OCEESA Profile

Overseas Chinese Environmental Engineers & Scientists Association (OCEESA) is a non-profit organization incorporated in the State of Ohio in 1980, it holds tax exempt status under sec 501(c)(3) of IRS Code. OCEESA is devoted to promote academic and professional excellence and networking in environmental science. OCEESA members work and reside throughout the USA, Canada and in many countries of Asia. In 1988, OCEESA became a chapter of the Chinese Institute of Engineers/USA to affiliate with other Chinese American professional organizations.

OCEESA Officers & Board of Directors

President Dr. Clark Chen-Kun Liu 劉成均 University of Hawaii
Vice President Dr. Wei-Yin Chen 陳惟寅 University of Mississippi
Secretary/Treasurer Mr. An-Min Liu 劉安民 AML Env Engr Consultants

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Dr. David Tai-Ko Shaw 蕭台戈 State University of New York at Buffalo
Dr. John Jian Wang 王堅 Meridian Aquatic Technology, LLC.,

Director (2008-2009)

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Dr. Chun-Chao Chou 周俊釗 Wastewater Chemistry Laboratory, City of San Diego
Dr. Jeff Jih-Fen Kuo, 郭繼汾 California State University - Fullerton

Ex-Officio (2008): Dr. Pao-Chaing Yuan 袁保強 Jackson State University

Permanent Executive Director: Dr. Yung-Tse Hung 洪永哲 Cleveland State University

Advisors: Dr. Shoou-Yuh Chang 全少玉 Dr. John C. P. Huang 黃肇鑣 Dr. Wen-Chi Ku 王抗曝 Dr. Robert Chang-Chun Lao 劉長春 Dr. Don Tsye-Lang Tang 唐次朗 Dr. Lawrence Kong-Pu Wang 王慶宗 Dr. Jen-Tai Yang 楊仁泰

Membership: Regular member $25 per year, Student member $15 per year, Corporate member $100 per year.

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(ISSN 1072-7248)

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OVERSEAS CHINESE ENVIRONMENTAL ENGINEERS & SCIENTISTS ASSOCIATION
CHINESE INSTITUTE OF ENGINEERS CIE/USA
CLEVELAND, OHIO, USA

OCEESA World Wide Web Homepage: http://www.oceesa.org
OCEESA MEMBER NEWS (October 2008)

1. We would like to cordially welcome the following new OCEESA members who have recently joined OCEESA:

   Dr. Rebecca Shain-Yue Chou, Chief, Groundwater Permitting Unit, Los Angeles Regional Water Quality Control Board, California EPA, Los Angeles, California
   Email: rebeccachou@sbcglobal.net, rchou@waterboards.ca.gov,

   Dr. Kaimin Shih, Asst Prof., Dept of Civil Eng,
   University of Hong Kong, Hong Kong
   Email: kshih@hku.hk, sakom39@yahoo.com,

2. The 12th Mainland Taiwan Environmental Protection Conference (MTEPC) was successfully held during the week of October 20-26, 2008 in Kaohiung, Taiwan. The conference was organized jointly by National Kaohsiung First University of Science and Technology (NKFUST), Harbin Institute of Technology (HIT), and Overseas Chinese Environmental Engineers and Scientists Association (OCEESA). A total of 11 OCEESA members presented 12 papers at the conference.

   Total number of participants at 12 th MTEPC was 246. Number of participants at 12th MTEPC was 65 from China, 170 from Taiwan and 11 from OCEESA. Number of papers presented was 155 by Mainland, 171 by Taiwan and 12 by OCEESA authors.

3. OCEESA Best Paper Award Committee of 12th MTEPC, Kaohiung, Taiwan, October 20-26, 2008, has accepted the selection of 5 best papers from China by China MTEPC Organization Committee. No paper was received from Taiwan MTEPC Organization Committee. The OCEESA Best Paper Award Committee presented certificates and US$100 per paper (to authors of papers) during 12th MTEPC.

4. OCEESA Best Paper Award Committee of 12th MTEPC, Kaohiung, Taiwan, October 20-26, 2008, consisted of Dr. Wei-Yin Chen (Committee Chair), Dr. Rebecca Shain-Yue Chou (Committee Secretary), Dr. Clark Chen-Kun Liu, Mr. Steven Sun-Yu Fan, Dr. David Tai-Ko Shaw, Dr. Pao-Chiang Yuan.
   We would like to thank all committee members for their excellent service.

5. OCEESA Consultative Committee of 12th MTEPC, Kaohiung, Taiwan, October 20-26, 2008, consists of the following.
   Dr. Clark Chen-Kun Liu, OCEESA President (Committee Chair)
   Dr. Yung-Tse Hung, OCEESA Permanent Executive Director (Committee Secretary)
   Dr. Wei-Yin Chen, OCEESA Vice President
   Mr. Anmin Liu, OCEESA Secretary/Treasurer
   Dr. Pao-Chaing Yuan, OCEESA Ex-Officio

   We would like to thank all committee members for their excellent service.
6. OCEESA Outstanding Service Plaque s were presented to Prof. I-Chang Jou, President, National Kaohsiung First University of Science and Technology, Kaohsiung, Taiwan, and to Prof. Ping-Chi Hsu, Chairman, Department of Safety, Health and Environmental Engineering, National Kaohsiung First University of Science and Technology, Kaohsiung, Taiwan, on October 21, 2008, by Prof. Clark Chen-Kun Liu, President, OCEESA, during 12th MTEPC, Kaohsiung, Taiwan, for their outstanding service in organizing 12th MTEPC.

7. Prof. Yung-Tse Hung, Permanent Executive Director, OCEESA, received a plaque from Prof. I-Chang Jou, President, National Kaohsiung First University of Science and Technology, Kaohsiung, Taiwan, to thank him for his outstanding service for coordinating 12th MTEPC for OCEESA. In Prof. Yung-Tse Hung’s absence the plaque was received by Prof. Clark Chen-Kun Liu, President, OCEESA, on behalf of Prof. Yung-Tse Hung, on October 21, 2008, during 12th MTEPC, Kaohsiung, Taiwan.

8. OCEESA Nomination Committee of 2008 consists of the following. Election will be held in December 2008. Please contact Dr. Wei-Yin Chen, OCEESA Vice President, Email: cmchengs@olemiss.edu, if you have questions.
Dr. Wei-Yin Chen, Vice President (Committee Chair)
Dr. Yung-Tse Hung, Permanent Executive Director (Committee Secretary)
Dr. Clark Chen-Kun Liu, President
Mr. Anmin Liu, Secretary-Treasurer
Dr. Pao-Chiang Yuan, Ex-Officio

9. OCEESA Outstanding Service Plaque was presented to Prof. Pao-Chiang Yuan, OCEESA President of 2007, on October 21, 2008, by Prof. Clark Chen-Kun Liu, President, OCEESA, during 12th MTEPC, Kaohsiung, Taiwan, for his outstanding service to OCEESA as OCEESA President of 2007.

10. Happy retirement to the following OCEESA members who have retired on July 1, 2008:
Dr. Chun-Chao Chou, Chemist, Wastewater Chemistry Lab, City of San Diego, Email: phcc-chou@cox.net,
Dr. Ruth Hsing-Tze Ruan Chang, Research Scientist III, Environmental Chemistry Lab, California Dept of Toxic Substances Control, Email: htrchang@yahoo.com

EDITOR'S NOTE
OCEESA members are encouraged to email before January 15, 2009, news items and papers with a maximum length of 10 typed pages (single space, letter size 10, put all figures and tables after your text) to: Dr. Yung-Tse Hung, Editor-OCEESA Journal, Professor, 16945 Deerfield Dr., Strongsville, Ohio 44136-6214 USA. Tel (440) 238-0407 FAX: (216) 687-5395 Email: yungtsehung@yahoo.com, yungtsehung@gmail.com. Please also email your complete manuscript in electronic version (as attachment of email) to Dr. Hung before the deadline. Photos and pictures must be scanned and must be put in electronic version.
OCEESA World Wide Web Homepage: http://www.oceesa.org
# PAST OVERSEAS CHINESE ENVIRONMENTAL ENGINEERS AND SCIENTIST ASSOCIATION (OCEESA) PRESIDENTS

<table>
<thead>
<tr>
<th>Year</th>
<th>President</th>
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<tbody>
<tr>
<td>1. 1980-81</td>
<td>Dr. Robert Hsi-Lin Howe (Deceased)</td>
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<td>2. 1981-82</td>
<td>Dr. Howard Ju-Chang Huang</td>
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<td>3. 1982-83</td>
<td>Dr. Edward Shing-Ke Chian</td>
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<td>4. 1983-84</td>
<td>Mr. Eugene Y. Hsi (Deceased)</td>
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<td>5. 1984-85</td>
<td>Dr. Allen Chia-Chen Chao</td>
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<td>6. 1985-86</td>
<td>Dr. Yung-Tse Hung</td>
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<td>(Also Executive Director 6-1-86 to present)</td>
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<td>7. 1986-87</td>
<td>Dr. Charles Chi-Su Chou</td>
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<td>8. 1987-88</td>
<td>Dr. James Wen-Chi Ku</td>
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<td>9. 1988-89</td>
<td>Dr. Wei-Chi Ying</td>
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<td>10. 1989-90</td>
<td>Dr. Lawrence Kong-Pu Wang</td>
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<td>11. 1991</td>
<td>Dr. Don Tsy-Lang Tang</td>
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<td>12. 1992</td>
<td>Dr. Chin-Pao Huang</td>
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<td>13. 1993</td>
<td>Dr. Thomas To Shen (deceased 3-26-05)</td>
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<td>14. 1994</td>
<td>Dr. James Shia-Pin Whang</td>
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<td>15. 1995</td>
<td>Dr. Ching-Tzone Tien</td>
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<td>16. 1996</td>
<td>Dr. Jen-Tai Yang</td>
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<td>17. 1997</td>
<td>Dr. Shou-Yuh Chang</td>
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<td>18. 1998</td>
<td>Dr. John Chao-Piao Huang</td>
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<td>19. 1999</td>
<td>Dr. Oliver Jing-Ching Hao</td>
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<td>20. 2000</td>
<td>Dr. Chang-Lu Lin</td>
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<td>21. 2001</td>
<td>Dr. Tsen-Cheng Wang</td>
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<td>22. 2002</td>
<td>Mr. Anmin Liu</td>
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<td>23. 2003</td>
<td>Mr. Edward T. Chen</td>
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<td>24. 2004</td>
<td>Dr. Chein-Chi Chang</td>
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<td>25. 2005</td>
<td>Dr. Yung-Sung Cheng</td>
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<td>26. 2006</td>
<td>Dr. Francis Hun-I Chang</td>
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<tr>
<td>27. 2007</td>
<td>Dr. Pao-Chaing Yuan</td>
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<td>28. 2008</td>
<td>Dr. Clark Chen-Kun Liu</td>
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The 12th Mainland Taiwan Environmental Protection Conference (MTEPC) was successfully held during the week of October 20-26, 2008 in Kaohsiung, Taiwan, ROC. The conference was organized jointly by National Kaohsiung First University of Science and Technology (NKFUST), Harbin Institute of Technology (HIT), and Overseas Chinese Environmental Engineers and Scientists Association (OCEESA).

Overseas Chinese Environmental Engineering and Science Association (OCEES) were instrumental in organizing the first MTEPC which was held in 1992 at Tongji University in Shanghai. Since then, MTEPC has been held alternately in Mainland and Taiwan every one or two years. As across-the-strait conferences or workshops have proliferated into many academic and professional areas, MTEPC is well recognized as the first and the most successful one. As the general relationship between Mainland and Taiwan is improving, the importance of OCEESA to the organization and conducting of MTEPC is diminishing. However, the presence of OCEESA in MTEPC is still considered by our colleagues in Chinese Mainland and Taiwan to be highly desirable, if not at all essential. All three parties are anxious to develop new ideas to make the OCEESA a productive and mutually-beneficial component of the future of MTEPCs; and in a broader sense, the environmental protection and sustainable development in Mainland and Taiwan.

The OCEESA team at the 12th MTEPC was made up of 11 active members (Appendix 1) and presented a total of 12 technical papers – Dr. Kaimin Shih of the University of Hong Kong presented two papers to the conference (Appendix 2). In addition, OCEESA members were active at opening ceremony, technical sessions, consultative committee meeting, best paper awards, and closing ceremony. The following is a brief report of these activities. Total number of participants at 12 the MTEPC was 246. Number of participants at 12th MTEPC was 65 from
China, 170 from Taiwan and 11 from OCEESA. Number of papers presented was 155 by Mainland, 171 by Taiwan and 12 by OCEESA authors.

**Opening Ceremony**
Three keynote speeches were the highlights of the conference opening ceremony. OCEESA vice-president Dr. Wei-Ying Chen delivered a keynote speech on Climate Change – Causes, Effects and Solutions. This speech deals with one of the most critical environmental problems the mankind is facing. His speech will also provide a base on which further efforts can be made by OCEESA and its members in coming years.

**Technical Sessions**
There were a total of 35 technical sessions covering essentially all important technical areas of environmental engineering and sciences. Besides the presentation of 11 technical papers, OCEESA members were also invited to chair 10 of these technical sessions (Appendix 3).

**Consultative Committee meeting**
This meeting was one of the most important events of 12th MTEPC. OCEESA was represented in the consultative meeting by Clark C.K. Liu, Wei-Ying Chen, and Pao-Chiang Yuan. During the meeting, past activities were reviewed and universities that are to host the next two MTEPCs were tentatively decided. The Chongqing University in Mainland will host the 13th MTEPC to be held sometime in 2010. The Cheng-Kung University in Taiwan will host the 14th MTEPC (Appendix 3). Other important resolutions made by the meeting were summarized in Appendix 3.

**The Best Paper awards**
Five best papers were selected based on recommendations of Mainland Organizing Committee. During the closing ceremony, Dr. Clark C.K. Liu congratulated the recipients and presented a certificate and $100 cash award to each of the five senior authors of these selected papers (Appendix 4).

**Closing Ceremony**
MTEPC consists two parts: technical sessions or paper presentation and technical tours. Technical sessions of 12th MTEPC were successfully concluded in the late afternoon of October 22, 2008 and were followed by the closing ceremony (Appendix 5). In his concluding remarks, Dr. Yi-Chang Chou, president of the National Kaohsiung First University of Science and Technology summarized the important accomplishments of the conference and gave thanks to all participants and conference sponsors. Dr. Chou also presented two appreciation plaques to Dr. Ren Nanqi, Dean of the school of Municipal and Environmental Engineering, Harbin Institute of Technology (HIT), and to Dr. Yung-Tse Hong, Permanent Executive Secretary of OCEESA. Dr. Hong was not able to attend the conference. However, as a contact person between OCEESA and conference local organizing committee, Dr. Hong spent many hours and made tremendous efforts during the past 12 months to make sure that OCEESA would be well represented in this conference. Afterwards, Dr. Clark C.K. Liu, on behalf of OCEESA, gave thanks to the conference host university and presented appreciation plaques to President Chou and Dr. Fan, Dean of the College of Engineering (Appendix 6).
Appendix 1  A List of OCEESA delegates to the 12th MTEPC

Dr. Wei-Yin Chen, University of Mississippi
Dr. Rebecca Shain-Yue Chou, California Department of Toxic Substances Control
Mr. Steven Sun-Yu Fan, Hyperion Treatment Plant, Los Angeles, California
Dr. Herbert Han-Ping Fang, University of Hong Kong
Dr. Clark Chen-Kun Liu, University of Hawaii at Manoa, Honolulu, Hawaii
Dr. Robert Chang-Chun Lao
Dr. Ju-Chang Huang, Hong Kong University of Science and Technology
Dr. David T. Shaw, State University of New York at Buffalo, Amherst, New York
Dr. Kaimin Shih, University of Hong Kong
Dr. Wei-chi Ying, East China University of Science and Technology, Shanghai
Dr. Pao-Chiang Yuan, Jackson State University, Jackson, Mississippi

Appendix 2  A List of OCEESA Papers at 12th MTEPC

Note that the presenters are denoted in bold face

1. Effective Reburning by Novel Selection of Mixed Fuels
   By Yaxin Su, Benson B. Gathitu, Wei-Yin Chen

2. A Step-Wise Approach to Assess the Significance of Subsurface Petroleum Vapor Intrusion to Indoor Air
   By Chawn Y. Jeng and Rebecca Shain-Yue Chou

3. Effects of Thermophilic Digester Temperature on Formation of Various Sulfur Compounds in Digester Gas
   By Steve Sun-Yu Fan, Hansong Lee, Jordan siplon

4. Sulfide oxidation and metal speciation of a marine sediment under denitrification treatment
   By Tong Zhang, Mingfei Shao and Herbert Han-Ping Fang

5. Corrosion and Biofilm Sloughing in a 10-Km Transport System Carrying Chlorinated Secondary Effluent
   By Feng XIAO, Liming ZHAI, Chun-Mao CHIANG and Ju-Chang HUANG

6. Cleaner Production, Circular Economy, and Sustainable Development in China
   By Robert Chang-Chun Lao

7. GIS-Based Water Quality Analysis of a Hawaii Watershed Subject to Development Pressure
   By Clark C. Liu

8. Toward A Combined Mitigation-Geo-engineering Strategy for Global Climate Stabilization
   By David T. Shaw, Professor
9. Spinels Stabilize Nickel and Copper in Thermally Treated Construction Ceramics
   By Kaimin Shih, Ching-Yao Hu, and Shang-Lian Lo

10. Characterization and Performance of Palladium-Indium Catalyst for
    Reduction of N-Nitrosodimethylamine
    By Kaimin Shih, Matthew G. Davie, and Martin Reinhard

11. Estimating the Henry’s Law constants of MTBE and other VOCs in groundwater and soil
    samples
    By Wei-chi Ying, Wei Zhang, Yan Lv, Liu-ya Huang, Juan Hu, Bing-jing Li, and Wan-dong Liu

12. E-Waste Management in Developing and Developed Countries
    By Pao-Chiang Yuan
# Appendix 3 Conference Agenda

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- Description: Session B Description 1

### Session C
- Title: Conference Topic 3
- Description: Session C Description 1

### Session D
- Title: Conference Topic 4
- Description: Session D Description 1

### Session E
- Title: Conference Topic 5
- Description: Session E Description 1

### Session F
- Title: Conference Topic 6
- Description: Session F Description 1

### Session G
- Title: Conference Topic 7
- Description: Session G Description 1

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### Lunch Break
- Duration: 12:00-13:00
- Location: Conference Venue

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### Coffee Break
- Duration: 15:30-16:00
- Location: Conference Venue

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### Conference Dinner
- Date: 18/03/2009
- Time: 18:00-20:00
- Location: Conference Venue

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第十二海峽兩岸環境保護研討會諮議委員會決議

2008 年 10 月 21 日，來自海外華人環境保護學會（OCEESA）與海峽兩岸諮議委員齐聚高雄第一科技大學會議室，召開「第十二海峽兩岸環境保護研討會諮議委員會議」，會中回顧 2006 年 8 月 5 日於上海同濟大學簽署之「海峽兩岸環境保護學術研討會諮議委員會會議紀要」資料，與參考 2007 年 6 月 9 日於哈爾濱工業大學之「海峽兩岸環境保護研討會諮議委員會決議」資料，達成以下共識：

1）對研討會舉辦的初衷及在大陸和臺灣舉辦十二屆以來的成果給予了充分肯定，認為該研討會對促進兩岸環境保護同行的學術交流、人員交往起了重要作用；並對 OCEESA 在研討會中的貢獻給予充分肯定。

2）本研討會舉辦將繼續以學術交流為基礎，努力促進海峽兩岸產學研討交流，更密切與環保產業結合、並吸引其參加。未來將共同加強教師交流與學生互換，並建立環境保護教育之培養與科研合作平台。

3）諮議委員會決定第 13 屆“海峽兩岸環境保護研討會”的舉辦單位是大陸重慶大學，舉辦時間初步建議定在 2010 年 4 月。大陸天津城市建設學院、天津大學及南開大學則為候補之共同承辦學校。建議研討主題為：「節能減排 Cool 地球」。

4）諮議委員會決定第 14 屆“海峽兩岸環境保護研討會”的舉辦單位是台灣成功大學。

5）有鑑於天津將成北方經濟中心，但環境問題複雜且生態環境脆弱，有待華人及全球之學者協助，諮議委員會建議委請大陸天津城市建設學院規劃於 2009 年 4 月在天津舉行小型主題國際研討會，同時召開諮議委員會議，以促使海外華人環境保護學會（OCEESA）與海峽兩岸諮議委員有更多交流討論與互訪機會。

6）台灣大學將於 2009 年 10 月，配合「The 3th IWA-ASPIRE Conference & Exhibition」之舉行，申辦「2009 年海峽兩岸永續水環境學術研討會」，歡迎諮議委員前往參加，並於台北召開諮議委員會議。

7）本會為「海峽兩岸環境保護」最具歷史學術交流之單位，未來應密切與海協會與海基會合作，共同推動兩岸環保產業與科技交流事宜。

8）本會代表對高雄第一科技大學與哈爾濱工業大學成功舉辦本次研討會表
示感謝！
海峽兩岸環境保護研討會秘書處2008年10月21日

秘書處聯絡方式：
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同濟大學環境科學與工程學院
上海四平路1239號，200092
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Email: siqingxia@tongji.edu.cn
Appendix 5  Photos of Presenting the best papers awards at 12th MTEPC by Dr. Clark Chen-Kun Liu and Dr. Wei-Yin Chen of OCEESA
Appendix 5 Photos taken at 12th MTEPC

a. Group photo of 12th MTEPC participants

b. Dr. Clark Chen-Kun Liu gave congratulatory remarks at the closing ceremony, 12th MTEPC
c. Dr. Clark Chen-Kun Liu presented appreciation plaques to Prof. I-Chang Jou, President, and Prof. Ping-Chi Hsu, Chairman, Department of Safety, Health and Environmental Engineering, of NKFUST on behalf of OCEESA.

Dr. Rebecca Shain-Yue Chou, OCEESA member, presented paper at 12th MTEPC.
第十二海峽兩岸環境保護研討會諮議委員會決議(草稿)

2008年10月21日，來自海外華人環境保護學會(OCEESA)與海峽兩岸諮議委員齊聚高雄第一科技大學會議室，召開「第十二海峽兩岸環境保護研討會諮議委員會會議」，會中回顧2006年8月5日於上海同濟大學簽署之「海峽兩岸環境保護學術研討會諮議委員會會議紀要」資料，與參考2007年6月9日於哈爾濱工業大學之「海峽兩岸環境保護研討會諮議委員會決議」資料，達成以下共識：

1. 對本研討會舉辦的初衷及在大陸和臺灣舉辦十二屆以來的成果給予了充分肯定，認為該研討會對促進兩岸環境保護同行的學術交流、人員交往起了重要作用；並對OCEESA在研討會中的貢獻給予充分肯定。

2. 本研討會舉辦將繼續以學術交流為基礎，努力促進海峽兩岸產學研討交流，更密切與環保產業結合、並吸引其參加。未來將共同加強教師交流與學生互換，並建立環境保護教育之培養與科研合作平台。

3. 諮議委員會決定第13屆“海峽兩岸環境保護研討會”的舉辦單位是大陸重慶大學，舉辦時間初步建議定在2010年4月。大陸天津城市建設學院、天津大學及南開大學則為候補之共同承辦學校。建議研討主題為：「節能減排Cool地球」。

4. 諮議委員會決定第14屆“海峽兩岸環境保護研討會”的舉辦單位是台灣成功大學。

5. 有鑑於天津將成北方經濟中心，但環境問題複雜且生態環境脆弱，有待華人及全球之學者協助，諮議委員會建議委請大陸天津城市建設學院規劃於2009年4月在天津舉行小型主題國際研討會，同時召開諮議委員會議，以促使海外華人環境保護學會(OCEESA)與海峽兩岸諮議委員有更多交流討論與互訪機會。

6. 台灣大學將於2009年10月，配合「The 3th IWA-ASPIRE Conference & Exhibition」之舉行，申辦「2009年海峽兩岸永續水環境學術研討會」，歡迎諮議
委員前往參加，並於台北召開諮詢委員會議。

7) 本會為「海峽兩岸環境保護」最具歷史學術交流之單位，未來應密切與海協會與海基會合作，共同推動兩岸環保產業與科技交流事宜。

8) 本會代表對高雄第一科技大學與哈爾濱工業大學成功舉辦本次研討會表示感謝！

海峽兩岸環境保護研討會秘書處 2008 年 10 月 21 日

秘書處聯絡方式：

夏四清教授博士生導師副院長
同濟大學環境科學與工程學院
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OCEESA Best Paper Awards Paper List, 12th Mainland Taiwan Environmental Protection Conference (MTEPC), Kaohsiung, Taiwan, October 20-26, 2008

Dr. Wei-Yin Chen, Professor
Department of Chemical Engineering
University of Mississippi
University, MS 38677 USA
Email: cmchengs@olemiss.edu

List of 5 OCEESA Best Paper Awards Papers from China

1. 过渡金属羟基化物催化水中臭氧分解和氧化痕量 pCNB 的研究
徐贞贞 陈忠林 贲岳
哈尔滨工业大学城市水资源与水环境国家重点实验室，哈尔滨，黑龙江

2. 废水生物/人工湿地生态联合脱氮过程协同模拟优化研究
周琪 林涛 闻岳
同济大学环境科学与工程学院 污染控制与资源化国家重点实验室

3. 生物降解与活性炭吸附协同净化含邻-二甲苯废气的研究
李琳¹, 王少彬², 刘俊新¹*

1. 中国科学院生态环境研究中心，环境水质学国家重点实验室，北京
2. Department of Chemical Engineering, Curtin University of Technology, Australia

4. Concurrent sampling of Persistent Organic Pollutants (POPs) in Chinese air and surface soil
Yi-Fan Li¹, Nanqi Ren¹, Bing Sun², Xinnan Wan³, Diandou Xu⁴, Ed Sverko⁵,⁶

¹ International Joint Research Center for Persistent Toxic Substances (IJRC-PTS), State Key Laboratory of Urban Water Resource and Environment, Harbin Institute of Technology, China
² IJRC-PTS, Dalian Maritime University, China
³ IJRC-PTS, Chengdu University of Technology, China
⁴ IJRC-PTS, Institute of High Energy Physics, Chinese Academy of Sciences, China
⁵ IJRC-PTS, McMaster University, Canada
⁶ Science and Technology Branch, Environment Canada
5. 区域循环经济规划的方法与应用
张天柱

清华大学环境科学与工程系，北京

OCEESA Best Paper Award Committee, 12th MTEPC
Dr. Wei-Yin Chen (Committee Chair), Dr. Rebecca Shain-Yue Chou (Committee Secretary), Dr. Clark Chen-Kun Liu, Mr. Steven Sun-Yu Fan, Dr. David Tai-Ko Shaw, Dr. Pao-Chiang Yuan.
1. 过渡金属羟基化物催化水中臭氧分解和氧化痕量\textit{pCNB} 的研究
徐贞贞 陈忠林 贲岳

摘要  比较了实验室制备的锰、铁、钴、镍、铜和锌六种过渡金属羟基化物催化臭氧分解和氧化水中痕量对氯硝基苯（\textit{pCNB}）的作用。采用电子顺磁共振波谱仪（ESR）测定了催化臭氧化过程中羟基自由基的生成，推导了其催化臭氧分解的途径。对催化剂进行了X射线粉末衍射（XRD）、原子力显微成像（AFM）、BET、表面羟基测定等表征。结果表明，铁、钴、锌的羟基化物具有较强的催化臭氧分解和氧化去除水中\textit{pCNB}的能力，与单独臭氧化相比，可以将\textit{pCNB}的去除率提高约35~50个百分点，并分别使臭氧的一级分解速率常数提高125%、152%和187%。而所制备的锰、铜、镍的羟基化物基本没有催化能力。水中臭氧分解时可以生成极微量的羟基自由基，加入铁、钴、锌的羟基化物后，羟基自由基的生成量明显提高。催化剂的催化活性与比表面积无关，与催化剂表面羟基基团的含量也无关。

关键词: 催化臭氧化, 过渡金属羟基化物, 羟基自由基, 对氯硝基苯

2. 废水生物/人工湿地生态联合脱氮过程协同学优化研究
周琪 林涛 闻岳

摘要
根据废水生物/人工湿地生态联合处理系统在多级缺氧-好氧工艺下运行处理氨氮的特点，利用协同学原理，分别建立处理系统物质流、能量流和信息流三个子系统的目标函数。以各子系统达到最优时，整个系统达到全局最优为最终目标，通过调控信息流子系统中的好氧区溶解氧浓度、混合液回流比和污泥回流比三个控制因素，根据均匀设计和回归分析等
统计学手段的分析结果，对各子系统进行调控，使各子系统满足各自目标函数。根据调控规律建立废水生物/生态联合处理系统氨氮处理过程的协同优化调控策略表。

关键词：氨氮处理；物质流；能量流；信息流；协同学优化

3. 生物降解与活性炭吸附协同净化含邻-二甲苯废气的研究
李琳 1, 王少彬 2, 刘俊新 1*

1. 中国科学院生态环境研究中心，环境水质学国家重点实验室，北京
2. Department of Chemical Engineering, Curtin University of Technology, Australia

摘要 生物法净化挥发性有机废气（VOCs）具有操作简单、运行成本低等优点，但当污染物浓度低于一定水平时，由于反应动力减弱，致使反应速率降低；活性炭具有高吸附性能，但高污染物浓度会使其吸附周期短、再生频繁，导致处理成本增加。本文研究了生物反应器对废气中邻-二甲苯的降解以及活性炭的吸附性能，并利用生物法与吸附法的技术优势互补，形成生物降解—活性炭吸附处理含邻-二甲苯废气的集成系统。试验结果表明，当废气中邻-二甲苯的浓度高于 1000 mg/m³时，在常规运行条件下，生物降解平均去除 81.2%，通过活性炭吸附可使出气中邻-二甲苯的浓度降至平均 24.6 mg/m³，即总去除率达到 98.6%。研究中对集成系统净化邻-二甲苯的效果和能力进行了系统的考察，分析了生物降解与吸附分离的协同关系与影响、吸附剂长期使用的稳定性，比较和选择了吸附剂的再生方法，并且用 Langmuir 以及 Freundlich 等温吸附线对其吸附行为进行描述。研究表明，生物降解与活性炭吸附结合可显著提高废气的净化效果，而且在进气负荷突然发生变化时保证出气质量的稳定，具有较高的耐冲击负荷能力。

关键词：废气处理；生物降解；活性炭吸附净化；邻-二甲苯

4. Concurrent sampling of Persistent Organic Pollutants (POPs) in Chinese air and surface soil
Yi-Fan Li1,6, Nanqi Ren1, Bing Sun2, Xinnan Wan3, Diandou Xu4, Ed Sverko5,6

1 International Joint Research Center for Persistent Toxic Substances (IJRC-PTS), State Key Laboratory of Urban Water Resource and Environment, Harbin Institute of Technology, China
2 IJRC-PTS, Dalian Maritime University, China
3 IJRC-PTS, Chengdu University of Technology, China
4 IJRC-PTS, Institute of High Energy Physics, Chinese Academy of Sciences, China
5 IJRC-PTS, McMaster University, Canada
6 Science and Technology Branch, Environment Canada
Abstract  Two programs, the Chinese persistent organic pollutant (POP) Soil and Air Monitoring Program (SAMP) and Chinese Active Atmospheric Sampling (CAAS) Program for POPs carried out by the International Joint Research Center for Persistent Toxic Substances (IJRC-PTS) are introduced. The work performed by these 2 programs is the first comprehensive study of its kind for POPs simultaneously measured in both air and soil on a national scale in China. Results of PCBs in both Chinese air and surface soil and DP in Chinese air are presented, and the future role of the 2 programs is also described.

Keywords: POPs, PCBs, DP, Monitoring, Air, Soil, China

5. 区域循环经济规划的方法与应用
张天柱

清华大学环境科学与工程系，北京

摘要 区域循环经济规划方法,对有效指导区域循环经济体系建设,促进循环经济发展具有极其重要的意义。本文结合中国正实施的循环经济区域试点工作,依据 DPSR 模型和修正的 3R 原则,对循环经济规划的概念内涵进行了定位辨析。以物质流分析方法为依托,阐述了从经济系统内部全过程降低资源环境压力,进行区域循环经济规划的方法框架。并以贵阳市循环经济规划为例,通过对经济增长、资源能源投入、废物产生排放等方面的基线分析,对该市经济系统物质代谢过程的特征进行了识别。进一步,结合循环经济规划方案的总结,对贵阳经济发展转型下物质代谢调控目标进行了情景分析。基于物质流分析的循环经济规划方法框架,可以对区域循环经济发展提供有力的规划与决策支持。

关键词: 循环经济，区域，规划，物质流分析

OCEESA Best Paper Award Committee, 12th MTEPC
Dr. Wei-Yin Chen (Committee Chair), Dr. Rebecca Shain-Yue Chou (Committee Secretary), Dr. Clark Chen-Kun Liu, Mr. Steven Sun-Yu Fan, Dr. David Tai-Ko Shaw, Dr. Pao-Chiang Yuan.
OCEESA Board of Directors Meeting Minutes, October 8, 2008, Los Angeles, California

Dr. Clark Chen-Kun Liu
OCEESA President of 2008

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*On leave from University of Hawaii

Date: Oct. 8, 2008
Place: Embassy Suite South, LAX, El Segundo (Los Angeles)
Time: 10:00 am – 6:00 pm
Attendees:
Dr. Clark Chen-Kun Liu, Dr. David Tai-Ko Shaw, Dr. Wei-Ping Pan, Dr. Jeff Jih-Fen Kuo, Dr. Charles Qun Cheng, Dr. Chun-Chao Chou, Mr. Anmin Liu

1. Call Meeting to Order and Introduction of Directors by Dr. Clark Liu
Dr. Clark Liu, OCEESA President, called the meeting to order at 10:00 am.
Dr. Liu stated that there are 7 directors present at this meeting; therefore, the quorum has been established. A self-introduction of each director was administered.

2. Introduction of OCEESA Status by Dr. Clark Liu
Clark Liu reported the present status of OCEESA with regard to the 12th MTEPC and the future SATEC (Sino American Technology and Engineering Conference) and METS (Modern Engineering Technology Seminars) programs. SATEC will be held in April 2009 in Beijing and NETS is scheduled to be held in November 2008 in Taipei. According to the report from CIE (Chinese Institute of Engineers), there may not be environmental related sessions in the upcoming SATEC and METS.
Dr. Clark Liu indicated that OCEESA was one of the founding members of the MTEPC, however, OCEESA’s role in the MTEPC, SATEC and METS is diminishing as the cooperating spirit between mainland China and Taiwan is progressing well without OCEESA’s effort. It should be realized that OCEESA has achieved the goal when the MTEPC was established back more than 20 years ago.
Dr. Clark Liu also stated that it is the time for OCEESA to seek new directions and new strategies in accordance with our constitution and by-laws.
3. **OCEESA Financial Report by Mr. Anmin Liu, Treasurer/Secretary**

   Mr. Anmin Liu, the OCEESA Treasurer, reported the financial status of OCEESA. The President Accounts, at the present time, has a balance of $7,000. Mr. Anmin Liu distributed the copies of the bank statements to the directors.

4. **Discussion on Remaining Issues of 2007 AAEOY**

   As one of CIE/USA member chapters, OCEESA successfully conducted in March 2007 the event of Asian American Engineers of the Year (AAEOY) in Washington DC. The OCEESA Board hereby commends members of 2007 AAEOY organizing committee for their hard work and contributions. Particularly, the Board wish to give its thanks to 2007 AAEOY chair, Dr. Francis Hun-I Chang, for his dedication and excellent leadership. The Board also raised concern on the late submission of official 2007 AAEOY activity report and financial report to the Board through the OCEESA Executive Committee. The Board is looking forward to receiving these reports by the end of 2008 from Dr. Francis Chang and Dr. Wei-Yin Chen, Treasurer of 2007 AAEOY.

5. **OCEESA’s Development Strategy**

   a) Need to build-up our identity by perform volunteering work using our expertise.

   b) Make connections with government agencies and other professional organizations and work with the agencies and organizations to do public education programs, outreach activities.

   c) Use our unique strengths (mandarin language and our wide spectrum of environmental knowledge and practical experience) to initiate contacts and participate on-going activities, either in China or Taiwan, to get our name known to the involved parties.

6. **Action Items Adopted by the Board**

   a) OCEESA will work with Director Dr. Wei-Ping Pan on USAID program in China. Director Dr. Wei-Ping Pan will contact the program chairperson on this program.

   b) OCEESA Board Directors decided to request Director Dr. Charles Cheng to contact Southern California Chinese American Environmental Protection Association regarding sharing of members contact information for the purpose of creating a wider notification network.

   c) As one of the Chapters of CIE (Chinese Institute of Engineers), OCEESA was designated as the responsible chapter to work on CIE 2006 Year Book. The OCEESA executive committee will work on this project.

   d) On behalf of Dr. Rubin Yu, the President of ICEF (International Chinese Environmental Federation), Mr. Anmin Liu reported to the Board that Dr. Yu requested OCEESA to lead the effort on the disposition of ICEF. The Board decides that OCEESA proposes that the ICEF be dissolved by Dr. Rubin Yu and distribute the remaining fund to all the founding members equally and OCEESA will resume the duties of ICEF from then on.

   e) Director Dr. David Tai-Ko Shaw will verify whether OCEESA is an NGO entity.

7. **Secretary Notes**
a) It is to be noted that ALL directors have donated their meeting subsidies to OCEESA.

Photo taken at OCEESA Board of Directors Meeting Minutes, October 8, 2008, Los Angeles, California

From left to right: Mr. Anmin Liu, Dr. Charles Qun Cheng, Dr. Jeff Jih-Fen Kuo, Dr. David Shaw, Dr. Chun-Chao Chou, Dr. Clark Chen-Kun Liu, Dr. Wei-Ping Pan.

OCEESA Board Directors meeting, 10-5-08, Los Angeles
Time: 09/21/2008 (Sunday), 8:00AM - 12:00 noon
Place: Hilton Hotel, Seattle
Attendees:
SFB - Bernard Shung, An-Yu Kuo
DFW - Meimei DiGennaro, Julius Chiang
GNYC - Kuo-Kuang Hsu
NM - Yung Sung Cheng
OCCESA - Anmin Liu, Wei-Yin Chen, Rubin Yu
SEA - James Lee, Ian Tien, Jiin Chen, Ta-Win Lin, Jack Peng, Kai Wang

Approval of meeting minutes of the 03/02/2008 NC meeting – motioned seconded, and approved by all attended members

Chair's report – Bernard Shung
• Resolution of financial supports via e-mail voting
  • Payment to consultant (Zarina Stanford) of 2007 AAEOY (approved)
  • Support of Future City (approved)
  • Support of China Marathon (rejected)
• Follow-up of other action items
  ■ Website update

  1. 501c-3 has been approved. CIE/USA needs to maintain an accounting procedure to meet government accounting requirement
  2. Existing accountant recommended -- to keep all accounting contacts at CIE-GNY
  3. Cost to retain a formal accountant will be $500 per year.
  4. Julius Chiang raised a question on tax liabilities of local chapters’ AAEOY with many discussions among attendees.
  5. Detailed income/expenses table, $16,250 account receivable, $7,232.33 in the bank.
Action Item: SEA, SF, GNY chapters need to pay NC $5,000, $625, $625, respectively, for overdue payments to NC.

SATEC – KK Hsu
  1. Held the 1st organization meeting in July in Beijing
  2. Waiting for government reorganization
3. Suggested China government to shorten the entire event

**HKTED – Bernard Shung for Eric Pai**
This event will not happen this time due to changes in HK government

**METS – Jiin Chen for Barry Lin**
- The 22nd METS to be held Nov 17-19, 2008 in Taipei with several topics of interests to Taiwan
- Getting approvals from speakers’ employers is required to minimize CIE/USA’s liability. This may become an issue in recruiting speakers.

**NC Year Books – all**
- Discussions on format (electronic versus hard copy), coverage (combine 2006-2008 vs. year by year), cost (color vs. black and white).

Action items:
1. DFW will produce 2007 year book, possibly in electronic format.
2. OCCESA will produce 2006 year book, possibly in electronic format
3. SF will be responsible for 2008 year book.
4. To review strategy, value and execution of yearbook publishing next time

**Chapter Reports:**

**DFW– Meimei DiGennaro**
- Math competition and math fun
- Youth programs
- English essay contest
- Speech contest
- Spelling bee contest
- Several Technical seminars
- National E-Week

**SFB– An-Yu Kuo**
- 2 bio-engineering conferences
- Host Hi-recruit job fairs
- Host a speech contest with WJ
- AAEYOY preparation just got started in September
- Discuss of proposal from Lockheed-Martin on step-up sponsor level

**NM– Yung Sung Cheng**
- Recruit of younger members
- Technical seminars
- Scholarship program

**SEA– Ian Tien (see detailed report attached)**
- A couple conferences
- A couple technical seminars
- Annual convention
GNY– Kuo-Kuang Hsu  
5-6 short courses  
Support several local conferences  
Annual conference with technical sessions

OCCESA– Rubin Yu, Wei-Yin Chen and Anmin Liu  
Sponsor a conference in October (speakers from USA/China/Taiwan) in Kaohsiung Taiwan  
Will have a board meeting in October 4, 2008 in LA  
Need to review and form a new strategy for OCCESA

IBM Fund– James Lee  
About $35,000 left  
No more than $4,000 per chapter, no more than 2007’s & it is a continuation from 2007  
Estimated, there will be $10,000 left

Meeting Adjourn & Next Meeting  
SF Chapter is to host the next NC meeting on 2/22/2009 in San Jose, CA 2009.
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Effects of Temperature, Ammonia and Initial Mixing on Secondary Effluent Disinfection

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Chii Shang 商启(Associate Professor, Dept. of Civil Engineering, HKUST) and
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ABSTRACT
Secondary effluents generated in both Tai Po and Shatin Treatment Works in Hong Kong are being considered for chlorine disinfection. The treated effluents is to be transported via existing 4-km force mains and a 7-km concrete tunnel before discharging to the Victoria Harbour. This study is taken to address some operational concerns including: 1) the effects of temperature and ammonia fluctuations in secondary effluent as well as the initial mixing on the chlorine dosage requirement to achieve the target E. coli goal of 1000 CFU/100 ml; 2) the impact of activated sludge operating sludge on the chlorine byproduct formation; 3) the impact of chlorine residuals on biofilm behaviors, including biofilm sloughing, re-growth, and CBP formation in the transportation force mains and tunnel; and 4) the potential acceleration of ductile iron pipe corrosion by chlorine residuals. Due to page limitation, only the findings of the first objective are presented here.

Keywords: chlorine disinfection, secondary effluent, effects of temperature, ammonia and initial mixing.

EFFECT OF TEMPERATURE
The secondary effluent temperature in Hong Kong varies from 16 to 32°C, and thus the relationship of temperature and coliform kill was first established, as shown in Fig. 1. At 2 ppm chlorination, the E. coli levels can be reduced to around 100 to 200 CFU/100 ml at test temperatures of 10, 22, and 30°C, all being much lower than the effluent requirement of 1000 CFU/100ml. The data reflect that the lower the temperature, the slighter better is the disinfection performance. This is mainly attributed to the fact that a higher temperature leads to a faster satisfaction of chlorine demand, resulting in a lower total residual chlorine (TRC) for coliform inactivation, as shown in Fig. 2.
Fig. 1 Effect of temperature on time-dependent *E. coli* inactivation at a chlorine dose of 2.0 mg/L (as Cl₂), and a background ammonia-N of 0.57 mg/L.

Figure 3 illustrates the time-dependent inactivation of *E. coli* at 22°C for different chlorine dosing levels of 1.0, 2.0 and 5.0 mg/L as Cl₂. A rapid reduction of *E. coli* always occurs in the first 15 to 20 minutes, which is also accompanied by a similar trend of rapid TRC reduction (Fig. 2). To achieve an effluent standard of 1000 CFU/100 ml, a chlorinate dosing of 2.0 ppm appears to be satisfactory.
**Fig. 3** Effect of applied chlorine doses on time-dependent *E. coli* inactivation at 22ºC and a background ammonia-N of 0.5 to 0.57 mg/L (as shown by the numerical in bracket)

**EFFECT OF EFFLUENT AMMONIA LEVEL**

When ammonia is present in the effluent, the dosed chlorine quickly reacts with ammonia to form monochloramine, thereby minimizing the existence of free residual. On the other hand, monochloramine is much less reactive than free chlorine, and thus it is much more persistent in providing continuous inactivation of *E. coli*. Figures 4 and 5 illustrate the effect of ammonia-N (from 0.57 to 0.96 mg/L) at 22 ºC with 2.0 mg/L chlorination on time-dependent *E. coli* inactivation and TRC. It is found, as expected, that increasing ammonia-N will lead to a higher *E. coli* inactivation. This is because an increase in ammonia leads to an increase in TRC in the treated effluent (Fig. 5). In fact, the extents of the first 15-minute inactivation at a given chlorine dosing but different ammonia concentrations are quite similar, but at an ammonia-N of 0.96 mg/L, a higher TRC (approx. 1 mg/L as Cl₂) still prevails after 15 minutes of contact. This results in a gradual but continuous reduction of *E. coli*. The similar time-dependent trends are also observed for ammonia levels of up to 4.6 mgN/L at varying chlorine dosing of 1 to 5 mg/L (as Cl₂).
**Fig. 4** Effect of ammonia-N on time-dependent *E. coli* inactivation at 22°C with a chlorine dosing of 2.0 mg/L.

**Fig. 5** Effect of ammonia-N on time-dependent total residual chlorine (TRC) at 22°C with a chlorine dosing of 2.0 mg/L.

**Fig. 6** Effect of ammonium concentrations on the 60-min TRC
EFFECT OF INITIAL MIXING
In using the effluent transport conduits (force main and tunnel) to provide the needed chlorine contact time, it involves some difficulty in providing adequate initial in-line mixing. Thus, a test is carried out to assess the impact of initial mixing on the disinfection performance both in a batch reactor and also in a 68-meter 2.5” pipe loop. The experimental data reflect that at 2.0 ppm chlorine dosing, an instantaneous complete mixing leads to a higher level of TRC in the test solution than the no-mixing condition, and this of course results in a higher disinfection performance. It is believed that a high mixing condition allows more ammonia to react with chlorine, thereby maximizing the TRC and minimizing the initial chlorine demand. As for THM formation (chlorination byproducts), the factor of initial mixing does not seem to play any significant role, as shown in Fig. 7.

Fig. 7 Effect of initial mixing on the THM formation at 2.0 and 5.0 chlorine dosing

CONCLUSIONS
Based on the experimental results, the following conclusions can be drawn:

1. For secondary effluent disinfection by chlorine, temperature does not play a significant role in affecting the chlorine dosage requirement.

2. The ammonia level in the secondary effluent has a significant impact on the chlorine dosage requirement. With more than 20 repeated chlorination tests conducted in this study, it has always been observed that an increase in ammonia-N invariably leads to a higher level of TRC at a given chlorine dosing, and this results in a higher *E. coli* inactivation.

3. A higher initial mixing allows more chlorine to react with ammonia and this maximizes the TCR level as well as the coliform inactivation. For this reason, chlorine may be dosed to the suction end of the effluent pump station to achieve the maximum level of initial mixing.
REFERENCES


A Step-Wise Approach to Assess the Significance of Subsurface Petroleum Vapor Intrusion to Indoor Air

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ABSTRACT

A step-wise approach was used to assess the potential significance of subsurface petroleum vapor migration into residential and commercial buildings near an oil refinery. Previous environmental investigations indicated that soil and groundwater underlying the refinery have been impacted by petroleum-related chemicals, and elevated levels of methane and gasoline vapors, including benzene, are present in the subsurface at some residential and commercial properties adjacent to the refinery.

To determine if mitigation measures are necessary to prevent indoor air exposures due to subsurface vapor intrusion, a step-wise approach was developed: 1) comparison of shallow soil gas data with health-based screening criteria to identify selected residential and commercial buildings indicating high potential for subsurface vapor intrusion; 2) collection of indoor and outdoor air monitoring data from the candidate residences; 3) collection of subslab soil vapor data beneath foundations of the selected commercial buildings; and 4) assessment of indoor air, ambient air, and soil gas data for the significance of subsurface vapor intrusion considering contributions from various sources for organic vapors, including building materials, household products and ambient air background.

To assess the significance of subsurface vapor intrusion into residential homes, indoor and outdoor air concentrations along with shallow soil gas data collected from the residences were plotted for five key chemicals (methane, benzene, toluene, ethylbenzene, and xylenses). While the soil gas concentrations show a decreasing trend with increasing distance from the suspected source area, the corresponding indoor air data are relatively constant among these homes and comparable with outdoor air data in most cases. This suggests that the indoor air quality is not affected at any significant level by elevated soil gas vapors beneath the homes, and may be influenced by the ambient air background instead. Ratios of indoor air and soil gas concentrations (“apparent” attenuation factors) of the key chemicals in each residence were also compared with the attenuation factors predicted by a screening-level vapor intrusion model (Johnson and Ettinger, 1991). The apparent attenuation factors for some of the chemicals differ by two to three orders of magnitude in the same house, and do not agree with the model prediction showing that these chemicals should have similar attenuation factors. Based on the above analyses, it was concluded that subsurface vapor intrusion does not have a significant effect on indoor air quality in these homes.
**Key Words:** vapor intrusion, indoor air quality, soil gas, ambient air background, petroleum hydrocarbons, benzene, methane, Johnson and Ettinger model

**INTRODUCTION**

Previous environmental investigations at an oil refinery located in southern California identified that soil and groundwater underlying the refinery was impacted by petroleum-related chemicals. Since the mid-1980s, investigation and remediation of soil and groundwater contamination has been ongoing under the direction of the state regulatory agencies. In response to a recent complaint of a strong odor in the garage of a residence near the refinery, initial soil vapor and indoor air sampling was conducted in this residence and surrounding residences to evaluate the presence and source of any hazardous soil vapors and determine if immediate response was warranted. The initial investigation determined that methane and gasoline-type vapors, including benzene, were present in the soils beneath some residences and commercial buildings near the refinery and that concentrations detected in soil vapors could pose a potential threat to human health and therefore required additional study.

This paper describes a step-wise approach on assessing the potential significance of subsurface petroleum vapor migration into residential and commercial buildings. To determine if mitigation measures are necessary to prevent indoor air exposures from subsurface vapor intrusion, the following activities were performed: 1) comparison of shallow soil gas data with health-based screening criteria to identify candidate commercial and residential buildings indicating high potential for subsurface vapor intrusion; 2) collection of subslab soil vapor data beneath foundations of the selected commercial buildings; 3) collection of indoor and outdoor air monitoring data from the selected residences; and 4) assessment of indoor air, ambient air, and soil gas data for the significance of subsurface vapor intrusion considering contributions from various sources for organic vapors, including building materials, household products and ambient air background. The remaining sections discuss the work that was conducted to support the individual components of the approach.

**COLLECTION AND EVALUATION OF SOIL GAS DATA**

More than 200 soil gas samples were collected from 116 locations in and around residential and commercial buildings adjacent to the refinery to determine the lateral and vertical extent of hazardous vapors in soil. Soil vapor points were installed at 5 and 15 feet below surface and sampled after a minimum of 48-hour waiting period. The samples were collected using 6-liter Summa canisters following proper purging and leak test procedures accepted by the State of California [1]. All samples were analyzed for methane and volatile organic compounds (VOCs) using the USEPA Methods TO-3 and TO-15, respectively, by State-certified laboratories.

The principal constituents detected in the soil gas samples were methane and benzene. Methane distribution in soil gas was very similar to benzene generally. The source of methane was likely due to the biodegradation of petroleum hydrocarbons in soil, groundwater, and residual non-aqueous phase liquid (NAPL) smear zone. Ethylbenzene, toluene, and xylenes were also detected but generally at lower concentrations than benzene.
To determine the need for additional study for selected buildings, the soil gas data was compared with California Human Health Screening Levels (CHHSLs) for shallow soil gas. The CHHSLs are conservative health-based screening criteria at an excess lifetime cancer risk of one-in-a-million ($10^{-6}$) and a hazard quotient of 1 for noncancer health effects. Table 1 shows the ranges of soil gas sampling results and the CHHSLs for the key chemicals detected in soil gas. Because methane does not cause major adverse health effects (no CHHSL values are available), 10% of its lower explosion limit (LEL) was used for the comparison with methane concentrations in soil gas [2].

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Soil Gas Concentration</th>
<th>Residential CHHSL</th>
<th>Commercial CHHSL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methane (ppmv)</td>
<td>ND – 500,000</td>
<td>5,000*</td>
<td>5,000*</td>
</tr>
<tr>
<td>Benzene (ppbv)</td>
<td>ND – 160,000</td>
<td>10</td>
<td>44</td>
</tr>
<tr>
<td>Ethylbenzene (ppbv)</td>
<td>ND – 6,200</td>
<td>98</td>
<td>330</td>
</tr>
<tr>
<td>Toluene (ppbv)</td>
<td>ND – 9,700</td>
<td>36,000</td>
<td>100,000</td>
</tr>
<tr>
<td>o-Xylene (ppbv)</td>
<td>ND – 1,200</td>
<td>73,000</td>
<td>200,000</td>
</tr>
<tr>
<td>m/p-Xylene (ppbv)</td>
<td>ND – 4,700</td>
<td>73,000</td>
<td>200,000</td>
</tr>
</tbody>
</table>

ND – Nondetect; *10% of methane LEL

Nine residential homes and four commercial buildings were selected for subsequent sampling and evaluation, based on elevated shallow soil gas concentrations relative to the screening levels. Additional subslab vapor or indoor/ambient air data were collected in these buildings, and their results are discussed below.

**COLLECTION OF SUBSLAB VAPOR DATA FOR COMMERCIAL BUILDINGS**

A total of eight sub-slab soil vapor probes (two per building) were installed in the four commercial buildings that were selected for further study based on the soil gas data screening results. It should be noted that indoor air sampling was not recommended in this case because industrial and laboratory chemicals containing VOCs were regularly used in these buildings. These VOC sources could not be removed prior to the sampling, thus introducing bias to indoor air sample collection and difficulty in interpretation of results.

Figure 1 shows construction detail of a typical sub-slab soil vapor probe. The subslab vapor probe tip was generally installed approximately 3-4 inches below the concrete slab. Because probe installation inside a building was not feasible inside some buildings, some of the probes were installed near the perimeter of the building beneath the concrete slab footings.

**Figure 1 Schematic Diagram of a Sub-Slab Vapor Sampling Probe**
The sub-slab vapor probe sampling followed the same procedures used in the soil gas sampling described above. All samples were analyzed for methane and VOCs using the USEPA Methods TO-3 and TO-15 by State certified laboratories. Table 2 summarizes the results of sub-slab vapor sampling for the key chemicals:

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Sub-Slab Vapor Concentration</th>
<th>Screening Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methane (ppmv)</td>
<td>1 – 4.9</td>
<td>5000*</td>
</tr>
<tr>
<td>Benzene (ppbv)</td>
<td>ND – 1</td>
<td>4.3</td>
</tr>
<tr>
<td>Ethylbenzene (ppbv)</td>
<td>All ND</td>
<td>37</td>
</tr>
<tr>
<td>Toluene (ppbv)</td>
<td>ND – 0.59</td>
<td>11,000</td>
</tr>
<tr>
<td>α-Xylene (ppbv)</td>
<td>ND – 1.5</td>
<td>23,000</td>
</tr>
<tr>
<td>m/p-Xylene (ppbv)</td>
<td>ND – 2.5</td>
<td>23,000</td>
</tr>
<tr>
<td>ND – Nondetect; *10% of methane LEL</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The screening levels for sub-slab vapor samples were derived using the indoor air CHHSLs for commercial and industrial land use with an adjustment factor of 100 to account for attenuation through foundation slab and dilution in buildings [3]. Because the sub-slab vapor concentrations beneath these commercial buildings are significantly lower than the screening levels, indicating that the potential for subsurface vapor intrusion was unlikely, no subsequent action was recommended.

COLLECTION OF INDOOR AIR DATA FOR RESIDENTIAL BUILDINGS
The indoor air quality assessment of nine homes was performed in accordance with regulatory guidance [3], and included the following work elements prior to air sample collection: (a) inspection and survey of all homes to understand the building characteristics that could affect air flow and to identify potential indoor air sources for VOCs; (b) removal of potential VOC sources (e.g., air refreshers, perfumes, nail polish, paints, and bathroom/kitchen cleaners) from each residence and attached garage to the extent possible; and (c) maintenance of normal building operations with the furnace/air conditioning systems and avoiding other potential interference (e.g., no use of fireplaces or smoking inside the building) at least 24 hours prior to sampling.

Up to four indoor air samples (including one duplicate sample) were collected from commonly occupied areas (i.e., central living area and bedroom) and potential VOC infiltration points (bathroom or kitchen) in each residence. At least one ambient air sample was also collected outside of each residence. All indoor and ambient air samples were collected 3 to 5 feet above ground level (breathing zone height) using 6-liter Summa canisters over an 8-hour period. The samples were analyzed for methane and VOCs using the USEPA Methods TO-3 and TO-15 by laboratories certified by the State. Table 3 summarizes indoor and ambient air sampling results for the key chemicals:

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Indoor Air Concentration</th>
<th>Ambient Air Concentration</th>
<th>Residential CHHSL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methane (ppmv)</td>
<td>ND – 32</td>
<td>ND - 87</td>
<td>500*</td>
</tr>
<tr>
<td>Benzene (ppbv)</td>
<td>ND – 1.8</td>
<td>ND – 1.5</td>
<td>0.03</td>
</tr>
<tr>
<td>Ethylbenzene (ppbv)</td>
<td>ND – 2.2</td>
<td>ND – 1.7</td>
<td>0.22</td>
</tr>
<tr>
<td>Toluene (ppbv)</td>
<td>1.4 – 13</td>
<td>0.97 – 2.9</td>
<td>81.8</td>
</tr>
<tr>
<td>o-Xylene (ppbv)</td>
<td>ND – 0.85</td>
<td>ND</td>
<td>166</td>
</tr>
<tr>
<td>m/p-Xylene (ppbv)</td>
<td>ND – 4.2</td>
<td>ND – 3.1</td>
<td>166</td>
</tr>
</tbody>
</table>

ND – Nondetect; *1% of methane LEL (a CHHSL value is not available for methane)

For methane, toluene, and xylenes, the indoor air concentrations are all significantly less than their respective indoor air CHHSLs for residential land use. Some benzene and ethylbenzene concentrations in indoor air are higher than the residential CHHSLs, but are comparable to the range of ambient air concentrations.

Because the key constituents present in soil gas were also found in most indoor air samples, additional data analyses were performed to evaluate potential significance of subsurface petroleum vapor migration into these residences. Results of these analyses are discussed in the next section.

**EVALUATION OF POTENTIAL VAPOR INTRUSION AT RESIDENTIAL HOMES**

To assess the significance of subsurface vapor intrusion into residential homes, several techniques were used to evaluate the data sets (soil gas, indoor air, and ambient air) collected from nine residences. Because potential sources of VOCs measured in indoor air include ambient air and indoor sources besides subsurface vapor intrusion, these techniques were used to provide
multiple lines of evidence to reject the hypothesis that vapor intrusion is occurring (i.e., looking for signs that indoor air quality is not affected significantly by vapor intrusion, if any).

First, indoor air data from these homes were compared with regional and site-specific ambient air results for any significant difference from subsurface vapor intrusion or other factors. As shown on Table 3, the indoor air concentrations for all key chemicals are comparable to the range of ambient air concentrations measured outside these residences, with the exception of toluene in the three samples collected from one residence (11 to 13 ppbv). While the source of toluene in this case is unknown, the three samples also exhibited elevated levels of tetrachloroethylene (PCE; 3.7 to 4 ppbv) even though no PCE was detected in shallow soil gas near this residence. It is possible that not all VOC sources were removed during the building preparation. Nonetheless, the toluene levels found in this home are significantly lower than the risk-based CHHSL, and therefore do not pose a health risk. The indoor air concentrations in these nine homes are also consistent with typical background levels of these chemicals found in indoor air in North America (mean background value: benzene 1.5 ppbv, ethylbenzene 1.4 ppbv, toluene 6.7 ppbv, o-xylene 1.1 ppbv, and p/m-xylenes 2.9 ppbv [4]). Additionally, indoor air samples were collected from several homes outside the soil vapor plume area, and their results are also comparable with the indoor air concentrations of the nine homes within the soil vapor plume area. Based on these comparisons, the indoor air concentrations at these nine homes are consistent with ambient and indoor air quality in typical residences, and do not appear to be affected to any significant level by the soil gas plume present in this area.

Second, indoor air, ambient air, and soil vapor concentrations collected from each residence were plotted to examine spatial relationship among the data sets. Figures 2a through 2f present the spatial data plots for the six key constituents found in soil gas:
As shown on these figures, while soil gas concentrations are generally lower in the homes that are farther away from the suspected source area (near Residence 1), the corresponding indoor air data does not follow a decreasing trend and is relatively constant among the nine homes for most chemicals. In fact, the indoor air concentrations typically match well with ambient air data, indicating that ambient air may have a strong influence on the indoor air quality at these homes. Slightly elevated levels of methane and/or benzene were detected in Residences 4, 6, and 9, which could be attributed to indoor sources (natural gas leaks from stoves and water heaters were reported in these homes).

Finally, ratios of measured indoor air and soil gas concentrations (also known as “apparent attenuation factors”) were calculated in order to compare with the attenuation factors predicted by the Johnson and Ettinger model [5], which is a screening-level heuristic model for evaluating subsurface vapor intrusion into buildings. Table 4 shows the apparent attenuation factors of the key constituents in several residences.

<table>
<thead>
<tr>
<th>Residence #</th>
<th>Methane</th>
<th>Benzene</th>
<th>Toluene</th>
<th>Ethylbenzene</th>
<th>m/p-Xylenes</th>
</tr>
</thead>
</table>

Table 4 Apparent Attenuation Factors for Select Residences
<table>
<thead>
<tr>
<th>1</th>
<th>2.0E-5</th>
<th>2.7E-5</th>
<th>1.8E-2</th>
<th>7.8E-3</th>
<th>1.7E-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>3.8E-5</td>
<td>9.5E-4</td>
<td>1.9E-2</td>
<td>5.3E-3</td>
<td>5.1E-3</td>
</tr>
<tr>
<td>5</td>
<td>1.2E-3</td>
<td>5.0E-1</td>
<td>1.1E+0</td>
<td>1.9E+0</td>
<td>9.7E-1</td>
</tr>
<tr>
<td>7</td>
<td>9.2E-2</td>
<td>1.8E-3</td>
<td>1.9E-1</td>
<td>9.1E-1</td>
<td>3.5E-1</td>
</tr>
<tr>
<td>9</td>
<td>9.5E+0</td>
<td>2.9E-2</td>
<td>2.0E-2</td>
<td>7.8E-2</td>
<td>3.2E-2</td>
</tr>
</tbody>
</table>

*Average of apparent attenuation factors in each residence*

It should be noted that these apparent attenuation factors are specific to individual residences (i.e., affected by differences in building structures and ventilation among the residences), but are expected to be comparable for the key constituents within the same residence because these chemicals have similar physical and transport properties. For example, the attenuation factors for the five key constituents predicted by the Johnson and Ettinger model are less than one order of magnitude difference. However, the apparent attenuation factors among these chemicals differ by two to three orders of magnitude in the same house (Table 4) and do not agree with the model prediction. Furthermore, many of the apparent attenuation factors are significantly higher than typical attenuation factors reported for shallow soil vapor intrusion (0.01 or less) [3,6]. In fact, some values are close to or even exceeding one, which is the theoretical upper bound for vapor intrusion (i.e., the indoor air concentration is approaching the soil vapor concentration). Therefore, it is unlikely that vapor intrusion is occurring at a significant level at these homes and the measured indoor air concentrations are likely attributed to sources not related to the soil gas plume (e.g., ambient air and/or indoor sources).

**SUMMARY**

A step-wise approach was used to assess the potential significance of subsurface petroleum vapor migration into residential and commercial buildings near an oil refinery. The data sets collected from these buildings were analyzed and several techniques were used to assess the significance of subsurface vapor intrusion into residential homes. First, indoor air data were compared with regional and site-specific ambient and indoor air results for indication of significant vapor intrusion into indoor air. Second, indoor air and soil vapor concentrations collected from the residences within the soil vapor plume were evaluated for spatial relationship among different homes analyzed. Finally, ratios of indoor air and soil vapor concentrations were compared with the attenuation factors predicted by the Johnson and Ettinger Model for key chemicals. It was concluded that subsurface vapor intrusion does not have a significant effect on indoor air quality in these homes based on the multiple lines of evidence from these analyses.

**ACKNOWLEDGMENTS**

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**REFERENCES**

2. Department of Toxics Substances Control (2005), “Advisory on Methane Assessment and Common Remedies at School Sites.”


Effects of Thermophilic Digester Temperature
On Formation of Various Sulfur Compounds in Digester Gas

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ABSTRACT

Soon after the Hyperion Treatment Plant (HTP) of the City of Los Angeles began to produce Class A biosolids in October 2002, the plant started to experience unusually high concentration of methyl mercaptan in the digester gas. The level of methyl mercaptan was high enough to cause serious odor problems and to violate air quality permit limits. The plant lowered the operating temperature of primary and batch digesters to from 135 degree F to 128 degree F immediately after realizing the extraordinarily high methyl mercaptan level might have been caused by relatively high digester operating temperature. Although the methyl mercaptan concentration was brought under control in just a few days later with reduced digester operating temperature, it was no longer possible for the plant to meet the Federal Rule 40 CFR 503.32 – Alternative 1 for producing Class A biosolids. Since it is the plant’s best interest to produce Class A biosolids which will comply with the Federal Rule 40 CFR 503.32 – Alternative 1, the plant initiated a test project in early February of 2003 to determine the optimum digester operating temperature for the anaerobic digesters to produce Class A biosolids without significantly increasing the sulfur compounds concentrations in the digester gas. During the test, only one of the existing sixteen primary digesters was used for this testing purpose. The temperature of the test digester was raised incrementally at one degree Fahrenheit at a time starting at the original level of 128 degree F while other operating parameters such as feed rate and feed composition were kept at constant level. Once the temperature was raised, it was held constant for a month to ensure that the digestion process was at steady state condition. For the duration of the test period, the digester gas from the test digester was tested for various sulfur compounds on a daily basis. The testing continued until any of the individual sulfur compounds, except hydrogen sulfide, reached 5 ppmv or higher in the digester gas.

This paper provides valuable data linking the formation of odor causing sulfur compounds with the digester operating temperature. The plant has utilized the data to set the optimum digester operation temperature to produce Class A biosolids which has complied with the Federal Rule 40 CFR 503.32 – Alternative 1 while meeting the air quality permit limits.

Keywords: Class A Biosolids, Thermophilic Digestion, Sulfur Compound, Odor, ferric Chloride, Ferrous Chloride

INTRODUCTION

The test project was designed based on the experience gained by the coordinated efforts of engineering, operations and laboratory staffs operating thermophilic digesters since July 2000. In order to minimize impacts to the current digestion process, only one of the existing sixteen
primary digesters was used for this test. The temperature of the test digester was raised incrementally at one degree Fahrenheit at a time starting at the original level of 128 °F while other operating parameters such as feed rate and feed composition are kept at constant level. Once the temperature was raised a degree, it was held constant for a month to ensure that the digestion process was in a steady state condition. For the duration of the test period, the digester gas from the test digester was tested for various sulfur compounds on a daily basis. The testing program was scheduled to continue until any of the individual sulfur compounds, except hydrogen sulfide, reached 5 ppmv or higher in the digester gas or 135 °F was reached. Moreover, the ferric chloride injection rate in the raw sewage stream and ferrous chloride injection rate in the raw sludge line were varied independently during the test in order to study the impact of ferric and ferrous chloride on suppression of generation of odor causing sulfur compounds.

The test provided valuable data linking the formation of odor causing sulfur compounds with the digester operating temperature.

**TEST OBJECTIVE AND SETUP**

The objective of this test project was to determine the optimum operating temperature for the HTP anaerobic digester to produce Class “A” biosolids, which will comply with Federal Rule 40 CFR 503.32 – Alternative No. 1 without significantly increasing the sulfur compounds concentrations in the digester gas.

**Figure 1: Schematic Diagram of the Test Setup**
HTP utilizes Advanced Primary Treatment to maximize primary treatment removal efficiency; chemicals are added to the influent sewage to facilitate the removal of settleable solids. At HTP, ferric chloride followed by an anionic polymer solution is injected into the influent to facilitate coagulation and flocculation of solids. The ferric chloride is injected upstream of the Headworks, and flocculation occurs in the Aerated Grit Basins. Raw sludge from the primary tanks is fed to 16 first-stage digesters. Figure 1 shows the schematic diagram of the test setup. In this test, only one digester was used for the test. For the duration of the test, the primary sludge flow rate to the test digester was intentionally kept steady at 170,000 gallons per day. Ferrous chloride was added to the raw sludge before it was pumped to the digesters to reduce hydrogen sulfide levels in the digester gas.

At HTP, Waste Activated Sludge (WAS) from the Final Sedimentation Tanks is thickened, with the use of a polymer, from approximately 0.5 percent to about 6 percent solids. The thickening process is carried out in solid bowl, counter-current type centrifuges. During the test, Thickened Waste Activated Sludge (TWAS) was then pumped to the test digester at the rate of 45,000 gallons per day for the duration of the test, and the rest of the flow was equally distributed to the remaining 15 primary digesters. Normally, Raw Sludge from primary settling tanks and TWAS are pumped to sixteen first stage egg shaped digesters and digested thermophilically at 128 °F for about 12 days. The digested sludge from the first stage digesters then flows to four second stage batch digesters for further digestion lasting 24 hours. The digested sludge is then pumped into the Digester Screening Facility. Hair, fibers, rags, grit, and other impurities that may cause potential plugging problems are removed before it is sent to the dewatering facility. Screened sludge then gravity flows to a wet well. Diluted polymer solution is injected at the downstream side of the wet well pump where the sludge and the polymer solution are mixed through an in-line static mixer before the mixture is fed to the centrifuge. The egg-shaped digesters are equipped with mechanical mixers, and are heated to 128 °F by direct steam injection. Digester gas consisting of 64% methane was produced at an average rate of 7.5 million cubic feet per day (MCFD). A majority of the digester gas produced in the digestion process is sent to a nearby Power Generating Plant to produce electricity. From 2/10/2003 to 3/10/2004, the test digester, 1D1, was operated according to the following conditions. These conditions were verified frequently throughout the twelve test periods:

- Raw sludge flow rate was maintained at 170,000 GPD and TWAS flow rate was 45,000 GPD.
- The detention time was approximately 11.5 days.
- The digester temperature was raised at the rate of one degree per month from 128 to 135 °F.
- Total solids concentration in feed sludge and scum was about 4% by weight.
- Typical volatile solids content in the feed sludge was about 65%.
- Total solids concentration in digested sludge was about 2% by weight.
- Volatile solids destruction rate was typically 55%.
- Digester gas samples were taken daily and tested for hydrogen sulfide, carbonyl sulfide, methyl mercaptan, ethyl mercaptan, dimethyl mercaptan, carbon disulfide, 2-propyl mercaptan, 1-propyl mercaptan, and dimethyl disulfide. Carbon dioxide and methane were tested twice per week.
• Digested sludge samples were taken twice a week and tested for ammonia and dissolved sulfate.
• During the first ten days of each test period, volatile acids, alkalinity, pH, total solids and volatile total solids were tested daily. For the remainder of each test period, they were tested twice per week.

RESULTS AND DISCUSSION

Figure 2:

Figure 2 represents the volatile acid and alkalinity data collected over the test period. The chart seemed to indicate that both the volatile acid and alkalinity levels dropped as the digester temperature was raised above 134 °F. However, the drops in volatile acid and alkalinity levels were due to a reduction in solids loading in the test digester. Although the primary sludge and thickened WAS flow rate to the test digester was maintained at a steady rate, the concentration of the feed sources could not be maintained. The chart shows that concentration of both the volatile acid and the alkalinity decreased as the mass loading to the digester decreased.

Figure 3:
Figure 3 represents the volatile acid level in both 1D1 and 2D1 digesters. During the test periods, the mass loading to both digesters were held at exactly the same rate. The temperature in 2D1 digester was held steady at 128 °F while the temperature in 1D1 was varied from 128 to 135 °F. The chart shows that the volatile acid level in both digesters did not vary much from each other during the test period. From this chart, it is safe to conclude that the operating temperature of the test digester had no or minimal impact on volatile acid level provided that the operating temperature of the test digester was kept below 135 °F.

Figure 4:

Figure 4 represents the alkalinity level in both 1D1 and 2D1 digesters. During the test periods, the mass loading to both digesters were held exactly the same. The temperature in 2D1 digester was held steady at 128 °F while the temperature in 1D1 was varied from 128 to 135 °F. The
chart shows that the alkalinity level in both digesters did not vary much from each other during the test period. From this chart, it is difficult to find a correlation between alkalinity level and the digester operating temperature. As stated previously, the changes in alkalinity level in both digesters were due to changes in mass loading rather than changes in temperature.

**Figure 5:**

The results of sulfur compound analysis in digester gas are summarized in Figure 5. With the exception of hydrogen sulfide, methyl mercaptan, and dimethyl sulfide, other sulfur compounds in digester gas remained undetected throughout the test periods. The hydrogen sulfide level increased with the increase in digester temperature. However, the hydrogen sulfide concentration could be prevented from increasing further by increasing the ferric and/or ferrous dosages. When the ferric chloride injection was increased from 6,300 lbs/day to 8,700 lbs/day, the hydrogen concentration in the digester gas decreased from 140 ppm to 120 ppm. The digester operating temperature was maintained at 132 °F and ferrous chloride dosage at 1,500 lbs/day during this test period. The reduction in hydrogen sulfide gas concentration took place 2 to 3 days after the ferric chloride increase. In general, about 10% increase in ferric chloride dosage resulted in 5% reduction in hydrogen sulfide in digester gas. No changes in methyl mercaptan and other sulfur compounds concentrations in the digester gas were observed when ferric chloride dosage was varied. The ferric chloride injection test was repeated at the digester operating temperature of 135 °F and ferrous chloride dosage was set at 2,400 lbs/day. This time when the ferric chloride dosage was reduced from 11,000 lbs/day to 5,000 lbs/day, the hydrogen sulfide concentration increased from 180 ppm to about 300 ppm. Again, no changes in methyl mercaptan and other sulfur compounds concentration in the digester gas were observed.

While holding the ferric chloride dosage steady at 6,000 lbs/day and digester temperature at 134 °F, the ferrous chloride dosage was increased from 1,700 to 2,700 lbs/day. This increase in
ferrous chloride dosage caused the hydrogen sulfide level to drop from 250 to 130 ppm. The test was repeated at a digester temperature of 135 °F. When the ferrous and ferric chloride dosages were increased from 2,500 to 3,800 and 5,000 to 6,400 lbs/day respectively, the hydrogen sulfide level dropped from 290 ppm to 90 ppm. The test showed that hydrogen sulfide levels in the digester gas could be prevented from surging if proper dosages of ferric and ferrous chloride were added to the system. The test indicates that the hydrogen sulfide concentration could be maintained below 120 ppm with a ferric dosage of 6,000 lbs/day and a ferrous dosage of 2,700 lbs/day at the digester operating temperature of 134 °F. However the ferrous dosage had to be increased to 3,800 lbs/day in order to maintain the hydrogen sulfide level below 120 ppm while the digester was operating at 135 °F. The methyl mercaptan concentration did not respond to the increase of either the ferric and ferrous chloride dosage. The methyl mercaptan level was only brought to an acceptable level by lowering the digester temperature to 133 °F.

**Figure 6:**

Effect of Ferrous Chloride Dosage on Hydrogen Sulfide

CONCLUSION AND SUMMARY

In order for the HTP anaerobic digesters to produce Class “A” biosolids, which will comply with Federal Rule 40 CFR 503.32 – Alternative No. 1 without significantly increasing the sulfur compounds concentrations in the digester gas, the first-stage thermophilic digesters should be operated at 133 °F or lower in order to minimize the chance of producing odorous sulfur compounds in digester gas. However, ferric and ferrous chloride needs to be dosed appropriately to the raw sewage and sludge respectively.

The concentrations of both volatile acids and alkalinity in the digester were not affected by the gradual increase in the digester operating temperature, at least to 135 °F. The hydrogen sulfide
level increased with the increase in digester temperature. However, by raising the ferric and/or ferrous dosage, we were able to prevent the hydrogen sulfide concentration from increasing further.

As long as the digester temperature was maintained steadily at 133 °F or lower, no increase in concentrations of various sulfur compounds in the digester gas, with the exception of hydrogen sulfide, was noted. When the digester operating temperature was raised to 135 °F, abrupt increases in the methyl mercaptan and dimethyl sulfide concentrations were observed. Although fairly large amounts of ferric and ferrous chloride were added to raw sewage and primary sludge respectively, the increase in methyl mercaptan and dimethyl sulfide concentration could not be controlled when the digester was operated at a constant temperature of 135 °F. These compounds were brought under control only after the digester operating temperature was lowered to 133 °F.
Water Treatment Processes for Water Supply

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ABSTRACT

The goal of all water treatment process is to remove contaminants in the water, improving it for subsequent use. Several biological and physico-chemical processes are in practice which include ultraviolet light, filtration, water softening, reverse osmosis, ultrafiltration, molecular stripping, deionization, and carbon treatment. In this paper several case studies are included which brings a broader view on modern day treatment technologies.

Keywords: water treatment, water supply, physico-chemical processes, flocculation, disinfection, purification techniques

I. INTRODUCTION

Water treatment is used to make water more acceptable for a desired end-use. These can include use as drinking water, industrial processes, and other uses. The goal of all water treatment process is to remove existing contaminants in the water, improving it for subsequent use. The water treatment processes may include physical treatment processes such as settling, chemical treatment processes such as disinfection or coagulation or biological processes such as slow sand filtration. Water purification is the process of removing contaminants from a raw water source. The goal is to produce water for a specific purpose with a treatment profile designed to limit the inclusion of specific materials; most water is purified for human consumption. Water purification may also be designed for a variety of other purposes, including meeting the requirements of medical, pharmacology, chemical and industrial applications. Methods may include ultraviolet light, filtration, water softening, reverse osmosis, ultrafiltration, deionization and powdered activated carbon treatment. (1)

Water purification may remove: particulate sand; suspended particles of organic material; parasites, Giardia; Cryptosporidium; bacteria; algae; virus; fungi; etc. Minerals calcium, silica, magnesium, etc. and toxic metals (lead, copper, chromium, etc). Some purification may be elective in the purification process, including smell (hydrogen sulfide remediation), taste (mineral extraction), and appearance (iron encapsulation). (2)

Governments dictate the standards for drinking water quality. These standards will require minimum / maximum set points of contaminants and the inclusion of control elements that produce drinking water. Drinking water quality standards in many countries require specific
amounts of disinfectant (such as chlorine or ozone) in the water after it leaves the water treatment plant (WTP), in order to reduce the risk of re-contamination while the water is in the water distribution system. Several case studies for water treatment plants, which had upgrading to meet drinking water standards, were presented in the following section.

II. CASE STUDIES

(A) Reverse Osmosis Desalination Plant, Jeddah, Saudi Arabia (3)

The reverse osmosis (RO) desalination plant in Jeddah is one of the largest seawater RO plants in the world. The pretreatment used in this plant is as follows: disinfection with chlorine at the intake, coagulation and flocculation (using alum and polyelectrolyte, dual media gravity filters, acid dosing and sodium hexameta phosphate as anti scaling, and finally micron cartridge filters. This RO plant produced high quality product water for the first 2 years since its opening in 1989. Following this, the permeate quality began to decrease due to chlorine attack on the membranes. Hence, it was decided to use an intermittent chlorine injection method in which the membrane was subjected to a feed with a particular chlorine concentration for some time followed by other feed water free of chlorine for another period. This improved treatment plant performance.

(B) Water Treatment Improvement Project: Santa Clara Valley Water District (4) (5)

The water district was in the middle of major renovations at their three water treatment plants. The changes will allow the district to provide higher quality drinking water to residents of Santa Clara County, California.

The project included work at each of the district's three water treatment plants, conducted in two phases. The first phase was complete. Phase 2 construction started in 2002 with all work scheduled to be completed by 2010.

The project is the district's response to the Federal Safe Drinking Water Act and the Environmental Protection Agency's call for more stringent water quality regulations. Ozonation will reduce trihalomethane (THMs), a byproduct of chlorination. During the warmest times of the year when algae can cause tastes and odors, ozonation will also enhance the flavor of the finished water.

Not all drinking water is sent through the water treatment plants. The Santa Clara valley water district also operates a series of recharge ponds throughout the county. Water pumped into these ponds percolates down through the ground and into our deep underground aquifers. The water percolation process naturally cleans the water. Water pumped from underground aquifers needs less treatment than water imported from rivers or reservoir. The district manages the water storage in the aquifers which also prevents subsidence of ground surface elevation levels.

Nearly half of the water used in Santa Clara County comes from wells. The remaining water needed comes from the Sacramento- San Joaquin river delta. When the ozonation upgrades are completed all the three water district water treatment facilities, up to 240 million gallons of purified drinking water can be produced each day for Santa Clara county residents.

(C) WaterPro Water Treatment Plant, Draper, Utah (6)

WaterPro Water Treatment Plant in Draper, Utah, was planning to expand its treatment capacity from 2.8 MGD to 6.0 MGD and to provide high quality to meet the US Environmental Protection Agency’s (EPA) Long- Term 1 Enhanced Surface Water Treatment Rule.
Although the existing conventional tri-media filters had adequate treatment under normal flow conditions, melting snow in the spring and heavy rains caused high turbidity which overwhelmed the aging plant’s filtration system. WaterPro examined several treatment alternatives including conventional granular media systems, sand ballasted high rate settling, and membranes. The WaterPro selected GE’s ZeeWeed* ultrafiltration (UF) membranes in October 2002 to retrofit its granular media basins. Factors considered in selection were compact footprint, high quality water, resistance to turbidity and cost. The retrofit was more cost effective than constructing a new conventional water treatment plant.

WaterPro obtained raw water from mountain streams. Raw water flows through a sedimentation basin to remove large solids. From these basins, the water flows to two trains of membrane tanks. The membranes removed suspended solids and had greater than 4-log removal of pathogens such as Giardia and Cryptosporidium. Filtered water is collected from each fiber into a central header. Rejected particles remain in the process tank and are discharged to new drying beds where they are captured for disposal. Excess backwash water is decanted and sent to the pressure irrigation system. Chlorine and fluoride were added to the treated water before it is pumped to the WaterPro water distribution system.

The automated operation of the plant allowed the operator to monitor the plant from off-site location. Direct filtration of raw water eliminated the need for coagulant. The on-site hydro-generating station supplied electricity to the water treatment plant. The water treatment plant produced water that exceeded state and federal drinking water requirements.

**Big Canoe Water Treatment Plant, Big Canoe, Georgia (7) (8)**

Big Canoe is a mountain home development of single family and multi-family housing and has a mixture of commercial, golf courses, tennis and fitness facilities. The community with land area of approximately 8,000 acres has experienced growth since the early 1970's. As a result, there have been ongoing upgrades to the potable water treatment system. Big Canoe had previously used ground water wells for the potable water supply. To meet the water demand of the community, in 1992, a conventional sand filtration plant was constructed with capacity of 1.0 MGD (million gallons per day). Raw was from Lake Petit. Since its completion in 1996, the surface water treatment plant has met the needs of Big Canoe’s water consumption. However, with the increased growth, increasing water demand has lead to the need to upgrade the water treatment capacity of the system. Concern over water supply during drought period had prompted a thorough evaluation of the decision whether to continue to withdraw water from Lake Petit.

After evaluating several alternatives, engineering firm recommended a plan to withdraw raw water from Blackwell Creek instead of Lake Petit to minimize the impacts of the water withdrawal on lake levels and provide a more reliable source of water. Water will be pumped to a new reservoir and then drawn into a new 1.0 MGD water treatment plant which used membrane process for treatment. The existing water treatment plant at Lake Petit would remain in service as backup during drought conditions.

REFERENCES

Small Scale Water Treatment Plants
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ABSTRACT

Although 70% of the earth is covered with water, clean and safe drinking water has not been accessible to most people in the world. Meeting the drinking water needs of the people in rural communities still remains a major challenge. Implementing small scale water treatment approaches and techniques in these areas can provide relief to these people to a certain extent. Governments and communities have initiated these approaches in different parts of the world and the outcomes of these initiatives have been very promising. This paper discusses the available techniques for small scale water treatment and analyzes a number of case studies from different parts of the world in the relevant field.

Keywords: small scale water treatment, water purification, on-site water treatment

1. INTRODUCTION

Water treatment is the process of removing contaminants from water. Usually a treatment profile designed to limit the concentration of specific materials and this depends on the end use of the treated water. As far as drinking water is concerned, during the process of treatment bacteria, algae, viruses, fungi, minerals such as iron and sulfur, and man-made chemical pollutants are removed. To prevent recontamination of the drinking water once it leaves the treatment plant, chlorination or ozonation are carried out. When it comes to standards, governments usually dictate the standards for drinking water quality. A standard involves minimum/maximum set points of contaminants and the inclusion of control elements that produce drinking water. The most commonly used processes include filtration, flocculation and sedimentation and disinfection for surface water. Some treatments also include ion exchange and adsorption. Water utilities select a combination of treatment process most appropriate to treat the contaminant found in the raw water used by the system.

For small scale water treatment plants boiling, granular activated carbon, distillation, reverse osmosis, ion exchange and electrodeionization are the most common purification techniques used.

(a) Boiling
Boiling is a type of phase transition, which involves rapid vaporization of a liquid, which typically occurs when a liquid is heated to its boiling point; which is the temperature at which the vapor pressure of the liquid is equal to the pressure exerted on the liquid by the surrounding environmental pressure. Boiling is used as a method of water purification. Boiling is commonly advocated as an emergency water treatment method, or as a method of portable water purification in rural or wilderness settings without access to a potable water infrastructure. Boiling water as recommended will kill bacterial, parasitic, and viral causes of diarrhea. Boiling can also remove some volatile organic compounds from the water. It is one of the most inexpensive techniques for water purification. Filtration before boiling can prove to be very effective.

(b) Activated Carbon

Carbon is one of the strongest absorbent, and has been used to remove impurities from water. Activated carbon filters for small scale water treatment mostly contain granular activated carbon (GAC). Activated carbon filters can remove or reduce many volatile organic chemicals (VOC), pesticides and herbicides, as well as chlorine, benzene, trihalomethane (THM) compounds, radon, solvents and hundreds of other man-made chemicals found in tap water. Some activated carbon filters are moderately effective at removing some, but not all, heavy metals. In addition, densely compacted carbon block filters mechanically remove particles down to 0.5 micron, including Giardia and Cryptosporidium, turbidity and particulates. Although some iron, manganese, and hydrogen sulfide will be removed by these higher quality activated carbon filters, a manganese greensand iron reduction filter is generally preferred to remove these contaminants as the effectiveness of carbon filter against iron and manganese is generally short-lived if the contaminant concentration is high [1].

(c) Distillation

Distillation is a method of separating chemical substances based on differences in their volatilities in a boiling liquid mixture. Distillation usually forms part of a larger chemical process, and is thus referred to as a unit operation. Distillation is the most common separation technique. It can effectively remove many contaminants from drinking water, including bacteria, inorganic and many organic compounds. Contaminated water is heated to form steam. Inorganic compounds and large non-volatile organic molecules do not evaporate with the water and are left behind. The steam then cools and condenses to form purified water. Distillation is most effective in removing inorganic compounds such as metals (iron and lead) and nitrate; hardness (calcium and magnesium); and particulates from a contaminated water supply. The boiling process also kills microorganisms such as bacteria and some viruses. The effectiveness of distillation in removing organic compounds varies, depending on such chemical characteristics of the organic compound as solubility and boiling point. Organic compounds that boil at temperatures greater than the boiling point of water (some pesticides) can be effectively removed from the water. Organic compounds that boil at temperatures lower than the boiling point of water (ex., benzene and toluene) will be vaporized along with the water. If these harmful compounds are not removed prior to condensation, they will re-contaminate the purified product [2].

(d) Reverse Osmosis

Reverse Osmosis (RO) is a separation process that uses pressure to force a solution through a membrane that retains the solute on one side and allows the pure solvent to pass to the other side.
More formally, it is the process of forcing a solvent from a region of high solute concentration through a membrane to a region of low solute concentration by applying a pressure in excess of the osmotic pressure. This is the reverse of the normal osmosis process, which is the natural movement of solvent from an area of low solute concentration, through a membrane, to an area of high solute concentration when no external pressure is applied. The membrane here is semi permeable, meaning it allows the passage of solvent but not of solute [3].

For drinking water purification systems, including a reverse osmosis step is commonly used for improving water quality. These systems typically include a number of stages, a sediment filter to trap particles including rust and calcium carbonate, a second sediment filter (optional) with smaller pores, an activated carbon filter to trap organic chemicals, and chlorine which will attack and degrade TFC reverse osmosis membranes, a reverse osmosis (RO) filter which is a thin composite membrane, optionally a second carbon filter to capture those chemicals not removed by the RO membrane. An ultra violet lamp (optional) is used for disinfection of any microbes that may escape filtering by the reverse osmosis membrane [3].

Portable RO water processors can be used by people who live in rural areas without clean water, far away from the city's water pipes. Rural people filter river or ocean water themselves, as the device is easy to use (Saline water may need special membranes). Also, in the production of bottled mineral water, the water passes through an RO water processor to remove pollutants and microorganisms.

(e) Ion Exchange

Ion Exchange is an exchange of ions between two electrolytes or between an electrolyte solution and a complex. In most cases the term is used to denote the processes of purification, separation, and decontamination of aqueous and other ion-containing solutions with solid polymeric or mineral ion exchangers.

When contaminants dissolve in water, they typically form ions. Ions are electrically charged portions of a compound. There is a balance of positively and negatively charged ions in natural waters. When contaminants are dissolved in water, the water is typically crystal clear. If the water is cloudy or otherwise discolored, it is likely that some, or all, of the contaminants are in a solid form. Solid particles are not removed by IE and will clog the treatment media. Typical ion exchangers are ion exchange resins, zeolites, montmorillonite, clay, and soil humus. Ion exchangers are either cation exchangers, that exchange positively charged ions or anion exchangers that exchange negatively charged ions. There are also amphoteric exchangers that are able to exchange both cations and anions simultaneously. Most typical application of ion exchange is preparation of high purity water [4].

(f) Electrodeionization

Electrodeionization (EDI) is a continuous and chemical-free process of removing ionized and ionizable species from feed water using DC power. EDI, is a membrane process that removes ions from the water to produce ultra pure water. EDI is typically used to polish reverse osmosis (RO) permeate and to replace conventional mixed bed ion exchangers by eliminating the need to store and handle hazardous chemicals that are used for resin regeneration and the associated waste neutralization requirement. EDI is comprised of ion exchange resin and membranes. The module gets a DC voltage applied across it to help drive the ions into the reject stream. This allows the pure water to exit the module through the product stream.
The continuous electrodeionization (EDI) process is distinguished from other electrochemical collection/discharge processes such as electrochemical ion exchange (EIX) or capacitive deionization (CapDI), in that EDI performance is determined by the ionic transport properties of the active media, not the ionic capacity of the media. EDI devices typically contain semi-permeable ion-exchange membranes and permanently charged media such as ion-exchange resin. The EDI process is essentially a hybrid of two well-known separation processes - ion exchange deionization and electrodialysis, and is sometimes referred to as filled-cell electrodialysis [5].

II. CASE STUDIES

(a) Membrane Treatment

A single treatment facility producing boiler feed, food processing water, and drinking water This is a case study from a sugar mill and refinery facility operating in the agricultural area of Southeast Florida. This study examines this facility and demonstrates that the quality of water produced by a membrane treatment plant can be varied to suit many requirements, without expanding the facility. The plant is designed to produce 750,000 gpd and it provides three different qualities of water. This facility was built to provide process quality water to a sugar refinery on a year-round basis and boiler feed water during the six month period each year when the sugar milling process is not in operation. The consistently high quality of water improved the quality of refined sugar and allowed the refinery to operate all year. In addition, the treatment plant provides potable water for use and consumption by the employees. Potable water was previously trucked to the site on a daily basis [6]. The water from the stand by wells is pumped to the membrane treatment plant. A part of the effluent water is used as a boiler feed and the remaining is passed to a treatment tank. The clean water is then supplied for general purposes, drinking water and heated water.

(b) Desalination Using PV Systems

This is a case study regarding the feasibility of brackish water desalination in the Egyptian deserts and rural regions using PV systems. In the Egyptian deserts and rural areas, there is a shortage of fresh water despite the presence of large sources of brackish water. Solar energy is abundant in these remote areas of Egypt, where the amount of sunshine hours is around 3500 h/year. In this case a photovoltaic energy was used as the primary source of energy. The availability of water resources and solar energy in these areas was investigated. Also, a design of a PV powered small scale reverse osmosis water desalination system was studied and economically estimated.

It is found that the cost of producing 1 m³ of fresh water using the small PV powered RO water desalination systems is $3.73. The use of renewable energy sources in feeding different systems in these rural areas with their energy demands will maintain their environment clean and healthy for people. Desalination by the technique of reverse osmosis has proved to be the lowest energy consuming technique according to many studies. PV generators are direct, simple, maintenance-free, quiet, clean, renewable and economic power sources in rural areas. It consumes nearly around half of the energy needed for thermal processes. Also, the modularity of reverse osmosis units, their simplicity of operation, their compact sizes and lower environmental impacts give them priority to be used for water desalination in remote areas. Water desalination by reverse osmosis units removes not only inorganic ions but also organic matters, viruses and bacteria. On the other hand, PV generators are direct, simple, maintenance-free, quiet, clean,
renewable and economic power sources in rural areas. In conclusion the study confirmed the importance and suitability of using the technique of photovoltaic powered RO desalination plants in remote areas of the Egyptian desert [7].

(c) Nitrate Removal with Reverse Osmosis

The study was conducted in rural South Africa. The nitrate-nitrogen concentration (>6 mg/l) and the salinity (>1000 mg/l TDS) of many borehole waters in rural areas in South Africa are considered too high for human consumption. Therefore, an urgent need for water denitrification and water desalination exists in these areas. Reverse osmosis (RO), electrodialysis (ED), ion-exchange (IX) and certain biological technologies can be very effectively applied for water denitrification. Although each of these technologies, have their own advantages and disadvantages, reverse osmosis technology, was selected for this study because the technology is well known in South Africa, and also because it can be very effectively applied for water desalination. The objectives of this study were: to transfer RO technology through process demonstration performance for water denitrification and water desalination to people living in rural areas; to build capacity regarding the operation and maintenance of an RO application in a rural area; to produce a preliminary operational and maintenance manual for the operation of an RO unit in a rural environment; to train local operators to operate and maintain an RO plant in a rural environment; to evaluate stock watering as brine disposal option; and to determine the preliminary economics of the process.

It was demonstrated that the RO process could be very effectively applied for water denitrification and water desalination in a rural area. Nitrate-nitrogen was reduced from 42.5 mg/l in the RO feed to only 0.9 mg/l in the RO product water. The TDS of the RO feed was reduced from 1292 mg/l to 24 mg/l in the RO permeate. Therefore, excellent quality water could be produced for potable purposes. The RO brine at approximately 50% water recovery was concluded to be suitable for stock watering if the conditions for stock watering were met in terms of nitrate-nitrogen concentration, TDS and other constituent concentrations [8].

The borehole water was pumped to the feed tanks. After pretreatment it was pumped to a RO unit where the water was treated. The brine was used for stock watering. The treated water was passed to a storage tank after caustic dosing for reducing the pH to acceptable levels.

(d) Desalination in the Gaza Strip

This case study provides an example of how too many small scale water treatment plant can cause environmental impact in the absence appropriate governing rules and regulations. Due to the sharp shortage of water and the bad quality of groundwater, desalination plants were set up in the Gaza Strip area in Palestine. Currently, there are six reverse osmosis desalination plants in the Gaza Strip owned and operated by the Palestinian Water Authority (PWA) and different municipalities. In addition, there are many small desalination units owned and operated by private investors for commercial purposes. Currently there is a plan for a regional seawater desalination plant with a capacity up to 150,000 m³/y. According to the PWA plan, desalination seems to be the only viable alternative for water resources. However, large-scale desalination plants seem to be several years in the future. Meanwhile, studies on the environmental impact of desalination should be made in order to take the proper measures to protect the environment. So far, the currently operated plants have unfortunately not taken these measures. The effluent brines from these plants are not properly disposed of and the quality of desalinated water is not monitored [9].
III. CONCLUSION

From the study it can be concluded that small scale water treatment is an extremely positive initiative for rural water supply. Involving the local community in the project has demonstrated higher success rates. It seems like when governments when over-stretched in terms of financial and human resources make attempts to limit their role to that of water sector facilitator and regulator and to encourage communities to take responsibility for their water supplies anyways. Techniques like reverse osmosis, membrane processes, boiling, distillation, and solar disinfection can be easily applied to small scale water treatment plants and could play a major part in improving quality of life for a significant proportion of the world's population. However, a clear and concise government policy and adequate donor support is a must for initiating these small scale water treatment facilities. It is important to for governments and concerned agencies realize that provision of reliable supplies of water for drinking is a foundation of sustainable development.

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OCEESA MEMBERSHIP APPLICATION

Name: ____________________________________________________________________________

Last                First        Middle

Chinese Name (in Chinese): __________________________      Sex: □ Male   □ Female

Membership Status:  □ Regular  □ Student  □ Corporate

Title (Job Title): __________________________

Department: __________________________

Organization: __________________________

Business Address: ____________________________________________________________________

Street  City  State       ZIP

Home Address: ____________________________________________________________________

Street  City  State       ZIP

Office Phone: ___________________  Office Fax: __________________  Office Email: _________________

Home Phone: ___________________ Home Fax: __________________  Home Email: _________________

Occupation: □ Private Practice/Consulting   □ Educator   □ Industry   □ Laboratory

□ Federal Official   □ State Official   □ Local Official   □ Retired   □ Other: ___________

Birth Date: __/__/____   Birth Place: _________________________________________________

Month  Day  Year  City  State  Country

Professional Engineer License: ___________________________   Other License (please specify): ________________________________________

B.S. Degree: __________________________

Degree    Major    Year    Institution

M.S. Degree: __________________________

Degree    Major    Year    Institution

Ph.D. Degree: __________________________

Degree    Major    Year    Institution

Member of Associations:

□ AWMA  □ AIChE  □ APHA  □ APWA  □ ASEE  □ ASCE  □ ASME  □ AWWA  □ AEESP

□ GRCDCA  □ NSPE  □ WEF  □ ACS  □ Other: ___________

Major Fields of Expertise (list 3 from 2-digit code in Table 1):

Major Fields of Expertise (list 3 from topics of category in Table 1):

Areas of Specialization (list 5 from 4 digit codes in Table 2):

Additional Areas of Interests (list 3 areas):

Professional Experience:

Signature: __________________________

Date: __________________________

Annual Dues: Regular Member $25; Student Member $15; Corporate Member $100; Annual membership due on January 31. Please mail this membership form with 1-page resume and payment (payable to OCEESA) to: Dr. Yung-Tse Hung, Professor, 16945 Deerfield Dr., Strongsville, Ohio 44136-6214 USA Tel: O: (216) 687-2596 Tel:H: (440) 238-0407 Fax: (216) 687-5395 Email: y.hung@csuohio.edu, yungtsehung@yahoo.com Please note that the dues payment check must be in U.S. dollars and must be drawn from a U.S. bank located in U.S. Please also email your membership form and 1-page resume to Dr. Yung-Tse Hung. OCEESA Web Page: http://www.oceesa.org  Note: Format resume as follows: Name, position, department, employer, complete contact information, education, academic experience, industrial experience, professional engineering registration, professional association, major field of competence, list of publications (incl. presentations).
Table 1 and Table 2  OCEESA Expertise and Specialty

Note: Expertise (2 digits)  Specialty (4 digits)

01 AIR POLLUTION CONTROL PROCESSES

0101 Absorption
0102 Adsorption
0103 Combustion
0104 Electrostatic precipitation
0105 Particle filtration
0106 Gravity settler
0107 Inertial separator
0108 Scrubbers
0109 Source modification
0110 Biofiltration

02 ANALYTICAL METHODS

0201 Aerosol analysis
0202 Bioassay
0203 Chromatography, gas
0204 Chromatography, liquid
0205 Electron microscopy
0206 Elemental analysis
0207 Inorganic analysis
0208 Mass spectroscopy
0209 Organic analysis
0210 Quality control
0211 Sampling
0212 Solids analysis
0213 Spectrophotometry
0214 Taste and odor
0215 Toxicity

03 ATMOSPHERIC CHEMISTRY
AND AIR QUALITY

0301 Acid deposition
0302 Aerosols
0303 Chlorofluorocarbons
0304 Clouds chemistry and physics
0305 Gas-phase reactions
0306 Greenhouse gases
0307 Heterogenous reactions
0308 Indoor air quality
0309 Nitrogen oxides
0310 Ozone
0311 Photochemical reactions
0312 Smog
0313 Sulfur dioxides
0314 Transport
0315 Visibility
I. **04 BIOLOGICAL TREATMENT**

0401 Activated sludge  
0402 Biofilm process - aerobic  
0403 Biofilm process - anaerobic  
0404 Composting  
0405 Denitrification  
0406 Kinetics  
0407 Lagoons - aquatic macrophytes  
0408 Lagoons - stabilization  
0409 Methanogenesis  
0410 Nitrification  
0411 Phosphorus removal  
0412 Septic tanks  
0413 Sludge digestion  
0414 Sulfate reduction

**05 CHEMICAL AND PHYSICAL TREATMENT**  
**PROCESSES FOR WATER AND WASTEWATER**

0501 Adsorption  
0502 Chlorination and dechlorination  
0503 Coagulation/flocculation  
0504 Disinfection  
0505 Filtration  
0506 Flotation  
0507 Gas transfer  
0508 Ion exchange  
0509 Irradiation  
0510 Membrane processes  
0511 Ozonation  
0512 Precipitation  
0513 Sedimentation  
0514 Mixing

**06 DRINKING WATER QUALITY**

0601 Chemicals - inorganic  
0602 Chemicals - organic  
0603 Disinfection by-products  
0604 Disinfection residuals  
0605 Microbiological  
0606 Stability  
0607 Tastes and odors

**07 ECOLOGY**

0701 Aquatic  
0702 Microbial  
0703 Soil  
0704 Terrestrial  
0705 Toxicology

**08 GEOLOGICAL SCIENCES**
0801 Erosion
0802 Geology
0803 Geophysics
0804 Hydrogeology
0805 Mineralogy
0806 Sediment transport
0807 Soil classification

09 GROUNDWATER QUALITY

0901 Aquifer restoration
0902 Colloid transport
0903 Inorganic geochemistry
0904 Microbiology
0905 Monitoring
0906 Multiphase systems
0907 Organic geochemistry
0908 Radionuclides
0909 Sorption
0910 Transformation reactions

10 HAZARDOUS MATERIALS

1001 Biological treatment
1002 Characterization
1003 Chemical treatment
1004 Exposure and risk
1005 Incineration
1006 Intermedia transport
1007 Land disposal
1008 Management
1009 Physical treatment
1010 Reuse, recycling, recovery and source reduction
1011 Solidification
1012 Storage and transportation

11 HYDROLOGY

1101 Evaporation/precipitation
1102 Groundwater movement
1103 Groundwater/surface water interactions including recharge
1104 Land use
1105 Meteorology
1106 Seepage
1107 Water circulation
1108 Well analysis and design

12 HYDROMECHANICS

1201 Coastal hydraulics
1202 Cold regions
1203 Flooding
1204 Fluid mechanics
1205 Hydraulics
1206 Hydromechanics
1207 Open-channel flow
1208 Pumping
1209 Sedimentation
1210 Waves

13 MANAGEMENT/POLICY
1301 Air basins
1302 Economics and finance
1303 Environmental impact Assessment
1304 Laws and regulations
1305 River basins
1300 Utilities
1307 Water allocation
1308 Water conservation
1309 Water-quality standards

14 MATHEMATICAL MODELING
1401 Air-pollutant transport t
1402 Atmospheric chemical reactions
1403 Chemical kinetics and equilibrium
1404 Groundwater movement
1405 Groundwater solute transport
1406 Ocean outfalls
1407 Pipe networks
1408 R isle
1409 Stochastic processes
1410 Surface water quality
1411 Systems analysis
1412 Treatment processes and Facilities

15 MICROBIOLOGY
1501 Aerobic
1502 Algae
1503 Anaerobic
1504 Disinfection
1505 Groundwater
1506 Kinetics
1507 Marine
1508 Pathogens
1509 Soil
1510 Toxicology
1511 Viruses

16 PUBLIC HEALTH
1601 Communicable diseases
1602 Dose response
1603 Epidemiology
1604 Enteric bacteria
1605 Giardia
1606 Risk assessment
1607 Viruses
17 RADIOACTIVE MATERIALS

1701 High-level radioactive wastes
1702 Low-level radioactive wastes
1703 Radiation physics
1704 Radiotracers
1705 Radon
1706 Stable radionuclides

18 SLUDGE HANDLING AND DISPOSAL

1801 Aerobic digestion
1802 Anaerobic digestion
1803 Composting
1804 Conditioning
1805 Dewatering, centrifugal
1806 Dewatering, Filtration
1807 Dewatering, evaporative
1808 Incineration
1809 Land disposal and agricultural use
1810 Marine disposal
1811 Thickening

19 SOLID-WASTE MANAGEMENT

1901 Biological treatment
1902 Co-disposal
1903 Incineration
1904 Landfilling
1905 Recycling and recovery
1906 Volumetric reduction

20 SURFACE-WATER QUALITY

2001 Dissolved oxygen
2002 Drinking-water supply
2003 Eutrophication
2004 Fisheries
2005 Land-use control
2005 Mixing zones
2007 Non-point sources
2008 Pathogens
2009 Photo processes
2010 Recreation
2011 Sedimentation
2012 Waste load allocation

21 WASTEWATER COLLECTION

2101 Characterization of wastewaters
2102 Corrosion control
2103 Maintenance and construction
2104 Odor control
2105 Sewerage systems
2106 Storage or retention

22 WATER CHEMISTRY

2201 Acids and bases
2202 Complexation and chelation
2203 Corrosion and material degradation
2204 Kinetics
2205 Organic transformation
2206 Oxidation/reduction reactions
2207 Photochemistry
2208 Precipitation and dissolution
2209 Sorption
2210 Thermodynamics and Equilibrium

23 WATER DISTRIBUTION

2301 Bacterial growth
2302 Construction and maintenance
2303 Corrosion
2304 Disinfectant residual
2305 Reservoirs and storage tanks
2306 Tastes and odors
Did you move or change job?
Attached a recent OCEESA mailing label or fill in previous old label. Please send to: Prof. Yung-Tse Hung,
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<th>Middle Name</th>
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