current Webmaster of www.IUVA.org; and Kathy Harvey, IUVA Administrative Assistant. Frankly, the IUVA would simply not exist nor function without the daily efforts of Rip Rice, Jim Bolton and Kathy Harvey. However, the role and objectives of IUVA News, the very place you are likely reading this letter, have frequently been misunderstood due in part to my desire as Chair of its Editorial Board to get timely articles into the hands of our membership. As conceived of and developed by Rip Rice, IUVA News was and is intended to be a newsletter open to information provided by all sectors that relate to UV technologies. IUVA News was never intended to be a peer reviewed journal nor a reflection of IUVA Board policies and practices. It is my sincere hope that the role of IUVA News can be clarified in the near future through the development of a separate on-line peer reviewed journal. After finishing my term as president I will ask the board to allow me to chair a committee to evaluate the feasibility of creating on-line Journal IUVA.

The Business of UV: If I could place my finger on the one area in which I was ill-prepared to lead the IUVA it has been in striking that delicate balance between the mission of IUVA and
the business of UV. A stark reality for any association is that it takes money to accomplish one's mission. Raising the needed funds requires a dedicated membership and dedicated corporate sponsors. Corporate sponsors are placed in the toughest position of all since they willingly help pay for the association but then are asked by that same association to leave their business tactics at the door as they enter the IUVA board meetings. Nevertheless, I firmly believe that the IUVA simply cannot involve itself in the business of UV. The business of UV is at best an intense financial game played by risk-takers and at worst an all out financial war zone. IUVA simply cannot take positions or take sides or make public statements about UV business tactics. IUVA must continue to follow its mission statement: "To advance the science, engineering and applications of Ultraviolet technologies to enhance the quality of human life and protect the environment." Let all of us at IUVA never forget that first and foremost we are about improving the quality of life.

I close by asking each of you to join me in offering your full support and by wishing Dr. Jennifer L. Clancy all the best wishes, good fortunes and success as the new IUVA President.

Kind Regards,

James P. Malley, Jr., Ph.D.
Past President IUVA

Report from the IUVA Executive Director
Jim Bolton

Many IUVA Members may not be aware of what the IUVA Executive Director does, so I thought I would say a few words about my job.

- I and Kathy Harvey, IUVA’s Administrative Assistant, constitute the IUVA International Headquarters Office. We, plus Rip Rice, the Editor of IUVA News, are the only persons who receive compensation for our work for IUVA.
- I receive an “honorarium” of $1,500 (U.S.) per month.
- I am appointed by the IUVA International Board of Directors and report directly to the International President and the Board. I also serve as the IUVA International Secretary and have been appointed as Associate Editor of IUVA News.
- I devote at least 4-5 days per month to IUVA business; this includes:
  - Calling prospective Corporate members with a personal invitation to join IUVA,
  - Making sure that the IUVA Bylaws are being followed

and that proper procedures are followed in the conduct of business at IUVA Meetings,
- Trying gently to get Board Members to carry out their duties (sometimes this is a challenge!),
- Preparing a draft of the annual IUVA Budget for the International Treasurer,
- Taking careful notes and write accurate minutes of meetings,
- Answering and managing over 110 emails on IUVA business per month,
- Writing at least one major article for each issue of IUVA News,
- Organizing special projects, such as the "Buyer's Guide" for IUVA News,
- Speaking on behalf of IUVA at numerous events and making sure that enough copies of IUVA News (very heavy!) are available to hand out.
- Managing the affairs of the International Headquarters including signing all checks for IUVA expenditures.
- Helping with the organization of the First International Congress on Ultraviolet Technologies in Washington, DC.

Your Executive Director will be going through some significant life changes over the next several weeks:
- I am getting married in late May, and we are going to relocate to Edmonton, Alberta as of the end of July 2001.
- I have made arrangements so that I can carry out all of the duties of Executive Director and Associate Editor of IUVA News from my new location.

I always welcome suggestions as to how I can serve IUVA in new and better ways.

Issue Theme #5/2001: UV in Small Systems

Publication Date : 1st October 2001
Article Inputs : 1st September 2001
Advertising Input : 15th September, 2001

Issue #5/2001 is earmarked for concentrating on stories relating to small systems using UV for whatever purpose(s), e.g., air, water, foods, curing, etc. The Editors of IUVA News solicit various input(s) according to the schedule highlighted in the box above. Those interested in submitting articles for this upcoming issue, please contact Dr. Jim Bolton as soon as practicable for details and to “sign up”. <jbolton@iuva.org>. Those interested in advertising in this specific theme issue, please contact the Editor-in-Chief, Dr. Rip Rice <Rrice@iuva.org>.
Test Your Knowledge of Ultraviolet Disinfection

A Quiz taken from WE&T, May 2001, p. 82

True or False

1. T F In an ultraviolet (UV) system, solarization reduces the quartz sleeves' ability to transmit the necessary amount of UV radiation to the process.

2. T F Under normal conditions, when an operator needs to clean a single module of a sleeve in the UV system, the disinfection process must be stopped.

3. T F The best cleaning solutions for a quartz sleeve are nitric acid and phosphoric acid.

4. T F Between 30% and 40% of the decrease in a lamp's output occurs during the first 7500 hours.

Multiple Choice

5. Ultraviolet lamps contain which of the following hazardous substances?
   A. Hydrogen sulfide
   B. Chlorine gas
   C. Mercury vapor
   D. Methane

6. Which of the following affects the UV system efficiency?
   A. Turbidity
   B. Detention time
   C. Water temperature
   D. pH

7. Ultraviolet disinfection is becoming more popular because UV systems
   A. Reduce capital costs.
   B. Conserve energy.
   C. Require no maintenance.
   D. Eliminate safety concerns about handling chlorine.

8. In the process of ultraviolet disinfection, the final effluent is irradiated by light at a wavelength of
   A. 122 nm.
   B. 254 nm.
   C. 377 nm.
   D. 486 nm.

Answers on page 11.

International Ultraviolet Association
Second General Assembly

Notice of Meeting and Agenda

4:30 – 5:30 pm, 16 June 2001, Hyatt Hotel, Washington, DC

Agenda

9. Call to Order
10. Determination of a quorum.
12. Reports
13. International President – Jim Malley
14. Executive Director and Secretary – Jim Bolton
15. International Treasurer – Jim Cosman
16. Report of the Nominating Committee – Bob Cushing
17. Amendments to the Bylaws
18. Other business
19. Adjournment

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INTERNATIONAL ULTRAVIOLET ASSOC.
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Oil Rig Wastewater Treatment Includes UV

WAGENINGEN, THE NETHERLANDS -- Triqua BV will design, manufacture, test and deliver a wastewater treatment system based on the membrane bioreactor principal onto a man-made island in the Caspian Sea. On the island, a land-drilling rig for oil exploration and a self-contained accommodation module, together with all support services, will be installed. The island population, consisting of up to 120 people, will generate a series of waste streams, including domestic sewage, kitchen waste, laundry waste and the washroom waters used for washing and showering.

The Kazakh authorities have demanded very stringent discharge standards to protect the sensitive environment, including sturgeon, which is of great economical importance for the production of caviar. In addition, the environmental conditions in the Caspian Sea are very severe, with temperatures in the summer up to +45°C and in the winter down to 4°C. To meet these standards, wherever possible the final treated effluent will be recycled, with the remaining water returned to the Caspian Sea.

Triqua will supply a membrane bioreactor system, which combines biological treatment with membrane filtration, to treat the wastewater streams. This combination results in a very compact system with a very good effluent quality, which provides the possibility for water reuse, according to the company. The treatment system includes pretreatment, post-treatment and sludge treatment. The pretreatment consists of grease traps, a tilted plate separator and a drum sieve; the post-treatment consists of activated carbon filters, ultraviolet disinfection and bactericide dosing; and the sludge treatment consists of sludge preconditioning and a filter press. The dewatered sludge will be incinerated on the island. The whole system will be located in three air-conditioned 40-foot containers.

In October the system will be transported by truck from Wageningen to Kazakhstan. The treatment system could be in operation by November.

The oilfield in the Caspian Sea is the biggest in the world found in the last 30 years with an estimated oil reserve of 8 to 50 billion barrels. The field will be developed and operated by the Offshore Kazakhstan International Operating Co. (OKIOC) on behalf of the Kazakhstan Authorities. OKIOC is a consortium of Exxon-Mobil, Shell Group, BP Amoco, British Gas, TotalFinaElf, Statoil, ENI (Agip), Inpex and Philips Petroleum, with Agip assuming the role of operator for the field development. The artificial island will be made in a shallow part of the Caspian Sea, approximately 70 kilometers outside the coast near the city of Atyrau.

From WaterTech.online May 24, 2001 <watertechonline.com>

Trojan and PWN Team Up

LONDON, ONTARIO, CANADA -- Trojan Technologies Inc. has entered into an agreement with N.V. PWN Water Supply Co. North-Holland (PWN) to collaborate in the research, design, optimization and installation of ultraviolet (UV) treatment systems. These systems will provide both primary disinfection and an additional barrier against organic micropollutants, including herbicides and pesticides. The systems use UV technology, in combination with hydrogen peroxide ($H_2O_2$) in a process called advanced oxidation, to destroy organic contaminants in water and wastewater.

"We are extremely pleased to have established this relationship with PWN, a recognized leader in the treatment and supply of top quality drinking water in Europe, to implement a lasting solution to a difficult micropollutant problem," said Hank Van der Laan, president and CEO of Trojan Technologies.

"We selected Trojan Technologies after an extensive review process," said P.C. Kamp, director of production for PWN. "Trojan has fully demonstrated its abilities in both research and development of UV products for drinking water, and we look forward to combining their research and design capabilities with our expertise in advanced drinking water treatment."

The project, expected to be completed over a 2-1/2-year period, has three phases. The first two phases are joint research and development phases involving piloting and prototype testing at a major municipal drinking water treatment plant in the Netherlands.

PWN has conducted research on the effectiveness of UV light and advanced oxidation for more than five years. The combined effort, leveraging the unique expertise of both parties, will optimize the configuration of the final design. The third phase is the final equipment manufacture, delivery and installation of UV disinfection and advanced oxidation equipment. The
agreement provides that Trojan retains all intellectual property rights associated with the project.

The drinking-water treatment plant, located at Andijk, the Netherlands, serves approximately 500,000 people and treats approximately 25 million cubic meters of water per year. It is expected to be the largest installation involving UV technology in Europe and is the first of its kind to treat micropollutants.

Trojan Technologies is a Canadian-based, high-technology environmental company operating internationally. PWN is one of seven water supply companies in The Netherlands and delivers potable water to more than 2 million people across the entire province of North-Holland.

"The system provides peace of mind for our 30 service communities who no longer have to worry about Cryptosporidium and Giardia, the potentially deadly microscopic organisms that threaten people with suppressed immune systems, such as children, the elderly and those who are ill," said William Wunderly, West View Water Authority’s board chairman.

"The selection and installation of the state-of-the-art Sentinel system continues West View Water Authority’s proud tradition of being a true, proactive leader committed to delivering high-quality water to our roughly 200,000 customers," said Dan Daugherty, Executive Director of the authority.

According to Bob O’Brien, Senior Vice President of Calgon Carbon, "as a Pittsburgh-based company, Calgon Carbon is extremely proud to install the largest UV System in the United States, and the first in Pennsylvania, here in our own backyard at West View Water. Given our respective histories of being true innovators, this was a natural partnership for Calgon Carbon and West View Water. The fact that the benefits of the Sentinel system will be realized here in the Pittsburgh region only adds to our enthusiasm for this project."
HENDERSON, NV, USA: Henderson will be getting the first state and US Environmental Protection Agency (EPA)-approved ultraviolet (UV) drinking-water treatment plant with Cryptosporidium-inactivation capability in the United States. The city has awarded a contract for the plant to the British company Hanovia, through its American sister company, Erlanger, KY-based Aquionics Inc.

The UV plant, scheduled for completion this year, will provide at least 99-percent inactivation of Cryptosporidium oocysts, the infective stage of the organism. The system allows for 33-percent redundancy and will treat up to 70,000 cubic meters of water per day from nearby Lake Mead.

"We are excited about utilizing this technology," said Mike Morine, project engineer for the city of Henderson. "We take our commitment to the health and safety of our residents very seriously and we are implementing this project to provide the best possible disinfection for our community."

Henderson selected Hanovia and Aquionics after an international search in conjunction with the Nevada State Health Division and the engineering firm CH2M Hill.

A water purification system which fits into two suitcases and can convert any source water -- even seawater -- into drinking water, is ready to be flown out direct to disaster and war zones, if sponsors can be found.

Water engineer, Ron Hire of Hydromatic UK has used his years of experience working on UN water projects in Western Sahara -- and a lump sum from his pension -- to develop the unit which can supply up to 4,000 liters of drinking water per day Mr Hire said, 'If we can get these units on to a plane they can provide drinking water to survivors of disasters such as the recent earthquakes in Gujarat and El Salvador within two hours of arrival on site. Children and the elderly are the most vulnerable to waterborne diseases such as E. coli and quick access to clean drinking water is vital.'

Hydromatic purifies water to WHO and EC standards by reverse osmosis, then it is sterilized by UV and chlorine, immediately prior to point of delivery or for bulk storage. Mr. Hire points out that it takes only a liter/day to keep one person alive, which he could do with his units until the major NGOs arrived with their full-scale purifying equipment.

'Ideally, I'd like to have these units on standby at airports ready to fly out at a moment's notice with trained volunteer operatives,' said Mr Hire. To fly out a single unit with operator from the UK will cost between $4,000 and $5,000. Hydromatic worked closely with UK water technology company Hydrochem, to develop the compact purifier. For more information about the units and sponsorship details, email-- info@hydromatic.co.uk.
The Main San Gabriel Watermaster, The Upper San Gabriel Valley Municipal Water District, and the San Gabriel Basin Water Quality Authority jointly funded the La Puente facility, with design and permit applications provided by Stetson Engineers of West Covina, California.

Medical studies indicate that perchlorate, a key ingredient in rocket fuel and explosives, interferes with the normal functioning of the thyroid. Because of this potential health hazard, the CADOHS has established an Action Level of 18 parts per billion for perchlorate in drinking water.

Commenting on the announcement, Robert P. O'Brien, senior vice president of Calgon Carbon, said, "The award of the operating permit was the culmination of a two-year approval process. The permit represents a milestone in bringing pure drinking water to over a million people in the San Gabriel Basin."

Calgon Carbon Corporation (www.calgoncarbon.com), headquartered in Pittsburgh, Pennsylvania, is a global leader in services and solutions for making air and water cleaner and safer. The company employs approximately 1,000 people in 13 carbon manufacturing, reactivation and equipment fabrication facilities and 12 sales and service centers.

The primary aim of UV is the destruction of chloramines, the compounds responsible for the unpleasant smell and atmosphere often found in a pool environment. An important secondary action, however, is to kill any bacteria, viruses and molds in the water. Combined with reduced chlorine usage, this results in a safer, more pleasant atmosphere for bathers.

Norman Buck, maintenance manager of UEA, concluded after comparing protocols in other pools that UV represented 'a very clean and efficient way of killing bugs'. After installing and running Hanovia's UV system, the first microbial test showed levels of contaminants to be so low they were statistically insignificant. He continued: 'Customer feedback has been good; we are often told how much nicer the atmosphere is in this pool, compared with others our customers have visited.'

The 50-m pool, one of only nine other Olympic sized swimming pools in England, was opened to the public in September 2000 and features flooring that may be raised or lowered and a boom, a movable divider separating shallow and deep water. The pool was built as part of a new development, the East Anglian Sports Park, to accompany the existing athletics track at UEA, and the complex now offers activities ranging from martial arts to wall climbing.

Issued by: Hanovia Limited, 145 Farnham Road, Slough, Berkshire SL1 4XB. Web site: www.hanovia.net

Company contact: Sean Appleton. Tel: 01753 515328. Fax: 01753 534277. E-mail: sales@hanovia.co.uk

Answers to UV Disinfection Quiz (p. 6)

True or False

1. True. (Reference: Operation of Wastewater Treatment Plants, Vol. 1, Ch. 10, p. 424.)
2. False. If the other modules remain on-line while the one module is being cleaned, continuous disinfection is possible. (Reference: Operation of Wastewater Treatment Plants, Vol. 1, Ch. 10, p. 425.)
3. True. (Reference: Operation of Wastewater Treatment Plants, Vol. 1, Ch. 10, p. 425.)
4. True. (Reference: Operation of Wastewater Treatment Plants, Vol. 1, Ch. 10, p. 425.)

Multiple Choice

5. C - Mercury vapor. (Reference: Operation of Wastewater Treatment Plants, Vol. 1, Ch. 10, p. 424.)
6. A - Turbidity. (Reference: Operation of Wastewater Treatment Plants, Vol. 1, Ch. 10, p. 424.)
7. D - Eliminate safety concerns about handling chlorine. (Reference: Operation of Wastewater Treatment Plants, Vol. 1, Ch. 10, p. 422.)
8. B - 254 nm.
UV Lamp Validation via a Bioassay Equals Reality

G. Elliott Whitby, Bill Sotirakos, and Barbara Mellor

SUNTEC environmental, 106 Rayette Road, Unit #1, Concord, ON, Canada L4K 2G3
cwhitby@suntecuv.com

During the 1980's and early 90's the majority of UV systems for disinfecting wastewater used the same lamps and ballasts. Manufacturers made the same low-pressure mercury lamp called a G64T5L and one company made the ballast. The only difference in the lamps was the end connector. The lamps were placed horizontally in the water with a center to center spacing of 6.03 to 7.62 cm. The majority of the systems that were sold had the wastewater flowing parallel to the lamps. A few manufacturers used the same lamps in a horizontal configuration but they used the same ballasts. Now almost every UV manufacturer has UV systems with their own patented or proprietary lamps and ballasts. These UV systems also come with various configurations of the lamps in the water. The outputs of these lamps are usually measured in still air at 20°C and as shown in Figure 1, this may not be indicative of their UV output inside a quartz sleeve under water at 5 to 20°C.

Figure 1: Effect of water temperature on the UV output of a G64T5L lamp operating at 302 mAmps in a 24.5 mm OD quartz sleeve

Even when a sensor under water measures the UV intensity it does not give any indication of how well the UV light is converted into actual germicidal power. At the present time there is no formula for comparing one UV system to another. The UV fluence (UV Dose) provided by a UV reactor can be calculated mathematically or by carrying out a test called a bioassay under controlled conditions with a microorganism which has a known response to UV light. Calculating the UV fluence mathematically has led to exaggerated claims about the performance of UV systems and this has resulted in failures in the field. Two of the major errors are a result of incomplete characterization of the reactor's distribution of residence times and the UV output of the lamps. Therefore, it is very difficult for a consultant or a potential owner to determine whether the claims of the UV manufacturer are true and if the UV equipment will perform once it is installed in a wastewater treatment plant. To alleviate this problem SUNTEC environmental based the development of their UV systems on the use of a bioassay.

The bioassay uses a microorganism with a known response to UV light to measure the germicidal power of a UV system. As the microorganisms pass through the UV system they are affected by all the parameters that determine the performance of the equipment and the UV fluence is measured. If the UV lamps are not performing according to the measurements in air or there is fluid which is short-circuiting through the array of UV lamps or if there is not adequate mixing perpendicular to the lamps, it will be reflected in a UV fluence that is less than what would be expected from the modeling. This will result in a lower flow per lamp to meet the disinfection requirements and higher power consumption per volume of water treated. A cultured microorganism such as the UV-resistant MS2 coliphage or one that is indigenous in the wastewater can be used for the bioassay. The organism is calibrated in the laboratory under exact conditions. The organisms are all subjected to the same UV fluence by being exposed to an exact amount of UV light in a perfectly mixed container. A calibrated curve for the total aerobic spore-formers in the wastewater that was used for these experiments is shown in Figure 2. These organisms are indigenous in all wastewater treatment plants and they can be used to measure the UV fluence of a UV system for ongoing or a single performance validation. Suntec environmental chose the total aerobic spore-formers as their test organism.

The LPX200 was developed with the following differences from the typical UV system where the water flows parallel to the horizontal low-pressure mercury lamps. The ballasts for the UV systems are usually placed in cabinets or above the waterline on the racks that hold the UV lamps. The LPX200 has patented submerged ballasts that are adjacent to each UV lamp and this results in optimal cooling of the ballasts. It eliminates the requirement for large cabinets with some form of cooling. A
low-pressure lamp was developed that produces a higher UV output than the regular G64T5L (26.7 watts of UVC at a wavelength of 254 nm) thereby reducing the number of lamps. The center to center lamp spacing is 8.89 cm instead of 7.62 cm. This lamp, ballast and spacing combination had to be tested and compared to the typical UV system that made up the majority of sales in North America.

Figure 2: Graph of the average fluence (mJ/cm²) within the wastewater versus the Log of NN, of the total aerobic sporeformers

SUNTEC environmental and GAP Environmental Services Inc. of Toronto and London, Ontario, Canada, respectively, conducted an assay and related testing on a LPX200 ultraviolet disinfection system from SUNTEC environmental and a Standard low-pressure UV System using G64T5L lamps which were operated at 525 mA. These are both open channel UV systems where the water flows parallel to the lamps.

The LPX200 consisted of a 6-lamp battery assembled in a 3 x 2 array with centerline spacing of 8.89 cm. The lamps had an arc length of 162.6 cm and were configured horizontally and parallel to the direction of flow. The quartz sleeves had an OD of 23 mm and an ID of 20 mm. The LPX200 UV system was tested beside a Standard low-pressure UV System. The equipment consisted of a 6-lamp battery assembled in a 3 x 2 array with a centerline spacing of 7.62 cm. The lamps had an arc length of 147.3 cm and were configured horizontally and parallel to the direction of flow. The quartz sleeves had an OD of 23 mm and an ID of 20 mm. The lamps were conventional low-pressure lamps that produce 26.7 Watts of UV light at a wavelength of 254 nm in air. The electronic ballasts operated the UV lamps at a current of 525 mA for 100 percent lamp output. The experimental setup is shown in Figure 3.

The bioassays were conducted with undisinfected final effluent from a secondary activated sludge wastewater treatment plant. The UV transmittance of the wastewater was allowed to vary naturally at wavelength of 254 nm. The average UV transmission was 59 percent and the total suspended solids were less than 5 mg/L. These variables were taken into account by being able to compare the LPX200 to the Standard low-pressure UV System at the same time. The UV output of the lamps of the LPX200 was adjusted to 100 percent for the first tests and then to 60 percent to simulate a lower power setting with the variable output ballasts. The LPX200 was tested with flow rates of approximately 681, 757, 946, 1136, 1325, 1514, and 1893 liters per minute. The Standard low-pressure UV system was tested with flow rates of approximately 416, 568, 757, 946, 1136, 1325, and 1514, liters per minute. The results of the testing are shown in Figure 4.

The average UV fluence is equal to the retention time multiplied by the UV intensity. From the bioassay the average UV fluence is known. From tracer studies the average retention time can be calculated. Therefore, the average intensity can be calculated over the range of flows that were tested. This average intensity will be influenced by the hydraulics of the UV system, the UV output of the lamps, and their configuration in the wastewater. The average UV intensity will allow the calculation of the usable UV light produced by the lamps and the configuration of the UV system. Various germicidal wattages of the LPX200 lamp were put into TULIP, the point source summation portion of the UVDIS 3.1 program (HydroQual Inc., Mahwah, NJ, USA), until it predicted the average UV intensity. The average UV intensity for flows from 100 to 300 L/min per lamp was 9.3 mW/cm². With the addition of 10 percent for the losses through the quartz sleeves, this corresponds to an average lamp power of 63 Watts over the flow range that was tested for the LPX200.

On an equal flow per lamp basis the increase in the UV fluence by the LPX200 is 2.2 times that of the Standard low-pressure UV system. If the UV output of the lamps of the LPX200 were to be measured in air it would show a higher UV output, but the 63 Watts that have been demonstrated here is the working portion of the entire germicidal output at a wavelength of 254 nm.

In conclusion, mathematical models and measurements of the UV output of lamps in air are important tools for the designing
and understanding of a UV reactor, but they must be confirmed by experiments that measure the actual disinfection performance of the UV equipment. Validating the efficiency of a UV system and the output of the lamps by a bioassay provides the reality that will give the consultant or potential owner confidence that the UV system will perform as specified.

![Graph](image)

**New Books and Reports**


*Treatment Options for Giardia, Cryptosporidium, and Other Contaminants in Recycled Backwash Water, AWWA Research Foundation Report No. 90832, AWWA Research Foundation, 6666 W. Quincy Avenue, Denver, CO 80235. $125 (AWWA members), $195 (non-AWWA members).*

*ÖNORM M 5873-1, Plants for the Disinfection of Water Using Ultraviolet Radiation -- Requirements and Testing -- Low Pressure Mercury Lamp Plants, in English. Publication date 2001-03-01.*

Price excl. VAT EUR 94,97 / ATS (Austrian Schillings) 1.305,82. Sales contact: Austrian Standards Institute, Heinestrasse 38, A-1020 Wien, Austria. Tel: (00431) 21300-805; Fax:(00431) 21300-818. e-mail: sales@on-norm.at. home: http://www.on-norm.at.
After a five year study with UV:

Chlorine-Free in Karlshamn, Sweden

Iger Hansson, Director of VA of Karlshamn
Submitted by Sean Appleton, Hanovia Ltd., Slough, Berkshire, U.K.

The contents of seven-day heterotrophic bacteria in the pipe network have fallen since the large water works in Karlshamn went over to UV treatment to disinfect the drinking water.

The contents of two-day heterotrophic, coliform and E-coli bacteria have not changed significantly, but in any case they have not increased. After just over five years of studies, our conclusion is that we do not need any chlorine "for the sake of the pipe network".

The Water Works in Långasjön

The Karlshamn local authority supplies approximately 29,000 people with drinking water and handles sewerage for about 28,000 people. The volume of water produced in 1999 was 3.3 million cubic meters. The water works in Långasjön produces more than 98 percent of this quantity.

The water treatment currently comprises chemical precipitation with sedimentation and rapid filtration with UV treatment. The filtering takes place in the first stage using sand as the filter medium. In subsequent treatment, which takes place before the second filter stage, carbon dioxide and lime are added to raise the pH value and increase the hardness. The other stage of filtering consists of activated carbon. After that, the water is treated with UV light for disinfection. The slurry from the water works is pumped to the sewerage processing works.

The Hanovia UV system was installed by our own personnel and commenced operation in September 1995. It is what is known as the medium pressure type.

A reserve system for chlorination still exists, but has not been used since the UV system was taken into use. No chlorine is stored anymore but instead we have an agreement with the swimming pool to provide sodium hypochlorite if needed.

Tests on the Water Pipe Network

The network consists of 30-40 miles of mains water pipes. Every two months water samples are taken at 20 places in this network. In bacteriological terms, the seven-day and two-day earth bacteria are analyzed as well as the coliform and E-coli bacteria. We have compiled statistics since 1989 which record seven years with chlorine and five years with UV.

Samples are taken at 19 places every second month. Each column shows an average value of two measurements, i.e. 38 values every 4 months. Statistical calculations showed that the content of heterotrophic seven-day bacteria has only been lower during the five years which have passed since we installed the UV illumination than during the seven-year period before that. With 99 percent certainty, the average value in the pipe network was between 300 and 480 seven-day bacteria for every mL during the period before the transition to UV, whereas the average value after the transition was between 27 and 120/mL.
Thus, the content of seven-day bacteria is more than 50% lower than before the transition to UV.

For the two-day bacteria, on the other hand, we have reduced the level of confidence to 70 percent to be able to assert that they too have only fallen in number. With a certainty level of 99 percent, on the other hand, the intervals will overlap each other (1-7/mL before and 0-4/mL after UV).

With regard to coliform bacteria, the intervals overlap entirely: 0.92-1.3/100 mL before and 0.76-1.6/mL after the introduction of UV. That this is the case reflects the very high number of values which are less than 1/100 mL.

For E-coli bacteria we have not produced a diagram or calculations, since pretty well all the results of analysis, both before after the transition to UV, are less than 1/100 mL.

Variation in the Bacteria Content

The content of seven-day heterotrophic bacteria has fallen, as we have said. However, a regression analysis shows that the transition to UV only explains about 4 percent of how the content of seven-day heterotrophic bacteria varies throughout the pipe network or 13 percent at a specific place in the pipe network. It is interesting to note that the transition to UV explains 7 percent of the variation in the output from the water network, but also 13 percent at each specific measurement place.

The content of bacteria in the pipe network presumably is to be explained to a significantly higher extent by factors such as hygiene in the tapping points, events in the pipe network (leaks, air/water mixtures, residues from fire hydrants and change of valves), the output content from the water works, temperature and interruption time. During the period, the COD content in the water output from the water works has also fallen a certain amount, which could be a partial explanation of the lower bacteria contents. We are pleased with the performance of the Hanovia Medium Pressure UV System.

Inger Hansson, Director of VA in Karlshamn
Hanovia provides UV disinfection solutions for drinking water and effluent treatment worldwide. As the only UV equipment supplier to manufacture UV lamps and monitors, Hanovia leads the world in the development and application of ultraviolet technology.

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During the June 24-27, 2001 annual meeting and food exposition of the Institute of Food Technologists (the IFT), seven papers dealing with UV radiation will be presented. Abstracts of these seven papers appear below (taken from the IFT web site).

**Ultraviolet Light Destruction of Pathogens on Contaminated Stainless Steel and Their Biofilms**, T.J. Kim, T.C. Chen, J.L. Silva, and R.S. Chamul (Food Science and Technology, Mississippi State University, Box 9805, Miss. State, MS 39762).

Cleaning and sanitizing operations are used to destroy pathogens and their biofilms in food-processing plants and equipment. No studies have been conducted to assess the ability of ultraviolet light to destroy pathogens and their biofilms on stainless steel (SS).

To evaluate the effectiveness of UV light on SS surface contaminated with pathogens and their biofilms a UV Bench Lamp (Model UVG-54, maximum intensity of 1000 μW/cm² at 253.7 nm) was used. Biofilms were prepared by incubating SS chips for 3 days in tryptic soy broth with *Listeria monocytogenes*, *E. coli* O157:H7 and *Salmonella typhimurium*. Incubated SS chips were rinsed for 10 sec with sterile phosphate-buffered saline solution and exposed to UV dose of 500 μW/cm² for 1, 2, and 3 min. Contaminated SS chips were prepared by dipping into cultured broth with 10⁶ population of each pathogen for 10 min, removed aseptically, and dried for 30 min without rinse. UV doses of 250 and 500 μW/cm² for 1, 2, and 3 min were used per treatment.

Exposure for 3 min at 500 μW/cm² reduced biofilms of *L. monocytogenes*, *E. coli* O157:H7 and *S. typhimurium* by 0.6, 0.7, and 0.9 CFU/cm², respectively. Except for *L. monocytogenes*, treatment at 250 μW/cm² for 3 min destroyed *E. coli* O157:H7 and *S. typhimurium* contaminated on SS. Three minutes at 500 μW/cm² destroyed *L. monocytogenes*, *E. coli* O157:H7 and *S. typhimurium* contaminated on SS.

UV light destroyed pathogens on pathogens on contaminated SS. Biofilms are more resistant to UV light than surface contaminated cells. *L. monocytogenes* is more resistant to UV light than the other pathogens tested.


Vegetable processing and preservation technologies must keep fresh-like characteristics, while providing an acceptable and convenient shelf life, as well as assure safety and nutritional value. Nonthermal processes applied to food preservation without the collateral effects of heat treatments are being deeply studied and tested. One such procedure is the irradiation of foods with short-wave ultraviolet (UVC) light.

The objective of this investigation was to determine the efficacy of UVC irradiation to treat carrot juice. The effects of several flow rates and UVC-doses on natural microflora and carrot juice color were examined.

The UVC device consists of a 7.5 cm and 70 cm long glass tube fixed vertically with a 70 cm long UVC lamp (30 W, 254 nm, low pressure) inside the tube. Fresh carrot juice was pumped through the UVC chamber using a peristaltic pump adjusted to the desired flow rate (6 or 16 mL/s). Treated juice was recirculated up to 25 times from a well agitated and disinfected double wall cylindrical vessel connected to a circulating cold water bath to control juice temperature at 15°C.

The effect of UVC-light on standard plate counts resulted in a 5-log cycle reduction after a 30 min treatment when juice was circulated at 6 mL/s, or after 12 min when using 16 mL/s. Both treatments reduced the bacteria to <10 cfu/mL. However, mold and yeast counts were reduced only 1-1.5-log cycles, which represented survivors around 10² cfu/mL. UV-dosages varied depending on treatment and recirculation times and flow rates, being for the longest irradiated samples 12.9 - 34.4 J/cm², sufficient to eliminate naturally present bacterial vegetative cells. An ANOVA demonstrated a non-significant effect (p > 0.05) of treatment time and UV-dosage on juice color when compared with fresh carrot juice.

Continuous UVC-irradiation processes can be applied for heat sensitive juices, and combined with a refrigerated storage may prolong shelf life.

**Sulfite Analysis of Acidified Vegetables by HPLC with Ultraviolet Spectrophotometric Detection**, R.F. McFeters (Food Science Research Unit, USDA-ARS-South Atlantic Area, North Carolina State Univ., 322 Schaub Hall, Box 7624, Raleigh, NC 27695-7624) and A.O. Barish (Dept. of Food Science, North Carolina State Univ., Box 7624, Raleigh, NC 27695-7624).

Sulfite analysis in a variety of food products has been done by HPLC with electrochemical detectors, but there are electrode
fouling problems that require frequent standardization. Sulfur
dioxide has UV absorption maxima at 200 and 276 nm. This
property of the preservative has not been used for food analysis.
The objective was to demonstrate use of HPLC with a 50 mm
light path UV detector to measure sulfite in acidified vegetables.

Chromatography of 20 µL samples was done on a Bio-Rad
HPX-87H column (60°C) eluted with 0.03N sulfuric acid (flow
rate 0.8 mL/min), with a run time of 20 min. Data from a diode
array detector with 50 mm light path was collected at 210 and
276 nm. Sulfite was analyzed at 276 nm in acidified cucumbers, red bell peppers, tabasco pepper sauce, and banana
peppers. Samples for free sulfite were prepared by
centrifugation and dilution with eluant. Total sulfite samples
were prepared by addition of 3N NaOH to raise the pH to 12,
holding for 15 min, and then lowering the pH to <3.5 by
addition of 6N sulfuric acid.

Sulfite was baseline resolved from organic acids, which were
detected at 210 nm, with a 12.1-min retention time. The
minimum detectable level for sulfite was 2 ppm. With
standardization done every 25 samples, the coefficient of
variation for free sulfite determination of multiple samples from
the same containers of the four vegetables was ±1.4%. For total
sulfite analysis the coefficient of variation was 1.2%. Sulfite
concentrations in the samples were 10 to 450 ppm.

Reproducibility was comparable to the best previous published
results that used headspace sampling followed by HPLC, but
sample preparation was simpler. HPLC analysis of sulfite with
a diode array detector was stable, sensitive and selective. It
avoided electrode fouling problems associated with
electrochemical detection.

Effects of Combined Treatment of High Hydrostatic Pressure
and High Pressure CO2 System to Quality Characteristics
of Carrot Juice, J.I. Lee, S.J. Park, and J. Park (Biotechnology,
Yonsei University, 134, Shinchon-Dong, Seodaemun-Gu,
SEOUL, 120-749, South Korea).

Non-thermal methods for the preservation of foods are under
intense research to evaluate their potential as an alternative
process to traditional thermal methods. Pressurized CO2
penetrates into porous materials to reduce microorganisms in
foods and inactivates effectively both airborne and exposed
surface bacteria. High hydrostatic pressure (HHP) is being
investigated as a non-thermal processing technique to destroy
food-borne pathogens in order to enhance safety and shelf life
of perishable foods.

The purpose of this study was to investigate the effects of
combined treatment of HHP and high pressure CO2 system on
the quality of carrot juice.

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The activities of selected enzymes (polyphenoloxidase: PPO, lipoxygenase: LOX, pectinesterase: PE), microorganisms, pH, color, and physical properties (content of soluble and insoluble solid, turbidity, and cloudiness) of carrot juice were monitored during 4-week storage at 4°C.

Microorganisms were completely inactivated by pressure above 400 MPa and by combined treatment of high pressure CO₂ at 4.90 MPa and HHP at 300 MPa. PPO, LOX, and PE were effectively inactivated by combined treatment of high pressure CO₂ at 4.90 MPa and HHP at 600 MPa. The residual activities of PPO, LOX, and PE were less than 11.28%, 8.83%, and 35.14%, respectively. Combined treatment was more effective to inactivate the enzymes than HHP treatment alone. All the enzymes treated by the combined treatment were not reactivated during 4-week storage at 4°C.

Combined treatment of high pressure CO₂ at 2.94 MPa and HHP at 400 MPa provided the optimum condition for inactivation of enzymes and physical stability of carrot juice.

Studies on the effect of temperature, light and antioxidant on photooxidation of fish liver oil, W. Sang (Dept. of Food Science & Engineering, Ningbo Univ. of China, Ningbo, 315211, China) and Z. Jin (Dept. of Food Science & Technology, The Ohio State Univ., 2121 Fyffe Ct., Columbus, OH 43210).

Fish liver oil (FLO) is rich in high quality nutrients and health benefitting components including DHA and EPA. Because of its high content of unsaturated fatty acids, FLO’s easy oxidation causes odor flavor and reduces effectiveness of active components. A precious study showed that the auto-oxidation of FLO resulted mainly from the exposure to ultraviolet light. It is important to investigate the other factors that accelerate the oxidation. The objective of this study was to investigate the effects of temperature, light, and antioxidant on the oxidation of fish liver oil during the storage.

Oil samples, with or without addition of antioxidants, were stored in chambers simulating a daylight or dark environment. Two oils (crude fish liver oil and refined fish liver oil), two kinds of antioxidants (BHA, TBHQ), two storage temperatures (5°C and 40°C), and two light conditions (light and dark) were tested. The changes of Peroxide Value (POV), TBA and Acid Value were measured every three days until 18 days during storage.

The results showed that ordinary (daytime) light plays the same important role in acceleration of oxidation of fish liver oil as ultraviolet light. Refined fish liver oil has higher POV, TBA, Acid Value than crude fish liver oil at the same storage temperature and time. Samples at higher storage temperature have higher POV and TBA. The antioxidation intensity of fish liver oil shows in the following order: Dark +TBHQ > Dark + BHA > Light +TBHQ > Dark > Dark + BHA > Light.

This study shows the importance of storage conditions (temperature and light exposure) and type of antioxidants in preventing the oxidation of oil or oil products, and provides useful information for fish liver oil product manufacturers and retail stores.

Phytoalexin Production in Fresh-Cut Cantaloupe Melon, O. Lamikanra (Food Processing and Sensory Quality, USDA-ARS-Southern Regional Research Center, 1100 Robert E. Lee Boulevard, New Orleans, LA 70124 and O. A. Richard).

Fresh-cut processing induces degradative changes associated with plant tissue senescence and a consequent decrease in shelf life relative to the unprocessed produce. As part of a defense mechanism, plant tissues frequently produce compounds such as phytoalexins that are able to inhibit the growth of microorganisms. Synthesis of these naturally occurring compounds might be slow and they could be produced at concentrations that are very low relative to other compounds present. Ultraviolet light has thus been extensively used to simulate biological stress in plants and for determining resistance mechanisms of plant tissues. Cantaloupe melon is used more than any other fruit in fresh cut processing.
The objective of this study is to determine changes in volatile compounds induced by stress conditions in cantaloupe and their possible role in the sensory quality and shelf life of the fresh cut fruit. Volatile components of fresh cut cantaloupe exposed to UV light for 15 and 60 min, respectively, were extracted by headspace solid-phase microextraction (SPME) and determined by gas chromatography-mass spectrometry. Several volatile ester compounds were present, of which 21 were identified, in control fruit slices that were not exposed to UV light.

UV treatment caused significant decreases in the concentrations of aliphatic esters present in the fruit. In addition, UV treatment induced the production of phytoalexin terpenoids, cis- and trans- b-ionone, terpinyl acetate, and geranylacetone as well as b-cyclocitral and dihydroactinidiolide. These results suggest that the defense response of cantaloupe melon involves a reduction in the concentrations of aliphatic esters in the fruit, and the production of terpenoid phytoalexins. UV induced phytoalexins have been demonstrated to improve storage quality of fresh produce. The potential use of UV treatment for improving shelf life of cut cantaloupe is indicated by this study. The potential use of UV-induced stress for screening cultivars of Cucumis melo L. for their resistance to microorganism growth and insect damage is also demonstrated.

External Salmonella enteritidis Contamination Reduction on Shell-eggs by Combination Treatments, L A. Rodriguez-Romo and A.E. Yousef (Food Science and Technology Department, The Ohio State University, 2015, Fyffe Court, Columbus, OH 43210-1007. 

Presence of Salmonella enteritidis in shell-eggs constitutes a health hazard to consumers, an added liability to the industry and a burden on the government agencies involved in regulations and surveillance. Development of an effective non-thermal treatment to control Salmonella on eggs is currently needed. The objective of this research was to develop procedures to effectively reduce, in a short time and at low temperatures, the external S. enteritidis shell-egg contamination by utilizing gaseous and aqueous ozone, mild pressure, and short-wave ultraviolet (UV) light.

Shell-eggs were externally contaminated with S. enteritidis. On a first experiment, contaminated shell-eggs were exposed to a UV-light source (254 nm, intensity; 1500-2500 mW/cm²) for 1 min, followed by a treatment with gaseous ozone (20-40% V/V) under pressure (5-15 psi) for 1-3 min. In another experiment aqueous ozone (40 ppm) was applied for 2 min, followed by a treatment with UV-light (254 nm, intensity; 1500-2500 mW/cm²) for 1 min. Experiments were performed under simulated refrigeration conditions.

Results for the first experiment indicate that the exposure of shell-eggs to UV-light alone reduced the contamination by 2-3 logs. The brief exposure to gaseous ozone under pressure reduced the contamination by 0.8 log. The combination of UV-light followed by gaseous ozone under pressure effectively reduced S. enteritidis by 3.2-4.3 log. Results from the second experiment show that aqueous ozone alone, UV-light alone, and their combination in sequence, caused a 2-log reduction in population, irrespective of treatment.

Ozone-UV combinations for a short time (3-4 min) and under refrigeration conditions provide an effective low-temperature sanitization treatment of shell-eggs.
WELCOME New IUVA Members

The IUVA takes great pleasure in extending a heartfelt “welcome!!” to the following new members:

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Mr. Ken Matthews
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GET Inc. Water System Uses UV

GET Inc. offers a water-purification system for water stores and water bottling. Standard features include automated dual water softeners, reverse osmosis systems, glycerin-filled gauges, a recycle valve that saves water, digital TDS and temperature meter, ultraviolet water sterilizer, and more. For more information, call (562) 989-5400 or visit www.get-inc.com.

Hanovia's Water Disinfection System

Hanovia Limited offers Crossflow, a water-disinfection system designed to treat up to 10,000 cubic meters per hour within a single unit and use between five and 12 medium-pressure UV lamps at 25 degrees across the flow. It is used for very-high-capacity applications, such as municipal drinking water. Some features include the simplifying routine lamp changeover and low pressure drop across the chamber (as little as 30mbar). For more information, visit http://pull.xmr3.com/p/23448-845B/9723495/han.htm.

Singapore Effluent Reuse Includes UV

SLOUGH, ENGLAND -- Hanovia Ltd. has won the contract to supply the ultraviolet (UV) disinfection system for a major effluent reuse plant in Singapore. The plant, set up by the Singapore Ministry of the Environment and the Singapore Public Utilities Board in Bedok, over the next two years will test the feasibility and cost-effectiveness of recovering high-quality water from secondary treated sewage effluent. If successful, the pilot plant, believed to be the first setup of its kind in the world, could help countries that, like Singapore, are facing increasingly severe water shortages to have new sources of water.

The UV system, with three treatment chambers with photon controllers, is at the heart of the pilot plant and is capable of handling up to 420 cubic meters per hour of treated sewage effluent. Each treatment chamber contains two UV arc tubes, both fitted with automatic wipers, and a sensor for measuring absolute UV -- a device only available from Hanovia. The data-logging facilities provided with the photon controllers allow the operators to provide proof of all disinfection procedures.

At present, about 50 percent of water from the plant is used to irrigate three nearby golf courses. The final plant will be capable of providing 10,000 m³/day of high-quality water and is likely to be the largest of its kind in the world. The plant will help to alleviate the water shortage problem faced by Singapore.

Trojan Awarded Record Contract

LONDON, ONTARIO, CANADA -- Trojan Technologies Inc. has been awarded over C$20 million (US$13 million) in contracts to supply ultraviolet (UV) disinfection systems for municipal wastewater treatment since 1 March, including a record-setter. These contracts include the largest ever received in Trojan's history, with a value of over C$15 million (US$8 million).

The project is for the Jefferson County Commission-Environmental Services Department in Alabama (USA). Trojan will supply its UV disinfection technology to treat up to 360 million gallons per day (mgd) of municipal wastewater and sewer overflows during storm events. This expansion is a six-fold increase in the plant's treatment capacity. The consulting engineering firm of Gary L. Owen and Associates Inc. is responsible for the overall project design and construction management. The contracting firm of B.L. Harbert Construction International LLC was awarded the construction contract to install the UV systems.

Trojan also won several other contracts from the United States, Italy and Spain for its wastewater treatment products. "We are very pleased to have received these important new orders," said Marvin DeVries, executive vice president and chief operating officer with Trojan Technologies. "In particular, the project for
Jefferson County, AL was awarded after several years of intensive design and pilot testing efforts. This important contract affirms Trojan's product and engineering capabilities and competitive strengths in the UV marketplace.

WEDECO: Strong Sales and Earnings in the First Quarter

Düsseldorf, Germany, May 11, 2001 With very strong earnings growth in recent months, the Düsseldorf company, WEDECO AG Water Technology, a world market leader in water disinfection with ultraviolet (UV) light is accelerating its already very rapid expansion.

As Werner Klink, the Chairman of the Board of Directors, reported today when presenting the first quarter figures, group sales at €14.1 million were 58.3% above the previous year figure of €8.9 million. Thus growth momentum is twice that of one year ago.

In the first quarter the quarterly result after taxes reached €1.3 million, up 76.2% on the previous year (€723,000). Earnings per share increased accordingly from €0.07 to €0.13. EBIT more than doubled to €2.1 million, with EBITDA growth rates even higher, moving up to €2.4 million after €1.1 million in the previous year.

Cost Advantages from Large Series

Klink cited the key reasons for this satisfactory development as cost advantages resulting from large series which the company had achieved through further standardization of its production range and the rapid and smooth integration of the subsidiaries acquired into the group. However the continuing policy of rapid acquisitions resulted in the financial result posting a loss of €139,000 after a plus of €51,000 last year. However, according to Klink the deficit will disappear after the capital increase planned for the second half of the month.

Rapid Growth Continues

In the course of the year the Board expects growth to continue unabated. According to Klink, this growth was underpinned by the high order level of €18.3 million which was reached at the end of March and continuing excellent sales prospects.

This year's Annual General Meeting took place in Düsseldorf on May 29.

For further questions, contact:

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E-mail: christoph.dicks@wedeco.net
Hanovia Wins Queen's Award for Innovation for UV Water Treatment Technology

Slough, Berkshire, UK 21 April 2001: Hanovia's leadership in ultraviolet water treatment technology has been recognized with the grant of a 'Queen's Award for Innovation' for its expertise in manufacturing special-purpose UV lamps. The award reflects 'outstanding innovation resulting in substantial improvement in business performance and commercial success.'

The only UV treatment plant supplier with its own lamp R & D and manufacturing facilities, Hanovia won the award for its SuperTOC lamp. This is a unique UV lamp with an output spectrum optimized for TOC (total organic carbon) removal from ultrahigh purity water. The main application is in electronics production, but a similar photolysis technique has been used to remove pesticide residues from drinking water in the UK.

web: www.wyckomaruv.com  email: info@wyckomaruv.com

Chemical Free Water Purification!

High quality, low cost manufacturers of UV and ozone water purification systems for residential, industrial, municipal and military applications

The company's SuperTOC system has been adopted by the world's leading semiconductor fabricators and Hanovia has over 500 systems operating globally. Last September, the company won its largest single order for this type of equipment, valued at approximately; £630K, from a chip maker in Taiwan. Hanovia is now the preferred supplier to the world's largest semiconductor wafer fabricator and exports account for over 65 percent of total production.

Commenting on the Award, Hanovia's Managing Director Jon McClean said: "Starting in 1997, the company's Technical Director, David Hamilton, began a research project to develop a lamp that turned a high percentage of its energy input into UV light at the wavelengths needed for treating electronics rinse water." By experimenting with different types of quartz glass, proprietary chemical additives, lamp geometries and electrode designs, Hanovia's research team produced the SuperTOC lamp. "What we have achieved is a step change in the performance of this technology," said Jon McClean.

Where conventional lamps only manage to convert 0.2 percent of energy input into useful UV output for total organics destruction, the SuperTOC lamp delivers over 10 percent. "Today we manufacture between 12,000 and 15,000 lamps a year," added McClean, "and our in-field failure rate is consistently the lowest in the industry."

Hanovia's years of lamp building experience and careful material selection have paved the way to such bespoke solutions, allowing the company to offer UV treatment systems with wavelength output tailored to specific treatment requirements.

Part of the Halma Group, alongside sister companies Berson Milieutechniek BV and Aquionics Inc, Hanovia is the largest medium-pressure UV lamp manufacturer in the world. Over 40,000 Hanovia UV systems are installed worldwide for disinfection of drinking water, and industrial process water used in food, drink and pharmaceutical production. Other applications are in the treatment of high purity water to remove contaminants in electronics and pharmaceutical production and effluent treatment. The company is also a world leader in UV plant for swimming pool water treatment.

Although Hanovia's principal business will remain focused on disinfection of drinking and industrial process water, Jon McClean is looking for other markets where his company's world-beating lamp development skills can be applied to removing chemical impurities. "We are currently developing special-purpose lamps for breaking down industrial pollutants, such as NDMA* and MTBE**, which are a great cause of
concern in the drinking water supplies of several American states. Our next target is the Queen's Award for International Trade," he added.

**NDMA = N-Nitrosodimethylamine, a suspected carcinogen originally used as a fuel additive and in rubber manufacture which is found in groundwater in the USA and Canada. Some US cities (for example, Pittsburgh) have had to install drinking water treatment plant specifically to deal with NDMA.**

**MTBE = Methyl tert-butyl ether, an additive to petrol which is sometimes found in US drinking water and is controlled by federal government guidelines.**

Issued by: Hanovia Limited, 145 Farnham Road, Slough, Berkshire SL1 4XB, UK; Web site: www.hanovia.net

Company contacts: Jon McClean (Managing Director), Sean Appleton: Tel: 01753 515328. Fax: 01753 534277; E-mail: sales@hanovia.co.uk

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**New Sales Director for Hanovia**

Slough, Berkshire, UK, March 2001: Michael Shaw, B. Eng. (Hons), has been appointed Sales Director by Hanovia Limited, a world leader in ultraviolet (UV) disinfection technology. He graduated with a degree in Mechanical Engineering. Before joining the company, Michael was Sales and Marketing Director for Opperman Mastergear Limited, a manufacturer of power transmission equipment owned by the Regal Beloit Corporation, Beloit, USA. Michael will be responsible for all Sales and Marketing activities within Hanovia.

Issued by: Hanovia Limited, 145 Farnham Road, Slough, Berkshire SL1 4XB. Web site: www.hanovia.co.uk

Company contact: Michael Shaw. Tel: 0 1753 515328 Fax: 0 1753 534277. E-mail: sales@hanovia.co.uk

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**Vital Living Launches New UV System**

Matthews, NC, April, 2001 -- Vital Living Products Inc., doing business as American Water Service Inc., has launched a new line of ultraviolet (UV) water disinfection systems geared for homeowners concerned about bacteria in their well water. The new point-of-entry system, called PurGuard UV, is a disinfection system that is designed to kill bacteria, such as *E. coli*, coliform and viruses.

"The PurGuard UV is specifically designed to be consumer friendly," says Don Podrebarac, CEO of Vital Living Products. Vital Living Products plans to launch additional products over the next seven months. Meanwhile, the company has signed a financing agreement with a New York-based private-equity investment fund that will enable the company to expand its business operation and hasten new product development.

Vital Living reported that it has already completed the first half of the initial round of funding. The company will use the cash infusion of $450,000 to accelerate its plans. Under the terms of the agreement, additional funding will be provided as the company progresses in the execution of its business plan.

"We have been successful in generating sales of our PurTest products for the past several years," says Podrebarac. "Our goal is to increase our product offering and to strengthen our marketing efforts. This capital infusion is the next step toward our goal of further expanding the company and to achieving our ultimate goal of branding the PurTest and PurGuard product lines into household names."

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**Food for Thought**

It was our first university physical chemistry tutorial and the prof was eager to find out just what we remembered from sixth-form college.

"What's Boyle's Law?" From the forest of eagerly raised arms came the answer: "Pressure and volume of a fixed quantity of gas are inversely proportional."

"What's Charles' Law?" Again hands up everywhere. "At constant pressure, gas volume is proportional to absolute temperature." We were riding high. If this were all there was to university study, we'd all be B.Sc. Hons. in no time. Next question.

"What's Coles' Law?" Stunned silence. Embarrassed shuffling of feet. "Anybody?" Still nothing. You could have heard a pin drop as the prof selected a piece of fresh chalk, strode to the board and wrote: "Coles slaw: slices of carrot and white cabbage in a mayonnaise sauce."

Addressing Concerns Over Mercury Releases from UV Lamps

By

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BACKGROUND

Virtually all commercially available and cost-effective UV lamps used in drinking water disinfection systems contain some quantity of mercury. As a result, concerns over the potential release of this mercury to public health and the environment must be addressed. The UV Team at the University of New Hampshire has been looking into this issue for the past several years and presents the following summary of findings, discussion and recommendations to the UV profession.

At present, after evaluating the available literature and testing a few new lamps, it is the opinion of the UV Team, that existing mercury-free lamp technologies have not demonstrated that they are cost-effective, either due to extremely poor energy efficiency or extremely short lamp life. In addition, those environmental professionals concerned with the presence of mercury in the environment are correct to point out that replacing mercury-containing lamp technologies with energy inefficient mercury-free lamps is counter-productive due to the potential for an increased reliance on power generation from coal which can account for 30 to 50 percent by weight of the mercury found in a given ecosystem.

As a result, all UV lamp manufacturers are strongly encouraged to optimize their lamp designs to minimize the amount of mercury needed in each UV lamp. Further, research to develop mercury-free UV lamp technologies must be strongly promoted by both public and private research sponsors.

OFF-LINE BREAKAGE

Operating staff for UV systems must be trained in the proper containment and clean up of mercury from the off-line breakage of mercury-containing lamps, including UV lamps and typical fluorescent lighting lamps. Proper OSHA and HAZMAT mercury clean-up materials should be provided in critical areas of the water plants and disposal of the materials in accordance with all local, state and federal HAZMAT laws should be performed.

ON-LINE BREAKAGE

The risk of on-line breakage is much less likely, but needs to be discussed and safeguarded against through proper design. As part of the USEPA UV Technology Workgroup efforts, Dr. Malley and members of the UV Team performed a survey to identify and document cases and causes of on-line UV lamp failures. It is important to note that the survey was a non-statistical and voluntary sharing of information from UV lamp manufacturers (4), UV disinfection system manufacturers (6), drinking water utilities (10) and wastewater utilities (20). The statistical accuracy or bias of the study could not be determined due to limited sample size.

The survey uncovered nine cases of mercury lamp breakage involving medium pressure (MP) UV lamps. Low pressure (LP) UV lamps have the longest track record for use in water and wastewater, but no on-line lamp breakages were reported. However, low pressure lamp systems are not considered practical for most drinking water applications which are larger than about 5 MGD. Low pressure high output (LPHO) lamps have a very limited track record in water and wastewater with no facilities older than five years being found and no lamp breakage records reported. Some of the causes reported for the lamp breakages were considered to be independent of lamp type and could occur for MP, LP or LPHO lamps.

Description/resolutions for the nine documented lamp breakages are summarized below:

- Four of the nine MP lamp breakages occurred due to impacts from stones, and in all cases these lamps were oriented perpendicular to the flow. Realistically, one would expect similar breakages in LP and LPHO lamps if they were oriented perpendicular to the flow and were hit by a stone. However, LP lamps are most often oriented parallel
to the flow, which may explain their long history of use without this type of reported breakage. Modern UV reactor designs can take several steps, which would minimize rock or other object impacts. These could include inlet designs that essentially act as deflectors or grit chambers; UV lamps mounted parallel or at an angle relative to influent flow, and quartz sleeves strong enough to sustain the force of a prescribed design impact from an object.

- Two of the MP lamp breakages occurred in older designs because the MP lamps were mounted vertically in the UV reactor, resulting in differential sleeve heating (literally the heat accumulated at the top of the lamp and cracked the sleeve). Modern MP reactor designs can have the reactor mounted vertically, but the MP lamps are never mounted vertically, hence this problem no longer occurs.

- Two other MP lamp breakages occurred because the reactors lost water flow, allowing the lamps to heat in air to above 600°C and then the ambient (about 20°C) water was restored and the hot lamps exploded. Modern UV designs have at least two different safety systems which will shutdown the UV lamps if there is a loss of flow or a significant lamp temperature increase.

- The final MP lamp breakage was attributed to ‘driving’ the lamp too hard, as it was a 30kW lamp with specially doped sleeves for hazardous waste remediation applications, and the lamp burst from within. Proper lamp burn in and certification as well as pre-tested operating criteria for the lamps can prevent this and a myriad of potential lamp failures due to defects.

ENGINEERING RECOMMENDATIONS

Considering the reasons for the documented MP lamp breakages, it is possible to engineer effective solutions to prevent these problems. MP lamps can be mounted horizontally in all reactors and pre-certified for proper operation, including not be driven at powers above a specified safe range (e.g., up to 10 kW). All lamp and sleeve designs can be tested off-line to ensure adequate burn-in of lamps and adequate lamp and sleeve design and doping, as well as adequate sleeve structural integrity. Multiple safeguards such as flow sensors, lamp sensors and system temperature alarms can be provided to shut the UV lamps down if water flow is lost or lamps begin to overheat. In addition, automatic restart after a lamp heating alarm or failure should not be permitted. Protection of the MP lamps from impacts due to stones or other entrained materials should be designed into the system; this may be especially critical in an unfiltered application or other applications in which the UV system is not preceded by adequate solid/liquid separation technologies.

Spent lamps can be recycled in some cases, using programs such as those offered by Ashland Chemical Co. (Philadelphia, PA) or Clean Harbors, Inc. (Buffalo, NY). All UV lamps contain a certain amount of elemental mercury (Hg). If the lamps contain a pure form of Hg, then it is easily recyclable through a certified company. However, if the lamp manufacturer uses a combination of Hg and Indium (In) within the lamps, this creates a lamp that may not be recyclable and must be disposed of according to current state and federal waste management regulations.

Mineralization of aniline and 4-chlorophenol in acidic solution by ozonation catalyzed with Fe2+ and UVA light, R. Sauleda and E. Brillas (Department de Quimica Fisica, Laboratori de Ciencia i Tecnologia Electroquimica de Materials, Facultat de Quimica, Universitat de Barcelona, Marti i Franaués 1-11, 08028 Barcelona, Spain), Applied Catalysis B: Environmental 29:135-145 (2001).

Abstract: Solutions with 1.07 mmol dm\(^{-3}\) aniline or with 1.38 mmol dm\(^{-3}\) 4-chlorophenol at pH ca. 3 have been treated with ozone and ozonation catalyzed with Fe\(^{2+}\) and/or UVA. The initial mineralization rate increases as more oxidizing hydroxyl radical is produced in the medium by the catalyzed ozonations. Direct ozone treatment leads to stable oxidation products, which are quickly destroyed under UVA illumination. In the presence of Fe\(^{2+}\) as catalyst, the degradation process is inhibited by the formation of Fe\(^{3+}\) complexes with short organic diacids, being photodecomposed by UVA light. Each initial pollutant is destroyed at a similar rate in all processes. p-Benzquinone and nitrobenzene are identified as intermediates of aniline oxidation. The former product is only detected when high amounts of hydroxyl radical are produced by the action of Fe\(^{2+}\).

Ammonium ion released during p-benzoquinone formation is also generated in larger extension under the same conditions. Nitrate ion reaches maximum production under UVA irradiation, indicating that generation of nitrobenzene from selective attack of O1 on the amino group of aniline is photocatalyzed. Reaction of 4-chlorophenol with ozone leads to 4-chloro-1,3-dihydroxybenzene and 4-chloro-1,2-dihydroxybenzene. The last product is produced in larger extension when high amounts of hydroxyl radical can selectively attack the initial pollutant. Chloride ion is completely lost during the further degradation of both dihydroxylated derivatives. Oxidation of all aromatic intermediates detected during aniline and 4-chlorophenol degradation gives maleic acid, which is further mineralized via oxalic acid. A general reaction pathway for the degradation of each pollutant is proposed.
Upcoming Meetings

Meetings Of The IUVA

............. 2001 Meetings .............

Water Quality Association Water Treatment Fundamentals, Garden City, KS, June 7-8, 2001. Tel: 630-505-0160, etc. 503.


Institute of Food Technologists, Annual Meeting, New Orleans, LA, June 23-27, 2001. Contact: IFT, tel: 312-782-8424; fax: 312-782-0045; e-mail: info@ift.org; web site: www.ift.org. Will include 7 papers on applications of UV technology.


Institute in Drinking Water Treatment, Northampton, MA, USA, August 13-15, 2001. Will include Course Topics on: UV Disinfection; Water Treatment Processes to Remove Viruses, Bacteria, Cryptosporidium, Giardia, Algae and NOM; Ozonation Fundamentals and Applications. Contact: Jodi Ozdarski, Environmental Engineering Program, Dept. of Civil and Environmental Engineering, Univ. of Massachusetts, Amherst, MA, 01003-5205. Ph 413-545-0685; Fax 413-545-2202.

Aquatech Fitma Brazil, São Paulo, Brazil, 28-30 August 2001. Contact: Aquatech RAI, P.O. Box 77777, 1070 MS, Amsterdam, The Netherlands, Ph +31 (0)20 549 1212; Fax: +31 (0)20 549 1843; e-mail: aquatech@rai.nl; or visit www.aquatech-rai.com.


Environment China 2001, 4th Natl. Exhibition for Environmental Protection Technology and Equipment, Guangzhou, China, Sept 11-14, 2001. Contact: Miriam Hintz, IEG-GIMA GmbH & Co. KG, Eifberstrasse 585, 20537 Hamburg, Germany. Tel: +49 40 235 24351; Fax: +49 40 235 24405; e-mail: hintz@ieg-gima.de.


New Zealand Water & Wastes Assoc., 43rd Annual Conference & Expo, Wellington, New Zealand, 19-21 Sept. 2001. Contact: Liz Alexander, NZ Water & Wastes Assoc., P.O. Box 13880, Onehunga, Auckland, New Zealand, Tel: +64 9 636 3636; Fax: +64 9 636 1234; e-mail: water@nzwwa.org.nz, www.nzwwa.org.nz


2nd NSF International Conference on Food and Water Safety on Travel and Tourism, Palma de Mallorca, Spain, October 1-3, 2001. Contact: Keri Broughton, NSF International, Ann Arbor, MI, USA, Ph 1-734-827-6818; Fax 1-734-827-7795 / 6831; broughton@nsf.org; www.nsf.org/conference/it2.


Assoc. of State Drinking Water Administrators, Baltimore, MD, October 23-26, 2001. Contact: ASDWA, 1025 Connecticut Avenue, N.W., Suite 903, Washington, DC 20036, tel: 202-293-7655; Fax: 202-293-7576; e-mail: asdwa@erols.com; website: www.asdwa.org.


IWEX 2001, NEC, Birmingham, UK, 30 October - 1 November 2001. Contact: Aquatech RAI, P.O. Box 77777, 1070 MS, Amsterdam, The Netherlands, Ph +31 (0)20 549 1212; Fax: +31 (0)20 549 1843; e-mail: aquatech@rai.nl; or visit www.aquatech-rai.com.


2002 Meetings


IWA 5th Specialized Conference on Small Water and Wastewater Treatment Systems, Istanbul, Turkey, 23-25 Sept. 2002. Contact: Prof. Dr. Izzet Ozturk, Istanbul Teknik University, Civil Engrg. Faculty, Environmental Engineering Dept., 80626, Maslak, Istanbul, Turkey, Tel: +90 212 285 3790; Fax: +90 212 285 3781; e-mail: iozturk@srv.insitu.edu.tr Deadline for submission of abstracts: 31 January 2002.

Aquatech Amsterdam 2002, Amsterdam RAI, Amsterdam, The Netherlands, 1-4 October 2002. Contact: Aquatech RAI, P.O. Box 77777, 1070 MS, Amsterdam, The Netherlands, Ph +31 (0)20 549 1212; Fax: +31 (0)20 549 1843; e-mail: aquatech@rai.nl; or visit www.aquatech-rai.com.

Seattle Public Utilities provides sewer, drainage and solid waste services to the City of Seattle and drinking water services to 1.3 million people in Seattle and 26 adjacent wholesale water districts. Seattle operates two surface water supplies -- the Cedar and South Fork Tolt -- located on the western slopes of the Cascade mountains. The watersheds for these two supplies are 100% in public ownership (Seattle owns 99.6% of the Cedar and 70% of the South Fork Tolt watersheds; the U.S. Forest Service owns the remaining 30% of the Tolt watershed) and provide very high quality water that, until recently, has been unfiltered. In late 2000, a new ozone and high rate direct filtration plant for the Tolt supply was brought on line.

Seattle’s interest in UV relates to its treatment improvement project on the Cedar supply. Seattle is in the final stages of negotiating a design/build/operate (DBO) contract with CH2M Hill Mortenson OMI for a 180 MGD ozone/UV facility on this supply. The plant layout is compatible with the future addition of filtration, but there is no specific schedule for adding filtration. Plant performance requirements include 3-logs Cryptosporidium inactivation with W (40 mJ/cm²). SPU has been working closely with CH2M Hill, drinking water regulators and UV experts to ensure that this level of performance can be achieved. The new plant will go in service in 2004.

Contact: David J. Hilmoé, P.E., DEE, Water Quality and Supply Director, Seattle Public Utilities, 800 S. Stacy Street, Seattle, Washington 98134. Tel: (206) 684-7414; Fax: (206) 684-4133; E:mail: dave.hilmoé@ci.seattle.wa.us

Ace Hygiene Products Private Limited, Mumbai, India

As one of India’s leading manufacturers, Ace Hygiene Products Private Ltd is dedicated to the manufacture and distribution of UV sterilizers sold under the ALFA brand name. With over a 12-year record in customer satisfaction, ALFA’s mission is to contribute towards better health of the community through profitable utilization of the company’s expertise and resources in water purification systems.

The ALFA brand of UV sterilizers cover a complete range for domestic, commercial and industrial segments, for both process and drinking water applications, providing units of appropriate design involving excellence in manufacturing. All Alfa UV sterilizers are made of stainless steel with on-line monitoring systems.

Alfa’s rich experience in the UV industry combined with the goodwill of its customers has established it as a progressive and innovative leader in the UV business. Some reputed Alfa customers in the corporate sector include Pfizer, Pepsi, Cyanamid, Johnson and Johnson, and Glaxo to name a few.

Ace Hygiene is headquartered in Mumbai, India’s commercial capital, with its sales and service network spread across India.

Key Contacts:

Mr. Y. Nagnarayan, Vice President Sales
Mr. V A Raju, Director
Ms. R A Parikh, Director Sales & Marketing

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English is Creeping In

While cleaning out some old files recently, your E-i-C ran across this tidbit from the Dec. 17, 1990 issue of Chemical & Engineering News (p. 52).

“English is creeping into other languages, and Enno von Lowenstern, deputy editor of Die Welt, "has discovered to his horror," says the New York Times for Nov. 9, "that he can write an article in German using hardly any German words." Here's how he started:

**Two New Additions to the Periodic Table**

**ELEMENT NAME: WOMANIAM**

**Symbol:** XX  

**Atomic Weight:** (Don't go there)

**Physical Properties:** Generally soft and round in form. Boils at nothing and may freeze any time. Melts when treated properly. Very bitter if not used well.

**Chemical Properties:** Very active. Highly unstable. Possesses strong affinity with gold, silver, platinum and precious stones. Violent when left alone. Able to absorb great amounts of exotic food. Turns slightly green when placed next to a better specimen.

**Usage:** Highly ornamental. An extremely good catalyst for dispersion of wealth. Probably the most powerful income-reducing agent known.

**Caution:** Highly explosive in inexperienced hands!

**ELEMENT NAME: MANIUM**

**Symbol:** XY  

**Atomic Weight:** (180 ± 50)

**Physical Properties:** Solid at room temperature but gets bent out of shape easily. Fairly dense and sometimes flaky. Difficult to find a pure sample. Due to rust, aging samples are unable to conduct electricity as easily as young samples.

**Chemical Properties:** Attempts to bond with WO any chance it can get. Also tends to form strong bonds with itself. Becomes explosive when mixed with KD (Element: CHILDUIUM) for prolonged period of time. Neutralize by saturating with alcohol.

**Usage:** None known. Possibly good methane source. Good samples are able to produce large quantities on demand.

**Caution:** In the absence of WO, this element rapidly decomposes and begins to smell.

"Effect of Upstream Treatment Processes on UV Disinfection Performance". Water Environment Federation, Alexandria, VA, USA. 0999, 125p. Order this product from NTIS by: phone at 1-800-553-NTIS (U.S. customers); (703)605-6000 (other countries); fax at (703)605-6900; and email at orders@ntis.fedworld.gov. NTIS is located at 5285 Port Royal Road, Springfield, VA, 22161, USA. TWO reports with the same title and abstract: (1) Report No.: WEF-0067WEP; Price: PC$75.00; (2) WEF-0097WEP; Price: PC$75.00.

Abstract: Many processes used in treating wastewater produce varying levels of effluent quality that may impact UV disinfection performance. These processes can be categorized as particle forming, particle removing, or transmittance altering. This report is a comprehensive document evaluating the effect of a wide variety of upstream treatment processes on UV disinfection efficiency. It provides information for operators, consultants, and design engineers on process changes for enhancement of UV disinfection, and also provides guidance for new process design.

Control of pathogenic microorganisms and turbidity in poultry-processing chiller water using UV-enhanced ozonation, M.E. Diaz, S.E. Law, and J.F. Frank (Applied Electrostatics Laboratory, Department of Biological and Agricultural Engineering, University of Georgia, Athens, GA 30602-4435, USA; Department of Food Science and Technology, University of Georgia, Athens, GA 30602-4435, USA). Ozone: Science & Engineering, 23(1):53-64 2001.

Abstract: UV-enhanced ozonation experiments on unscreened overflow chiller-water from a commercial poultry-processing plant successfully compared the oxidative and bactericidal effects of four treatments (viz., O3/02/UV, O3/02/UV, and O3 as the control). Optimal treatments provided greater than 99.9% control of pathogenic microorganisms. Results far exceeded the USDA-FSIS requirements of at least a 60% reduction of aerobic plate count (APC) bacteria including similar reductions in numbers of coliforms and E. coli, as well as the maintenance of light transmission at a value no less than 60% that of fresh water, consequently permitting 90% recirculation of the required 0.5 gal (1.9 L) overflow per carcass. Also an additional synergistic reduction (>0.8 Log CFU/mL) in APC bacteria was documented for ozone acting in concert with UV photons as compared with the sum of the effects of O3 and UV acting in series.

Economic analysis of operational and maintenance costs for this UV-enhanced ozonation system estimates annual savings of $244,000 in a 1/4-million bird per day plant achieving water savings of 426,000 L/day (113,000 gal/day).


Abstract: A nominally room temperature photochemical method, simply employing ultraviolet light (187-254 nm) generated ozone environment, is shown to provide an efficient alternative for the removal of surfactant templates for a routine production of mesoporous silica thin films at low temperatures. The treatment concomitantly strengthens the silicate phase by fostering the condensation of unreacted silanols leading to mesoporous thin films with well-defined mesoscopic morphologies. The surfactant/silicate thin film mesophases were prepared onto a polycrystalline Au surface by dip-coating or spin-coating methods using sub-critical micelle concentration (cmc) nonionic ethylene oxide surfactant in an oligomeric silica sol mixture. The structures and compositions of the thin film mesophases before and after exposure to UV/ozone were determined using a combination of reflection-absorption Fourier transform infrared spectroscopy, transmission electron microscopy, and thin film X-ray diffraction measurements. The pore characteristics of the UV/ozone-treated films were determined using nitrogen adsorption/desorption isotherm measurements.

Results presented here clearly establish that the UV/ozone processing leads to complete removal of the surfactant template; strengthens the inorganic skeleton by fostering silica condensation; and renders the mesophase thin film surfaces highly hydrophilic. Two of the most attractive features of the method developed here, namely its usefulness in applications for temperature intolerant substrates (e.g., thin metal films) and in spatially selective removal of the surfactant templates to create patterns of mesoporous thin films, are also illustrated. Finally, the mechanistic implications of these observations are also discussed.
First International Congress On Ultraviolet Technologies

Washington, DC -- June 14-16, 2001

Hyatt Regency on Capitol Hill

PLUS

A Revised Directory of Ultraviolet Companies*

* See pages 35 -- 41
**Introduction**

This revised directory has been assembled from a series of questionnaires sent out to a database list of companies with interests in UV technology. The response was over 95%. IUVA News intends to provide updates to this Guide on a regular basis. If you would like your company added to this guide please contact Kathy Harvey the IUVA Administrative Assistant Tel: 519-632-8190; Fax: 519-632-9827; Email: kharvey@iuva.org.

**List by Product and Service**

1. **Manufacturer of medium pressure UV lamps**
   - Calgon Carbon Corporation
   - eta plus electronic gmbh & co. kg
   - Hanovia Ltd.
   - Heraeus Noblelight North America
   - Philips Lighting BV – Industrial/UV Lamps
   - Spectronics Corporation
   - WEDECO Ideal Horizons

2. **Manufacturer of low pressure UV lamps**
   - Aquafine Corporation
   - Atlantic Ultraviolet Corporation
   - Australian Ultra Violet Services Pty. Ltd.
   - First Light Technologies, Inc.
   - Heraeus Noblelight North America
   - JenAct Ltd.
   - Philips Lighting BV – Industrial/UV Lamps
   - Spectronics Corporation
   - WEDECO Ideal Horizons

3. **Manufacturer of low pressure high-output UV lamps**
   - Aquafine Corporation
   - Atlantic Ultraviolet Corporation
   - Australian Ultra Violet Services Pty. Ltd.
   - First Light Technologies, Inc.
   - Heraeus Noblelight North America
   - JenAct Ltd.
   - Philips Lighting BV – Industrial/UV Lamps
   - Spectronics Corporation
   - UV Systems Technology Inc.
   - WEDECO Ideal Horizons

4. **Distributor of UV lamps and supplies**
   - American Ultraviolet Company
   - Australian Ultra Violet Services Pty. Ltd.
   - Contamination Control Ltd.
   - eta plus electronic gmbh & co. kg
   - JenAct Ltd.
   - ONDEO Degremont, Inc.
   - Photoscience Japan Corporation
   - Solar Light Inc.
   - Suntec environmental
   - Trojan Technologies Inc.
   - Ultraviolet Devices Inc.
   - Ultraviolet Systems Inc.

5. **Manufacturer of UV Systems for disinfection of air**
   - American Ultraviolet Company
   - Aquafine Corporation
   - Aquionics Incorporated
   - Atlantic Ultraviolet Corporation
   - Australian Ultra Violet Services Pty. Ltd.
   - Clean Water Systems International
   - Contamination Control Ltd.
   - Hanovia Ltd.
   - JenAct Ltd.
   - Ultraviolet Devices Inc.
   - Ultraviolet Systems Inc.
   - UV Pure Technologies Inc.
   - Watertec Enterprise, Inc.
   - Wyckomar Inc.

6. **Manufacturer of small to medium-scale UV systems for disinfection of drinking water**
   - Ace Hygiene Products Pvt. Ltd.
   - Contamination Control Ltd.
   - ONDEO Degremont, Inc.
   - R-Can Environmental
   - Severn Trent Services, UltraDynamics
   - Solar Light Inc.
   - WaterHealth International, Inc.

7. **Manufacturer of small to medium-scale UV systems for disinfection waste water**
   - Contamination Control Ltd.
   - ONDEO Degremont, Inc.
   - Severn Trent Services, UltraDynamics

8. **Manufacturer of large-scale UV systems for disinfection of drinking water**
   - ABIOTEC
   - American Ultraviolet Company
   - Aquafine Corporation
   - Aquionics Incorporated
   - Atlantic Ultraviolet Corporation
   - Australian Ultra Violet Services Pty. Ltd.
   - Calgon Carbon Corporation
   - Clean Water Systems International
   - Contamination Control Ltd.
   - Hanovia Ltd.
   - ONDEO Degremont, Inc.
   - R-Can Environmental
   - Trojan Technologies Inc.
   - Ultraviolet Systems Inc.
   - UV Systems Technology Inc.
   - Watertec Enterprise, Inc.
   - WEDECO Ideal Horizons
   - Wyckomar Inc.

9. **Manufacturer of large-scale UV systems for disinfection of waste water**
   - American Ultraviolet Company
   - Aquafine Corporation
   - Aquionics Incorporated
   - Australian Ultra Violet Services Pty. Ltd.
   - Clean Water Systems International
   - Hanovia Ltd.
   - ONDEO Degremont, Inc.
   - Photoscience Japan Corporation
   - Suntec environmental
   - Trojan Technologies Inc.
   - UMEX GmbH Dresden
   - UV Systems Technology Inc.
   - Watertec Enterprise, Inc.
   - WEDECO Ideal Horizons
   - Wyckomar Inc.

10. **Distributor of large-scale UV systems for disinfection of drinking water**
    - ABIOTEC
    - Aquionics Incorporated
    - Australian Ultra Violet Services Pty. Ltd.
11. Distributor of large-scale UV systems for disinfection of waste water
   Aquafine Corporation
   Aquionics Incorporated
   Australian Ultra Violet Services Pty. Ltd.

12. Distributor of small-scale UV systems for disinfection of waste water
   Photoscience Japan Corporation
   Suntec environmental

13. Manufacturer of Point-of-use/Point-of-Entry UV systems for disinfection of drinking water
   Ace Hygiene Products Pvt. Ltd.
   American Ultraviolet Company
   Aquafine Corporation
   Atlantic Ultraviolet Corporation
   Australian Ultra Violet Services Pty. Ltd.
   BenRad AB
   Clean Water Systems International
   Contamination Control Ltd.
   Hanovia Ltd.
   ONDEO Degremont, Inc.
   Photoscience Japan Corporation
   R-Can Environmental
   Severn Trent Services, UltraDynamics
   Suntec environmental
   Trojan Technologies Inc.
   Ultraviolet Devices Inc.
   Ultraviolet Systems Inc.
   UMEX GmbH Dresden
   UV Pure Technologies Inc.
   WaterHealth International, Inc.
   Watertec Enterprise, Inc.
   WEDECO Ideal Horizons
   Wyckomar Inc.

14. Distributor of Point-of-use/Point-of-Entry UV systems for disinfection of drinking water
   Atlantic Ultraviolet Corporation
   Australian Ultra Violet Services Pty. Ltd.
   BenRad AB
   Clean Water Systems International
   Contamination Control Ltd.
   WaterHealth International, Inc.

15. Consumer products for UV disinfection
   Ace Hygiene Products Pvt. Ltd.
   American Ultraviolet Company
   Australian Ultra Violet Services Pty. Ltd.
   Clean Water Systems International
   Contamination Control Ltd.
   eta plus electronic gmbh & co. kg
   JenAct Ltd.
   Lyonnaise des Eaux – CIRSEE
   R-Can Environmental
   Severn Trent Services, UltraDynamics
   Trojan Technologies Inc.
   Ultraviolet Devices Inc.
   Ultraviolet Systems Inc.
   UMEX GmbH Dresden
   WaterHealth International, Inc.
   Watertec Enterprise, Inc.

16. UV curing equipment
   American Ultraviolet Company
   JenAct Ltd.
   Spectronics Corporation
   Ultraviolet Systems Inc.
   Watertec Enterprise, Inc.

17. UV sensors
   Aquafine Corporation
   Atlantic Ultraviolet Corporation
   Clean Water Systems International
   EIT Inc. Instrument Markets
   eta plus electronic gmbh & co. kg
   Hanovia Ltd.
   International Light, Inc.
   JenAct Ltd.
   R-Can Environmental
   Solar Light Inc.
   Solatell/4D Controls
   Spectronics Corporation
   Ultraviolet Devices Inc.
   Wyckomar Inc.

18. Consulting for UV systems
   5 SQUARE Consulting Inc.
   Acres & Associated Environmental Ltd.
   Advanced Engineering and Environmental Services, Inc.
   Australian Ultra Violet Services Pty. Ltd.
   Black & Veatch
   Bolton Photosciences Inc.
   Camp Dresser & McKee, Inc.
   Carollo Engineers, P.C.
   CH2M Hill
   Clean Water Systems International
   Earth Tech (Canada) Inc.
   Hazen & Sawyer, P.C.
   JenAct Ltd.
   Lyonnaise des Eaux – CIRSEE
   Malcolm Pirnie, Inc.
   PGConsult
   Norman Ammerer
   Rice Int'l Consulting Enterprises
   Solar Light Inc.
   Talec Enterprises Ltd.
   Trojan Technologies Inc.
   UMEX GmbH Dresden
   Watertec Enterprise, Inc.
   WEDECO Ideal Horizons

19. Research services for UV applications
   5 SQUARE Consulting Inc.
   Advanced Engineering and Environmental Services, Inc.
   BenRad AB
   Black & Veatch
   Bolton Photosciences Inc.
   Camp Dresser & McKee, Inc.
   CH2M Hill
   Clancy Environmental Consultants Inc.
   Clean Water Systems International
   Hazen & Sawyer, P.C.
   JenAct Ltd.
   Lyonnaise des Eaux – CIRSEE
   Malcolm Pirnie, Inc.
   ONDEO Degremont, Inc.
   Solar Light Inc.
   Suntec environmental
   Talec Enterprises Ltd.
   Trojan Technologies Inc.
   UMEX GmbH Dresden
   Watertec Enterprise, Inc.
   WEDECO Ideal Horizons
### List of Companies with Interests in UV Technology

**(* indicate IUVA Corporate Members)**

<table>
<thead>
<tr>
<th>Company Name</th>
<th>Address</th>
<th>Contact Details</th>
<th>Website(s)</th>
<th>P&amp;S categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 SQUARE Consulting Inc.*</td>
<td>242 Haddington Street, Caledonia, ON N3W 1G2 Canada</td>
<td>Tel/Fax: 905-765-0533, Contact: Brian Pett, President, Email: <a href="mailto:bpett@sympatico.ca">bpett@sympatico.ca</a></td>
<td>Website: <a href="http://www.5squareconsulting.com">www.5squareconsulting.com</a></td>
<td>18,19</td>
</tr>
<tr>
<td>Abiotec*</td>
<td>10 av Schneider, 92140 Clamart France</td>
<td>Tel: 33 (0) 1 46 45 19 19, Fax: 33 (0) 1 46 45 81 13, Contact: P. Sachoux, Email: <a href="mailto:abiotec@club-internet.fr">abiotec@club-internet.fr</a></td>
<td>Website: <a href="http://www.abiotec.com">www.abiotec.com</a></td>
<td>8,11</td>
</tr>
<tr>
<td>Ace Hygiene Products Pvt. Ltd.*</td>
<td>222 Shah &amp; Nahar A-2, Lower Parel, Mumbai Maharashtra 400013 India</td>
<td>Tel: 022 494 5567, Fax: 022 495 4250, Contact: Mr. Anand Parikh – Managing Director, Mr. V.A. Raju – Director, Email: <a href="mailto:aparikh@alfauv.com">aparikh@alfauv.com</a></td>
<td>Website: <a href="http://www.alfauv.com">www.alfauv.com</a></td>
<td>6,13,15</td>
</tr>
<tr>
<td>Acres &amp; Associated Environmental Ltd.*</td>
<td>525-21 Four Seasons Place, Toronto, ON M9B 6J8 Canada</td>
<td>Tel: 416-622-9502, Fax: 416-622-6249, Contact: Dennis Mutti, Manager, Water Division, Email: <a href="mailto:muttid@toronto.aae.on.ca">muttid@toronto.aae.on.ca</a></td>
<td>Website: <a href="http://www.aae.on.ca">www.aae.on.ca</a></td>
<td>2,13,15</td>
</tr>
<tr>
<td>Advanced Engineering &amp; Environmental Services Inc*</td>
<td>2016 S. Washington Street, Grand Forks, ND 58201 USA</td>
<td>Tel: 701-746-8087, Fax: 701-746-0370, Contact: R. Nathan Weisenburger, P.E., Email: <a href="mailto:Nate.Weisenburger@advenginc.com">Nate.Weisenburger@advenginc.com</a></td>
<td>Website: <a href="http://www.advancedengineering.com">www.advancedengineering.com</a></td>
<td>19</td>
</tr>
<tr>
<td>American Ultraviolet Company*</td>
<td>212 S. Mt. Zion Road, Lebanon, IN 46052 USA</td>
<td>Tel: 765-483-9514 Extn. 201, Fax: 765-483-9525, Contact: Meredith C. Stines, Email: <a href="mailto:mstines@americanultraviolet.com">mstines@americanultraviolet.com</a></td>
<td>Website: <a href="http://www.americanultraviolet.com">www.americanultraviolet.com</a></td>
<td>4,5,8,9,13,16,16,20 UV Blacklight equipment for inspection, Germicidal custom equipment</td>
</tr>
<tr>
<td>Aquafine Corporation*</td>
<td>29010 Avenue Paine, Valencia, CA 91355 USA</td>
<td>Tel: 661-257-5602, Fax: 661-257-8156, Contact: Michele Murphy, President Alexis Bruhn, Marketing Coordinator, Email: <a href="mailto:michael@aquafineuv.com">michael@aquafineuv.com</a>, <a href="mailto:a.bruhn@aquafineuv.com">a.bruhn@aquafineuv.com</a></td>
<td>Website: <a href="http://www.aquafineuv.com">www.aquafineuv.com</a></td>
<td>2,3,5,8,11,13,17,21</td>
</tr>
<tr>
<td>Aquionics Incorporated*</td>
<td>21 Kenton Lands Rd., PO Box 18395, Erlanger, KY 41018 USA</td>
<td>Tel: 859-341-0710, Fax: 859-341-0350, Contact: David L. McCarty, President, Email: <a href="mailto:dave@aquionics.com">dave@aquionics.com</a></td>
<td>Website: <a href="http://www.aquionics.com">www.aquionics.com</a></td>
<td>6,8,9,10,11</td>
</tr>
<tr>
<td>Atlantic Ultraviolet Corporation*</td>
<td>375 Marcus Blvd., Hauppauge, NY 11788 USA</td>
<td>Tel: 631-273-0500, Fax: 631-273-0771, Contact: R.D. Samuel Stevens, Email: <a href="mailto:sstevens@atlanticuv.com">sstevens@atlanticuv.com</a></td>
<td>Website: <a href="http://www.atlanticuv.com">www.atlanticuv.com</a></td>
<td>2,3,5,8,13,14,17</td>
</tr>
<tr>
<td>Australian Ultra Violet Services Pty. Ltd.*</td>
<td>23 Northgate Drive, Thomastown, Victoria 3974 Australia</td>
<td>Tel: 03 9464 3655, Fax: 03 9464 3666, Email: <a href="mailto:austuv@austuv.com">austuv@austuv.com</a></td>
<td>Website: <a href="http://www.austuv.com">www.austuv.com</a></td>
<td>2,3,4,5,8,9,10,11,13,14,15,18</td>
</tr>
<tr>
<td>BenRad AB*</td>
<td>Box 30112, Stockholm, SE-10425 Sweden</td>
<td>Tel: 46 8 25 98 88, Fax: 46 8 25 99 08, Contact: Rune Soremark, Email: <a href="mailto:r.soremark@benrad.se">r.soremark@benrad.se</a></td>
<td>Website: <a href="http://www.benrad.se">www.benrad.se</a></td>
<td>13,14</td>
</tr>
<tr>
<td>Black &amp; Veatch</td>
<td>8400 Ward Parkway, Kansas City, MO 64114 USA</td>
<td>Tel: 913-458-3441, Fax: 913-458-3730, Contact: Robert A. Hulsey, Email: <a href="mailto:hulseya@bv.com">hulseya@bv.com</a></td>
<td>Website: <a href="http://www.bv.com/bv/services/water_wastewater/index.htm">www.bv.com/bv/services/water_wastewater/index.htm</a></td>
<td>18,19</td>
</tr>
</tbody>
</table>

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20. UV radiometers

American Ultraviolet Company
Clean Water Systems International
EIT Inc. Instrument Markets
International Light, Inc.
JenAct Ltd.
Solar Light Inc.
Solatell/4D Controls
Spectronics Corporation
Ultraviolet Systems Inc.

21. Calibration of UV radiometers and sensors

Aquafine Corporation
EIT Inc. Instrument Markets
International Light, Inc.
JenAct Ltd.
Solatell/4D Controls
Spectronics Corporation

---
International Light, Inc.
17 Graf Road
Newburyport, MA 01950 USA
Tel: 978-465-5923; Fax: 978-462-0759
Contact: Roy Grayzel, VP Sales & Marketing
Email: Rgrayzel@intl-light.com
Website: www.intl-light.com
P&S categories: 17,20,21

JenAct Ltd.*
Ardglen Industrial Estate Evinger Rd.
Whitchurch, Hampshire RG28 7BB UK
Tel: 01256892194; Fax: 01256896496
Contact: Richard Little
Email: rlittle@jenton.co.uk
Website: www.jenton.co.uk
P&S categories: 3,4,5,16,17,18,19,20,21
Manufacturer of UV conveyors and ovens

Lyonnaise des Eaux – CIRSEE*
36, Rue du President Wilson
Le Pecq, F 78230 France
Tel: 33 1 34 80 23 29; Fax: 33 1 30 53 62 07
Contact: Marie-Laure Janex
Email: marie-laure.janex@lyonnaise-des-eaux.fr
Website: www.cirsee-lyonnaise-des-eaux.com
P&S categories: 15,18,19

Malcolm Pirnie, Inc.*
1900 Polaris Pkwy, Suite 200
Columbus OH 43240-2020 USA
Tel: 614-888-4953; Fax: 614-888-5638
Contact: Tom Marshall
Email: tmarshall@pirnie.com
Website: www.pirnie.com
P&S categories: 18,19

Norman Ammerer
635 Delaware Road
Buffalo, NY 14223-1330 USA
Tel: 716-873-4262; Fax: 716-873-4262
Contact: Norman Ammerer
Email: ammerer@aol.com
P&S categories: 18

ONDEO Degremont*
P.O. Box 71390
Richmond, VA 23255-1390 USA
Tel: 804-756-7600; Fax: 804-756-7643
Contact: Paul D. Spofford, Director of Marketing
Email: SpoffordP@ondeo-degremont-usa.com
Website: www.ondeo-degremont-usa.com
P&S categories: 4,6,7,8,9,13,19

PGConsult*
22Gatcombe Mews
London W53HF England
Tel: 44 0 20 8693 3523
Contact: Paul Gibson
Email: pgcon@globalnet.co.uk
P&S categories: 18

Philips Lighting BV – Industrial/UV Lamps*
Zwanzhoeistraat 2
Roosendaal 4702 LC The Netherlands
Tel: 31 165 577 749; Fax: 31 165 577 907
Contact: Henk Giller
Email: H.Giller@philips.com
P&S categories: 1,2,3

Photoscience Japan Corporation*
8-3 Sansanmachl 5-Chome
Tokyo, Hachioji-Shi 193-0832 Japan
Tel: 0426-67-5641; Fax: 0426-67-8666
Contact: Koji Nakano
P&S categories: 4,9,12,13

Pulsar UV Technologies*
9085 Foothills Blvd.
Roseville, CA 95747 USA
Tel: 916-677-1957; Fax: 916-677-1901
Contact: James Bender, President
Email: JimBender@pulsaruv.com
Website: www.pulsaruv.com
P&S categories: Pulsed broadband blackbody UV for drinking water, remediation and industrial

R-Can Environmental *
425 Clair Rd. W., P.O. Box 1719
Guelph, ON N1H 7X4 CANADA
Tel: 519-763-1032; Fax: 519-763-5069
Contact: Myron Lupal
Email: lupal@r-can.com
Website: www.r-can.com
P&S categories: 6,8,13,16,17

Rice International Consulting Enterprises*
1331 Patuxent Drive
Ashton, MD 20861 USA
Tel: 301-924-4424; Fax: 301-774-4493
Contact: Rip Rice
Email: RipRice4Ozone@cs.com; Rice@iuva.org
P&S categories: ozone consultant – applications of ozone with UV

Severn Trent, UltraDynamics*
3000 Advance Lane
Colmar, PA 18915 USA
Tel: 215-997-4000; Fax: 215-997-4062
Contact: Peter Hutwelker
Email: UV@capitalcontrols.com
Website: www.ultradynamicsUV.com
P&S categories: 6,7,13,16

Solar Light Inc.*
721 Oak Lane, Philadelphia, PA. 19126 USA
Tel: 215-927-4206; Fax: 215-927-8347
Contact: Saul Berger
Email: info@solart.com
Website: www.solar.com
P&S categories: 4,6,7,17,19,20
UV disinfection monitoring instrumentation for Waste Water, Potable water, Air disinfection & UV curing instrumentation; UV simulators

Solatell/4D Controls*
Unit 8, Poll Industrial Estate
Redruth, Cornwall TR15 3RH UK
Tel: 44 1209 214440; Fax: 44 1209 3144 15
Contact: Andrew Ridyard
Email: andrew@solatell.com
Website: www.solatell.com
P&S categories: 17,20,21
Spectronics Corporation
956 Brush Hollow Road
Westbury, NY 11590 USA
Tel: 800-274-8888; Fax: 800-491-6668
Contact: David J. Ross
Email: UVUV@aol.com
Website: www.spectroline.com
P&S categories: 1, 2, 3, 18, 17, 20, 21
Manufacturer of UV leak testing dyes, UV inspection lamps, UV equipment for life science technology, UV equipment for semiconductor manufacturing

Suntec Environmental
106 Rayette Rd., Unit #1
Concord, ON L4K 2G3 Canada
Tel: 905-669-4450; Fax: 905-669-4451
Contact: Doug Reed
Email: dreed@suntecuv.com
Website: www.suntecuv.com
P&S categories: 4, 8, 12, 13

Talec Enterprises Ltd.
2198-44A Ave.
Langley, BC V3A 8P9 Canada
Tel: 604-530-3906; Fax: 604-530-3906
Contact: Greg M’Lot
Email: taleceng@direct.ca
Website: www.talecuv.com
P&S categories: 18, 19

Trojan Technologies Inc.
3020 Gore Rd.
London, ON N5V 4T7 Canada
Tel: 519-457-3400; Fax: 519-457-3030
Contact: Jim Cosman
Email: jcosman@trojannuv.com
Website: www.trojannuv.com
P&S categories: 4, 8, 9, 13, 15, 16, 18

Ultraviolet Devices Inc.
28220 Industry Drive
Valencia, CA 91355 USA
Tel: 661-295-8550; Fax: 661-257-4696
Contact: Gene Doucette
Email: gned@uvdi.com
Website: www.uvdi.com
P&S categories: 4, 8, 13, 17

Ultraviolet Systems Inc.
Division of UV Technology LTD.
4600 S. Pinecrest
Houston, TX 77041 USA
Tel: 713-939-8889; Fax: 713-939-1101
Contact: Greg Ellis, Executive, VP
Email: info@ultravioletsystems.com
Website: www.ultravioletsystems.com
P&S categories: 4, 5, 8, 13, 16, 16, 19
Custom curing of 3-D objects
UV inks, coatings & adhesives

UMEX GmbH Dresden
Goslarer Strasse 61-63
Dresden, Sachsen 01217 Germany
Tel: +49 351 871 8296; Fax: +49 351 871 8439
Contact: Steffen Joffin
Email: umex.dresden@t-online.de
Website: www.umex.de
P&S categories: 9, 13, 15, 18, 19

UV Pure Technologies Inc.
526 McLeod Cres.
Pickering ON LlW 3M5 Canada
Tel: 416-208-9884; Fax: 416-208-5806
Contact: Ron Hallett
Email: rahallet@uv-pure.com
P&S categories: 5, 13

UV Systems Technology Inc.
2801 Ingleton Ave.
Burnaby, BC V5C 6G7 Canada
Tel: 604-451-1069; Fax: 604-808-3268
Contact: Peter Z. Colak, VP, Sales & Marketing
Email: pacolak@ultraguard.com
Website: www.ultraguard.com
P&S categories: 3, 8, 9

WaterHealth International, Inc.
1700 Sscos Ave., Suite 5
Napa, CA 94558 USA
Tel: 707-252-9002; Fax: 707-252-1514
Contact: Alice Hoghuy, Vice President Administration
Email: info@waterhealth.com
Website: www.waterhealth.com
P&S categories: 6, 13, 14, 15

Watertec Enterprise, Inc.
7F, No. 61 Da-Chi Street
Pan-Ciao, Taipei 220 Taiwan
Tel: 886-2-9869571; Fax: 886-2-29562460
Contact: Dragon Liang
Email: dragon@watertec.com
Website: www.watertec.com
P&S categories: 6, 8, 13, 15, 16, 18, 19

WEDECO Ideal Horizons
212 Ideal Way
Poultney, VT 05764 USA
Tel: 802-287-4488; Fax: 802-287-4486
Contact: Jesse Rodriguez
Email: jrodriguez@wedecouv.com
Website: www.wedecouv.com
P&S categories: 1, 2, 3, 8, 9, 13, 18, 19

Wek-Tec
Str. 77
Kehl 77694 Germany
Tel: +49 7131 629 864; Fax: +49 7131 629 867
Contact: Richard Wagner
Email: wektcc@aol.com
Website: www.wektcc.com
P&S categories: pulsed UV sterilization systems for packaging, food and hospital/medical applications

Wyckomar Inc.
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City officials in Seattle, Washington (USA) have approved a new $109 million 180-million-gallon-per-day ozone/UV drinking water treatment facility for the 1.3 million residents of the greater Seattle area. The Greenwood Village, CO-based engineering firm CH2M Hill will construct the facility and its operations arm, Operations Management International Inc., will operate and maintain the facility for up to 25 years, according to the terms of the contract signed 30 April 2001.

The treatment facility will be built to treat the water coming from the Cedar River and supplied to the city through the Seattle Public Utilities (SPU). The Cedar is an exceptionally high quality source from a watershed that is 99.6% in the City of Seattle ownership.

The plant layout is compatible with the future addition of filtration, but there is no specific schedule for adding filtration. The plant includes ozone for *Giardia* disinfection and taste and odor control and UV (40 mJ/cm²) for *Cryptosporidium* inactivation. A new intake will be constructed in Lake Youngs, a large transmission reservoir on the Cedar supply. Plant performance requirements include 3-logs *Cryptosporidium* inactivation with UV (40 mJ/cm²). SPU has been working closely with CH2M Hill, drinking water regulators and UV experts to ensure that this level of performance can be achieved.

Water will be pumped from the lake, ozonated (ozone contact in existing large transmission pipelines), disinfected with UV light and then chlorine and lime (for corrosion control) will be added. Ozone decay in Cedar water is exceptionally low, so very low doses of O₃ will be needed.

"The new Cedar Treatment Facility will meet strict water quality standards and provide new, improved treatment facilities that will assure high quality and reliable water for many years to come," said Seattle Mayor Paul Schell. "What's more, having the same contractor design, build and operate the facility will save ratepayers an estimated $50 million over the life of the contract."

Groundbreaking is expected in the spring of 2002 and the facility is expected to be operational by the end of 2004.
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**Effectiveness:** 4 Log crypto inactivation to ensure complete inactivation of microorganisms, including crypto and giardia.

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**Superior Design:** Powerful medium-pressure lamps treat up to 40 MGD; fewer lamps mean lower operating costs; and, its compact size enables Sentinel to be easily retrofitted into existing systems.

**Quality:** Calgon Carbon Corporation has been treating drinking water for more than 50 years and is the industry leader in UV disinfection technologies.

The bottom line is more than just clean, safe drinking water...it's peace of mind.

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“After learning the facts about UV technology, our city council voted unanimously to install a Sentinel UV Disinfection System from Calgon Carbon Corporation. Sentinel’s performance has been truly fantastic. We’re achieving a 6 log removal, and we’re able to treat up to 14 MGD per day. The most significant benefit, however, is safer drinking water for our community.”

Darrel Schuerman,
Water Superintendent, City of Grosse Pointe Farms, Michigan

Licenses for cryptosporidium inactivation technology are offered by Calgon Carbon Corporation. For more information about the technology license or the Sentinel system, contact Calgon Carbon at 1.800.422.7266 or send an e-mail to: lvaneWS@calgoncarbon.com.