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## OZONE NEWS

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**Editor:** Barry L. Loeb

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As a member of the IOA, you will receive bimonthly issues of the Ozone News newsletter, bimonthly issues of the technical journal Ozone: Science & Engineering (OS&E), and IOA's Publication Catalog which includes worldwide conference proceedings, monographs, and special reprints. In addition, members receive discounts on IOA worldwide publications and meetings.

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Make plans to attend Seattle Conference! An outstanding technical program has been assembled covering the emerging issues of concern to water and health officials. Tours to local drinking water plants are also being arranged. www.io3a.org

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This issue contains a brief summary of a survey regarding the growth of ozone and AOP markets. Growth of ozone systems is projected to be nearly 10% over the next six years – up to $600 million per year - good news for our organization. The study also projects the growth of the ozone market per application field. This study shows a greater market for wastewater than drinking water. This was surprising to your editor. Comments on this summary are invited.

At the Seattle conference, a paper will be presented “Worldwide Ozone Capacity for Drinking Water and Wastewater.” This work is based on input from individuals and IOA regional sections. To make the work complete, much more work is needed. At the conclusion of the Seattle conference, we will be deciding whether to continue the project, or whether it is impractical. Again, we are looking for member input.

Barry Loeb
Editor-in-Chief
COLUMBUS, OH TO USE OZONE

The City of Columbus, OH will use ozone and biologically active filtration (BAF) to control disinfection byproducts. The largest of the three Columbus water treatment facilities, the Hap Cremean Water Plant with a capacity of 100 million gallons per day will be the first to undergo modifications to address requirements of the Stage 2 DBP rule.

In reaching their decision, bench-scale and pilot-scale studies investigated several treatment techniques and three were finally considered for the plant design – Granular Activated Carbon (GAC), ozone/BAF and integrated membranes (ultrafiltration followed by low-pressure reverse osmosis). An additional advanced oxidation process utilizing ultraviolet radiation in conjunction with hydrogen peroxide was also investigated early in the project. The City selected the ozone/BAF process for implementation based on a variety of criteria including efficacy with respect to water quality, net present value, residuals, constructability, sustainability, and ease of operation. Ozone dosage will be 5-7 mg/L so the ozone plant capacity will approach 6,000 lb/day (110 kg/h).

The City of Columbus is in the process of initiating the design and construction of these improvements, with a target completion date of 2013.

Source: Ohio AWWA Section Newsletter, Summer 2010

CLEARWATER TECH, LLC ADDS LINE OF NEW OZONE GENERATORS

ClearWater Tech, LLC, San Luis Obispo, CA has added a recently designed CD12/AD corona discharge ozone generator to its line of wall mounted generators. The unit has dual ozone reaction chambers with a built-in air dryer. The self-contained air-cooled unit is designed to produce 2.6 g/h ozone at 1% concentration. Anticipated applications include residential swimming pools, commercial spas, residential well water, bottled water, waste water, aquaculture, and surface sanitation requirements. For more information visit: www.cwtozone.com.

Industry News
Interference-Free Measurement of Dissolved Ozone

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AOP solutions typically involve a combination of technologies that can include ozone (O₃), ultraviolet (UV) light, and hydrogen peroxide (H₂O₂) – usually as O₃/ H₂O₂, UV/ H₂O₂, or all three agents together.

ITT's Water & Wastewater business will supply the WEDECO MiPRO™ solution in three configurations:
- MiPRO™ eco – a WEDECO ozone system, H₂O₂ dosing unit, an injection/reaction unit and residual ozone destruction system
- MiPRO™ photo – a WEDECO UV system and H₂O₂ dosing unit
- MiPRO™ eco plus – a WEDECO ozone system, H₂O₂ dosing unit, an injection/reaction unit, residual ozone destruction system and a WEDECO UV system

WEDECO points out that there are more alternatives than medium-pressure UV and hydrogen peroxide when thinking of advanced oxidation processes as other choices may be more efficient and cost-effective, providing a faster return on investment for those considering AOP for their water or wastewater.
ASTRO PAK LAUNCHES NEW BIO DECONTAMINATION SERVICE COMPANY

Astro Pak Corporation, an IOA member and large precision cleaning and passivation company, has launched their new subsidiary, SixLog Corporation. SixLog provides on-site biological decontamination services utilizing proprietary iHP™ (ionized Hydrogen Peroxide) technology to a variety of industries including Life Sciences, Pharmaceutical, Healthcare, First Responders, Transportation, and Public Facilities. SixLog performs decontamination services for equipment, rooms, entire buildings, and modes of transportation such as ambulances, trains, and cruise ships.

The iHP™ bio decontamination technology was initially developed and perfected for military applications (biological weapons). In the commercial marketplace iHP™ can be used in open air and, once ionized, acts like a gas as opposed to vapor, providing excellent distribution properties, and destroying microorganisms even in those hard-to-reach areas.

The company has unveiled a website at www.sixlogcorp.com.

AQUENTIUM SIGNS DISTRIBUTION AGREEMENT

Aquentium, Perris, CA has signed a distribution agreement with IMPACT 3 Global for representation of Aquentium’s line of ozone disinfection and water purification equipment. Aquentium Cleaning Antimicrobial Systems have been developed for the food, beverage, hospitality, education and medical industries, using an ozone-based cold water technology. Information: www.aquentium.com

Cont’d on p 13.
19TH JAPAN OZONE ASSOCIATION ANNUAL CONFERENCE ON OZONE SCIENCE & TECHNOLOGY

On June 18-19, 2010, the Japan Ozone Association Annual Conference on Ozone Science & Technology was held at Katsura Campus, Kyoto University, Nishikyo-ku Japan. Around 150 professionals including engineers, researchers, students and professors attended the meeting. 37 papers including 3 poster presentations were submitted. This conference was sponsored by the Water Re-use Promotion Center, Japan Water Works Association and Japan Industrial Water Association.

A welcoming reception with was held in the school cafeteria at Kyoto University Katsura Campus. In attendance was Dr Ann of the Korea Ozone association as a special guest.

Prof. Horoshi Tsuno, President of the Japan Ozone Association and professor of Kyoto University, opened the conference and welcomed all attendees.

Topics covered included ozone generation, disinfection, drinking water purification, ozone generator design, manufacturing process, bromate formation and control, industrial applications, sludge reduction, air applications, municipal sewage treatment, reuse water and advanced municipal water applications.

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Diagnostics Tab: LED & output test, direct memory commands (password required).
Factory Tab:
Setups tab:
Write to file button:
oxidation processes.

Dr. Kuzumoto, vice president of the Japan Ozone association presented “Safe assessment and utilization of safety standard for ozone” for promotion on safety usage of ozone for the eleventh time.

Associate Professor Otaki summarized the technical contributions, recognizing both authors of oral and poster presentations.

The conference concluded with the JOA general assembly and the award ceremony.

A sampling of the technical papers presented follows. For a complete list of the papers presented and the conference proceedings (in Japanese) contact the Japan Ozone Association at takahara-joa@mrh.biglobe.ne.jp.

• Practical Application of Ozone Generation for Pure Oxygen (2 papers), Akira Murai, Chobei Yamabe and Satoshi Ihara.
• Simultaneous Control of Bromate Ion Formation and Odor Compounds Removal by Ozone/Hydrogen Peroxide Process, Tadao Mizuno, Shinya Ohara and Hiroshi Tsuno.
• Removal Characteristics of 1,4-dioxane by Ozone, Kensuke Okuda, Eri Hasegawa, Yuki Nishida, Fumitake Nishimura and Hiroshi Tsuno.
• The Influence on Facilities by Ozone Used for a Clean Room in A Sterilization Purpose – The Introductions of New Facilities on the Basis of this Experience, Noriyoshi Kosaka, Shinichi Okuda, Toshihiro Nogami, Takuji Iwamura and Hideharu Shintani

Reported by Hirofumi Takahara
Craig Woolard, current AWWA president opened the session and summarized the state of the industry. In 1900, there were only 300 water systems in the USA. Typhoid was a major problem. Today, this is unheard of. The economic situation has caused a major stress on the water utilities. Many cities are faced with aging distribution systems but have no good solutions for resolution. He reiterated a frequent position of the AWWA that we must emphasize the difference between the cost to produce water and its value.

Dennis Hayes, National Coordinator of the first Earth Day, provided the keynote address. Global water challenges grow direr each day due to population change, climate change and war. Humans and domesticated animals occupy 72% of the mass of all animals on earth. The fastest growing energy resources are solar, wind and geothermal. There are 30 billion bottles of water sold each year – 95% of these could be replaced by tap water, according to Mr. Hayes.

Exhibits

There were a number of exhibits sponsored by ozone equipment manufacturers and instrument suppliers. Exhibitors were very positive on the health of the ozone industry. The drinking water market appears to be stable with new projects being announced. There is a growing interest in wastewater
treatment with ozone due to the issue of emerging contaminants. The industrial market is growing but difficult to trace as many ozone sales are third party.

Technical Sessions

There was one technical session devoted to ozone applications; ozone was also highlighted in several other sessions.

IOA President Elect Jeff Neemann described the work on the future project for a WTP in NE Dallas/Ft. Worth (Lake Lavon). This facility will add ozone to meet DBP rules and improve taste and odor. It was found that intermediate ozonation was better than pre-ozonation. This 900 mgd facility will require 44,000 ppd ozone (11 x 3900 ppd generators).

Chris Schultz, CDM reviewed the synergistic benefits of an ozone-UV-chlorine process train for Vancouver’s unfiltered Coquitlam water supply. Ozone at a dosage of 1.5-2 mg/L will be used for preoxidation. UV will be used for final disinfection. It is hoped that the preoxidant lag time may reduce the iron fouling potential for UV systems.

PAG President-Elect Mike Oneby introduced a proposed methodology for incorporating sustainability in the evaluation and selection of disinfection technologies.

Regulatory Update

In the annual regulatory update session, Cynthia Dougherty, USEPA Office of Water updated the attendees on their activities. EPA is trying to address contaminants as groups, rather than one single contaminant. Of the water quality violations that the EPA processes, 96% are from small systems. The Economic Recovery Act (Stimulus) has devoted $1.8 billion for water treatment over 1349 projects.

EPA has identified candidate chemicals for further review of their toxicity: TCE (Trichloroethylene), PCE (tetrachloroethylene), acrylamide and epichlorohydrin.

Awards

The A. P. Black Research Award recognizes outstanding research contributions to water science and water supply practices rendered over an appreciable period. The 2010 award was presented to Dr. R. Rhodes Trussell. Dr. Trussell was co-author of a Harvey Rosen Award winning paper in OS&E. In a fascinating keynote address, Dr. Trussell traced the evolution of water technology and water science. Basic filtration and chlorination is considered water science. Water technologies are developed based on science, e.g. GAC, Air Stripping, Ozone, UV, AP, Membrane Filtration.

During this session the AWWA Academic Award for the best Doctoral Dissertation in 2009 was given. This award was given to Dr. Aleksiy Pisarenko, for his thesis “Analytical Measurements and Predictions of Perchlorate Ion Concentration in Sodium Hypochlorite Solutions and Drinking Water: Kinetics of Perchlorate Ion Formation and Effects of Associated Contaminants.” Dr. Pisarenko was a doctoral student in Chemistry at Miami University of Ohio under the guidance of his advisors Prof. Gilbert Pacey, professor of chemistry and biochemistry and Past IOA President, Prof. Gilbert Gordon, professor emeritus of chemistry and biochemistry. Dr. Pisarenko completed his doctoral work on an Internship sponsored by the Southern Nevada Water Authority where he worked in conjunction with Ben Snyder and Shane Snyder. This work was considered to be critical as perchlorate ion has been recognized as an endocrine disrupting agent, affecting the thyroid, and is on a fast track to be an EPA regulated substance in drinking water.
Emerging contaminants: removal, toxicity control.

The report particularly reviews ozonation and AOP technologies with discussions on market from data collected through interviews of major players in that sector, mainly IOA corporate members.

The global ozone market is estimated at US$ 361 million in 2010 and is expected to exceed US$ 597 million by 2016 according to a CAGR of 9.6% (Figure 1). Figure 2 shows the details on distribution according to the sub-markets by application. As a result, the ozone market reaches 3,334 US$ millions for the period 2010-2016. The top 3 ozone geographical markets includes East Asia Pacific (34.9%), North America (26.5%) and Western Europe (22.1%) and thus offers outstanding perspectives for IOA development in Asia besides old IOA areas (Figure 3). This typically reflects the demography level and evolution and is consistent with the water stress Indicator Map (Figure 4). This water stress
indicator (WSI) map takes into account environmental water needs, which is the amount of water needed to keep freshwater ecosystems in a fair condition. It was developed using global models of hydrology and water use. Red areas show where environmental water needs are not being satisfied because too much water is already being withdrawn for other uses.

The market forecast for AOPs ends in 1,143 US$ millions in the period 2010-2016 and highlights the predominance of the same geographical areas. It is based on the next widespread adoption of AOPs in point-of-use at the household or industry level for higher standard of treatment like for the production of ultrapure or in water re-use applications.

While these data can be questioned since few details are given on the procedure to support their reliability, the whole of this study is consistent with the qualitative market evolution we are experiencing in the IOA community. With input from IOA members, the data concerning ozone and advanced oxidation and the distribution of projects between drinking water and wastewater can be refined.

The best for the IOA can then be also expected!

Figure 3. Forecast of ozone market distribution per geographical area 2010-2016

Figure 4. Water Stress Index Map (Source: IWRM)
WEDECO Ozone Technology

ITT develops, designs and manufactures state-of-the-art WEDECO ozone systems for water treatment and industrial processes with capacities from 2 g/h up to 250 kg/h per unit. Patented Effizon® HP technology and years of manufacturing experience enable us to deliver unique, highly efficient and cost-effective WEDECO ozone systems. The philosophy behind the Effizon® HP technology is: To achieve highest reliability and performance at the lowest total costs.

www.ittwww.com
The Medford Water Commission operates a 45 mgd seasonal surface water treatment plant that utilizes ozone primarily for taste and odor control. The ozonation system consists of LOX, two 600 ppd generators, and sidestream injection. This plant serves to off-set the additional water needed from the year round spring supply during the warm, dryer summer months. As a seasonal and supplemental facility, the ozone system must be capable of approximately a six month operating window in which the system is started and stopped frequently for a portion of the time and operated twenty four hours a day for another portion. At the end of the operating season, the facility is taken out of service in a way so as to maintain and protect the operational integrity of the system. Prior to bringing the facility back into service each spring, a substantial commissioning process is initiated.

This paper will explore the unique aspects of seasonal operation of the ozone facility in conjunction with the water treatment plant. Issues to be addressed will include the various design aspects for the facility as well as the associated challenges of annual commissioning, decommissioning, and optimizing of the facility. Many lessons have been learned from this nine year old facility, and likely some are yet to be addressed.

INTRODUCTION

The Medford Water Commission built the Robert Duff Water Plant in 1968 to supplement Big Butte Springs which is the year round spring supply for Medford and the surrounding communities. The spring supply is a high quality ground water and supplies 26.4 MGD to the community each and every day. As the community has grown, the demand for water has far exceeded the supply from the springs during the summer months; therefore, the Duff Plant has grown over the years in an incremental fashion to keep up with the demand. The springs still supply enough water to limit the need for the Duff Plant to a six month operating window in the warmest time of each year. The Duff Plant is a conventional surface water treatment plant with the Rogue River as its water supply.

The community had grown to expect a high quality, aesthetically pleasing water and so the portion of the year that river water was processed usually generated a fair number of complaints regarding tastes and odors. The Medford Water Commission delivers water for an approximate population of 131,000, composed of the city of Medford and five surrounding cities. Because of the perceived differences in water quality during the summer months between the two sources, the Medford Water Commission was willing to do whatever it took to equalize the water quality between those two sources to the extent possible.

The source of the taste and odors from the river was determined to be Geosmin which varied in concentration from a background of 4 – 8 ng/L to a high of greater than 30 ng/L. Ozone was chosen as the best available technology for the removal of the taste and odor compounds after bench and pilot testing, results have been described in detail elsewhere (Neemann et. al. 2001). In 2001 the Medford Water Commission contracted with Black and Veatch to design a full scale preozonation system to treat the water coming into the water plant. One of the challenges in design was the fact that the plant is a seasonal plant and production is on a demand basis which often means daily start and stop.

The completed ozone system is composed of a 9000 gallon liquid oxygen (LOX) tank, two ambient vaporizers, two 600 ppd generators, a supplemental air system for Nitrogen boost, variable frequency drive (VFD) sidestream pumps for injection, and two ozone destruct units. The ozone system design had been described in detail elsewhere (Neemann et. al. 2002).

DESIGN

How do you design and integrate a multi-component system for daily start/stop and seasonal use while keeping the system user
friendly to a small staff with limited technical expertise? Itemized design features that aid the intent of seasonal use include the following:

1. An open loop cooling system using plant service water is discharged back into the headworks of the contactor. The water used is recycled, and the process minimizes on cooling water equipment and therefore on the maintenance required on a closed loop system.

2. Sidestream injection minimizes maintenance and potential problems with fine bubble diffuser damage, seals, and contactor cleaning. All components of the injection system are accessible in the pipe gallery. Transfer efficiencies are consistently better than 97%.

3. Contactors are baffled creating a serpentine flow path arrangement as opposed to the over/under type which makes for easier cleaning and less hazardous access.

4. Contactor access is from ground level therefore the challenges of top entry are eliminated.

5. Contactors are designed with a sediment trap at the influent chamber to allow seasonal heavy sediments to drop out rather than building up in the entire contactor. A plug valve can be opened on the sump to blow down the sediments.

6. A bypass installed in the service water line allows plant service water typically used for generator cooling to be bypassed to the contactors to allow filling, testing, and rinsing the contactors with clean water.

7. The destruct units are housed in the pipe gallery to allow for close observation and accessibility for maintenance purposes.

8. The integration and PLC control is very flexible and extremely reliable.

9. In order to achieve a complete ozone system start up which can be independent of the water plant control system or raw water flow, the sidestream system can be fed from the raw water or the contactors. The contactors supply serves as a source of water to the sidestream pumps until the ozone control system sees a minimum flow coming from the raw water pumps at which time the raw water valve to the sidestream pumps opens and the contactor valve closes. This also allows the ozone system to be started and operated during times when there is no raw water flow.

10. A sufficient number of isolation valves were needed to help isolate sections of pipe for maintenance and off season isolation.

11. A hydraulic loop was installed on the ozone line for added protection to help prevent any water which could potentially back up the gas line past the check valves and moisture detectors.

All of these features may or may not be in a continuous operating system as well but they are very beneficial in the start/stop and seasonal operation.

---

**Operations**

**Annual Commissioning**

The entire commissioning process takes about four weeks. These activities typically start with the following:

1. All high and low concentration ozone analyzers are serviced. This routinely includes the annual replacement of the UV lamps, tubing/fittings, quartz windows, internal destruct canisters, and pump bellows or other components as needed.

2. The dew point sensor is removed and sent to the factory for calibration.

3. The oxygen purity sensor is replaced with a new one, as well as all the ambient oxygen sensors.

4. The supplemental air compressors for the nitrogen boost system are serviced to maintain the filters, dryers, and compressors.

5. The contactor is filled with fresh water for commissioning purposes through the service water bypass line.

6. Both destruct units are operated at an elevated temperature to facilitate drying out the catalyst prior to further testing. At this time the vacuum control can be established in the contactor.

7. The LOX tank pressure is adjusted down to the operating pressure and the initial purge path is set up. The flow is then controlled to prevent any pressure surges to the vaporizers or generator shells.

8. The cooling water is maintained off to the generators so as not to facilitate condensation on the tubes within the shell.

9. The purge is maintained for a minimum of eight hours while confirming the dew point has been depressed to operating levels.

10. The supplemental air compressors for the nitrogen boost system are maintained off until the initial drying of the system is complete.
Annual Decommissioning

At the end of each operating season, the ozone system is decommissioned. These activities typically take a couple of weeks and usually occur in October. The following are typical steps toward this process.

1. The contactor is drained of raw water and accumulated sediment that may be caught in the sediment zone. The contactors are refilled with fresh water and then drained again. Draining is followed by opening the contactors and purging them with air in preparation for cleaning.

2. Contactor atmosphere is tested and confined space procedures are followed by personnel prior to entering the contactor in preparation of cleaning out the relatively small amount of fine sediments remaining in the contactors. Because the contactor floor is level and does not flow to the drain very well, a fresh stream of water is introduced at the outlet which flows toward the influent drain location and serves as a rinse to help carry the sediments.

3. Inspection of the contactor’s internal pipe, supports, sample manifolds and baffle walls is done upon completion of the cleaning process.

4. Leak testing is done for the various segments of GOX lines and the generators. This is done to find and repair any leaks that will cause the section of line to drop to atmospheric pressure over a period of weeks. The goal is to have a higher pressure in all the GOX lines than atmospheric to help maintain them in as dry a state as possible during the shut down period.

5. Each section of line is isolated using the manual valves as well as the actuated valves to help seal up all piping as good as possible.

6. Water is drained from the generator shells.

7. The temperature is raised on the destructs and they are run for a minimum of twelve hours. This final drying period is followed by isolating each of the units with the manual as well as the actuated valves. The goal is to dry the catalyst as much as possible prior to shutting the units down for the winter.

8. The supplemental air system is isolated from the GOX line with a manual valve and the individual pneumatic valve supply lines are closed. The compressor system is left operable for the off season even though there is minimal use.

Inventory management of LOX

The LOX tank is a 9000 gallon tank equipped with safety relief valves which open at 250 psi. As the operating season comes to an end, the LOX inventory is allowed to drop with a goal of being around 1000 gallons at the time of shutdown. Shut down is not predictable but is weather dependant so it is a gamble at best in managing the inventory in the latter days of the operating season. After the shut down of the plant, the pressure of the tank will slowly build from the normal operating pressure of 100 psi. The pressure will reach the relief or blow-off pressure in about 45 to 60 days at which time 2000 gallons of additional oxygen are ordered. The supplier will pump the liquid oxygen into the gas space of the tank which cools the tank down and lowers the pressure back to around 150 psi. Then the process starts over again and continues for the duration of the out of service period. Immediately prior to seasonal commissioning, one last allotment of oxygen is added to the tank for pressure control and the end result is a minimizing of oxygen wasted over the out of service period. Fortunately the cost of LOX has not been affected by this method because the LOX vendor has maintained the tank inventory as part of an area route, and therefore is not contingent on full loads.

Optimization

A unique aspect of the raw water is that the pH fluctuates on a diurnal basis. The pH will swing as much as 1.5 units from night to day which causes the dissolved ozone residual to disappear at the elevated pH’s due to the scavenging of the ozone by the hydroxyl radicals. The original pilot testing demonstrated sufficient Geosmin removal was achieved at 1 mg/L despite the fact that the dissolved ozone was not detectable. In an attempt to smooth out the unit process from the ozone system and downstream, a carbon dioxide system was installed. In making the pH consistent (around 7.0) prior to ozone, the dissolved ozone can be maintained through the first two cells. This will allow MWC to document additional disinfection for CT credits. The other advantages to the pH control are a decreased ozone dose to achieve the same effect which also lowers cost, and a lowering of the coagulant dose which helps to minimize production of residuals as well as cost. The addition of carbon dioxide has proven multiple benefits and smoothed out the operation greatly.
CHALLENGES

1. The automation of the ozone system and its PLC control is relatively complex with permissives, interlocks, miscellaneous safe guards, and integrated equipment. The automated system works extremely well. As a result of the dependability, the staff does not see a great deal of failures. This leads to staff who are not as intimate with troubleshooting failures as would be desired which can only be overcome with a great deal of experience.

2. The ozone system runs automatically and can be monitored continuously via SCADA as well as hourly rounds by operation staff. On rare occasions a tube fitting inside the high concentration analyzer will crack and the resultant leak of ozone will blind the analyzer. The generator therefore does not know how to pace itself and so ramps up to maximum production without generating any alarms until overheating occurs, or an operator finds the condition while making rounds.

3. The water plant is a seasonal plant and the operations staff is limited to a few trained individuals and some seasonal staff with limited expertise. The challenge of maintaining and developing an adequate technical skill set is on going.

4. The GOX temperature coming off of the ambient vaporizers tends to exceed the optimum temperature at times due to the high local ambient temperatures during many summer days and the size of the vaporizers.

5. One of the nitrogen boost compressors had a seal failure which is believed to have fouled the in service generator. The fouling was not noticed for quite some time so it was difficult to determine just when it did happen. If there was any change in the dew point value it was not noticed by operations staff. No real safeguard against such an occurrence exists.

6. As the system ages there is likely to be more maintenance challenges which will require a higher level of expertise or increased service cost from outside contractors.

7. The need is great to maintain very detailed and accurate Standard Operating Procedures (SOP’s) for troubleshooting. The SOP’s are used most often after power outages.

CONCLUSIONS

The combination of good design, redundant and robust equipment, consistent maintenance, well written SOPs, and staff that is willing to take ownership for the system is the key to having a well functioning seasonal ozone plant. No special activities are done as a result of the system being seasonal that should not be done in any other continuous operating system, and the down times allow for the routine preventive maintenance at fairly optimum intervals.

REFERENCES


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Meetings Calendar

Upcoming IOA Meetings

2010

September 20-22, 2010, Pan American Group Annual Conference and Exposition, with special emphasis on Commercial-Industrial Operations while still supporting the unique needs of the growing municipal market, Hyatt Regency, Bellevue (Seattle), WA. Registration for conference and hotel is open. For more information see this issue of Ozone News or visit: www.io3a.org

October 8-10, 2010, Ozone in Medicine, Vienna Hilton Stadtpark, Vienna, Austria. Conference is being conducted by the European Cooperation of Medical Ozone Societies. For more information: www.ozone-association.com or www.ozongesellschaft.de

October 20-23, 2010 AWT Annual Convention and Exposition, Reno NV. For more information: www.awt.org


2011

May 23-27, 2011, 20th World Congress & Exhibition, CAP 15 International Center of Businesses and Congress, Paris, France. This is a joint World Congress with the IUVA. Call for papers: Due October 10, 2010. For more information, contact: Ms. Béatrice Bernard, Secretariat IOA-EA3G ioa@esip.univ-poitiers.fr or www.ioa-ea3g.org. More detailed information is available in this issue

September 19-21, 2011, North American Conference on Ozone and Ultraviolet Technologies, Fairmont Royal York Hotel, Toronto, Canada. This will be a combined IOA-PAG/IUVA meeting. More information will be available in the future on the IOA website www.io3a.org.

Upcoming Meetings of Other Organizations

2010


October 2-6, 2010, WEFTEC 10, New Orleans, L.A. For more information: www.weftec.org

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<tr>
<th>Model</th>
<th>Concentration Ranges</th>
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<tbody>
<tr>
<td>OEM-106-L</td>
<td>0-10 ppm with 0.001 ppm (1 ppb) resolution</td>
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<tr>
<td>OEM-106-M</td>
<td>0-1000 ppm with 0.01 ppm resolution</td>
</tr>
<tr>
<td>OEM-106-H</td>
<td>0-20 wt % with 0.01% resolution</td>
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International Ozone Association
Pan American Group
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PAG 2010
HYATT REGENCY BELLEVUE
SEATTLE, WA, USA
SEPTEMBER 20-21, 2010

PAG 2011
THE FAIRMONT ROYAL YORK
TORONTO, ON, CANADA
SEPTEMBER 19-20, 2011

For More Information http://www.io3a.org

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SEPTEMBER 19-21, 2011

Mark your Calendar! The International Ozone Association (IOA) and International Ultraviolet Association (IUVA) happily announce their second joint North American Conference, September 19-21, 2011 in Toronto.

Check back for details at: www.io3a.org and www.iuva.org

For More Information: Diana Mitchell - Communications & Operations Manager
PO Box 28873 • Scottsdale, AZ 85255, USA • T: +1 480-544-0105 • F: +1 480-473-9068 • DianaM@io3a.org
The International Ozone Association and The International Ultraviolet Association are pleased to invite you to take part in their

2011 Joint World Congress & Exhibition
20th IOA World Congress - 6th IUVA World Congress

Ozone and UV: Leading-edge science and technologies

23-27 May 2011
Paris, France

This event continues a long series of successful congresses organized worldwide to provide an international forum for all concerned with fundamental, engineering and applied aspects oxidation techniques involving ozone and related oxidants and/or UV techniques.

Prior IOA World Congresses are listed in blue. Prior IUVA World Congresses are listed in violet. Our 1st Joint IOA / IUVA World Congress is listed in black


The upcoming congress will host experts from all over the world to present and discuss the latest advances in knowledge and technology for development and application of processes based on UV, ozone or any derived or comparable oxidants for:
• Environmental and human health protection (water, gas, soil and waste purification)
• Industrial manufacture and conditioning (pulp and paper, food, electronics, chemicals, …)
• Medical therapy.

The IOA and IUVA wish to continue to offer the world the unique opportunity:
• To interface with scientists, researchers, students, engineers, users, technical experts, representatives of leading organizations from various disciplines,
• To share the latest information on research topics, current issues, technologies under development, new applications, full-scale experiences and equipments and products,
• To consider and discuss directions able to deliver innovative, competitive and sustainable solutions which address current and next challenges.

FIRST ANNOUNCEMENT
CALL FOR PAPERS AND EXHIBITORS
The congress will feature:
- Four concurrent scientific and technical sessions including keynote lectures, oral communications, short oral presentations with connected poster sessions and discussions (23-25 May),
- Exhibition of Industry’s technologies, products and services (23-25 May),
- Technical visits of full-scale application plants (26-27 May),
- Social and cultural events for delegates and their guests.

Authors are kindly invited to propose an extended abstract in English of two pages (with title, authors’ names and addresses, keywords, tables and figures) preferably by e-mail to the IOA and IUVA at the following addresses:
- IOA office, ioa@esip.univ-poitiers.fr for Ozone abstracts
- IUVA office, abstracts@iuva.org for UV abstracts.

Each proposal should be accompanied by the Submission form and Agreement for publication to be downloaded at www.ioa-ea3g.org and duly filled.

<table>
<thead>
<tr>
<th>Date</th>
<th>Event Description</th>
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<tbody>
<tr>
<td>October 10, 2010</td>
<td>Deadline for submission of abstracts for next selection by the Scientific Committees</td>
</tr>
<tr>
<td>November 15, 2010</td>
<td>Notification about acceptance of papers and guidelines for manuscript layout</td>
</tr>
<tr>
<td>February 15, 2011</td>
<td>Deadline submission of print ready papers by e-mail</td>
</tr>
<tr>
<td>March 15, 2011</td>
<td>Final program</td>
</tr>
</tbody>
</table>

All papers will be published in the Congress proceedings that will be handed out to participants at registration and further available from IOA and IUVA. After the Congress, the editors of Ozone: Science & Engineering, the IOA’s peer-reviewed Journal, and IUVA News, the IUVA’s quartery publication, will select the best full papers for publication.

Organizations and companies are invited to support the Congress organization and to display their technologies, products and services related to the Congress theme. For exhibition or sponsoring options, please contact the Congress Offices via:
- IOA office ioa@esip.univ-poitiers.fr
- IUVA office DianaS@iuva.org

English will be the official language. Congress venue will be CAP 15 International Center of Businesses and Congress, located close to the Eiffel Tower in the France’s prestigious capital city of Paris.

The topics of interest connected to the general theme of the Congress include but are not limited to:
- Chemical and biochemical reactions
- Photochemical and photobiological reactions
- Reaction mechanisms
- Reaction kinetics and modeling
- Advanced oxidation processes
- Ozone and UV synergies
- Hydrodynamics and mass transfer
- Reactor design / Modeling / Validation
- By-products formation and control
- Process optimization and control tools
- Ozone generation
- UV source technologies
- Multiphase reactors
- Gas diffusion devices
- Regulatory requirements
- Gas treatment and odor control
- Soil remediation
- Biosolids treatment
- Water disinfection
- Emerging contaminants, occurrence and treatment
- Pollutants removal
- Wastewater treatment for reuse or discharge
- Application in agricultural and industrial processes
- Decontamination/Modification of materials and surfaces
- Measurement and on-line monitoring
- Operation studies
- Competitiveness of technologies
- Medical applications
- …

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