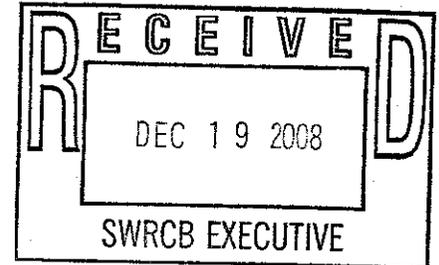




December 19, 2008

Jeanine Townsend  
Clerk to the Board  
State Water Resources Control Board  
P.O. Box 100  
Sacramento, CA 95812-0100



**Subject: Comment Letter – Proposed Recycled Water Policy**

Dear Ms. Townsend:

This comment letter addresses Section 10 – Emerging Constituents/Constituents of Emerging Concern.

In Line 463, the draft policy indicates the importance of source control and pollution prevention programs in minimizing the impacts of Constituents of Emerging Concern (CECs) on human health and the environment. In order to address the issue of source control, I recommend the blue-ribbon advisory panel (referred to in Lines 469 and 470) include an industrial chemist experienced with industrial/commercial sources of CECs and one medical doctor experienced with medicinal uses of CECs.

In Line 475, the draft policy indicates the involvement of a civil engineer familiar with the design and construction of recycled water treatment facilities. I recommend the Board consider Robert W. Emerick, Ph.D., P.E., and Vijay Sundaram for this role. Very brief resumes for these active CEC researchers are attached for the Board's consideration, along with a summary of their on-going work in the field. As noted in the research summary, they are working on more sustainable technologies (in terms of cost, power use, and waste stream production) to remove CECs than the conventional approach of RO, UV, and hydrogen peroxide. Their approach also includes multiple barriers to remove each class of CEC, which is an important aspect of process reliability and public acceptance. It is also important to note that their work is in concert with proposed CDPH regulations on groundwater recharge. Their presence on the panel should be complemented with a civil engineer personally experienced with the Southern California RO, UV, and hydrogen peroxide projects because they are excellent projects, though possibly not applicable to many smaller or inland utilities in California.

Please feel free to contact me, or Dr. Emerick, or Vijay directly if we can be of any further assistance in these matters.

Sincerely,

**ECO:LOGIC Engineering**

Richard E. Stowell, Ph.D., P.E.

cc: Robert W. Emerick, ECO:LOGIC Engineering Vijay Sundaram, ECO:LOGIC Engineering

## Robert W. Emerick, Ph.D., P.E. Principal

### Professional Registration

Civil Engineer No. 58914  
California

### Education

Ph.D., Civil and Environmental  
Engineering, University of  
California, Davis

M.S., Civil and Environmental  
Engineering, University of  
California, Davis

B.S., Civil Engineering, University  
of California, Davis

### Publications

Contributing author to *Wastewater  
Engineering, Treatment, Disposal,  
Reuse*, Metcalf and Eddy, Fourth  
Edition.

Loge, F. J., Emerick, R. W., Heath, M.,  
Jacangelo, J., Tchobanoglous, G.,  
and Darby, J. (1996) Ultraviolet  
Disinfection of Secondary  
Wastewater Effluents: Prediction  
of Performance and Design.  
*Water Environment Research*, 68:5,  
900-916.

Emerick, R. W., Test, R.,  
Tchobanoglous, G., and Darby, J.  
L. (1997) Shallow Intermittent  
Sand Filtration: Microorganism  
Removal, *The Small Flows Journal*,  
3:1, 12-22.

Loge F. J., Emerick, R. W.,  
Thompson, D. E., Nelson, D. C.,  
and Darby, J. L. (1999)  
Development and Application of  
a Fluorescent 16S rRNA  
Oligonucleotide Probe Specific to  
the Family *Enterobacteriaceae*.  
*Water Environment Research*, 71:1,  
75-83.

Loge, F. J., Emerick, R. W.,  
Thompson, D. E., Nelson, D. C.,  
and Darby, J. L. (1999) Factors  
Influencing UV Disinfection

Bob has over 14 years of water quality experience, including research of emerging treatment technologies, NPDES permitting, stream studies for priority pollutants, and wastewater treatment process development and design. He is an acknowledged leading expert in the design of UV disinfection systems, and obtaining waste discharge permits for public agencies, particularly involving effluent dominated water bodies. Bob is currently under contract to provide a series of classes to the State Water Quality Control Board that are related to wastewater permitting and design.

### Project Experience Water Reuse

**MF-Ozone-BAC Pilot Testing at Reno-Stead Water Reclamation Facility, Reno, NV.** Principal Investigator (PI) for developing and implementing Membrane Filtration (MF)-Ozonation-Biological Activated Carbon (BAC) pilot testing at the Reno-Stead Water Reclamation Facility. The pilot testing is being conducted to determine the effectiveness of MF-Ozone-BAC process train in removing over 300 Endocrine Disrupting Chemicals (EDCs), Pharmaceuticals and Personal Care Products (PPCPs), and other contaminants of concern. The effectiveness of the BAC process in removing Biodegradable Dissolved Organic Carbon (BDOC) and producing an effluent suitable for groundwater recharge applications is also being investigated.

**Washoe County Conceptual Level Regional Reclaimed Water Plan, Reno, NV.** Principal Investigator for developing a conceptual level regional reclaimed water plan discussing the integration of the City of Sparks, City of Reno, and Washoe County reclaimed water systems. The North Valleys Initiative is a process developed to implement a work plan to address many inter-related issues associated with expanding reclaimed water service. Key personnel from the City of Reno, Sparks, Washoe County, TMWA and the WRWC are involved to define and resolve many policy, regulatory, technical, and financial issues.

**Lincoln, CA and Rio Vista, CA.** Investigated the partitioning of priority pollutant contaminants and wastewater treatment process impacts on the removal/reduction of priority pollutants for Lincoln, CA and Rio Vista, CA.

**Sacramento Regional Wastewater Treatment Plant Coliform Bacteria Study.** Investigated the physical parameters influencing the development of coliform bacteria associated with wastewater particles for Sacramento Regional Wastewater Treatment Plant. Research involved developing an oligonucleotide probe specific to the family *Enterobacteriaceae* for visual identification of coliform bacteria within wastewater particles.

Performance - Part I: Light Penetration into Wastewater Particles. *Water Environment Research*, 71:3, 377-381.

Emerick, R. W., Loge, F. J., Thompson, D. E., and Darby, J. L. (1999) Factors Influencing UV Disinfection Performance - Part II: Association of Coliform Bacteria with Wastewater Particles. *Water Environment Research*, 71:6, 1178-1187.

Emerick, R. W., Manning, J., Tchobanoglous, G., and Darby, J. (2000) Impact of Bacteria and Dosing Frequency on the Removal of Virus Within Intermittently Dosed Biological Filters. *The Small Flows Journal*, 1:1, 36-41.

Emerick, R.W., Loge, F.J., Ginn, T., and Darby, J. (2000) Modeling the Inactivation of Coliform Bacteria Associated with Particles. *Water Environment Research*, 72:4, 432-438.

Emerick, R.W., Loge, F.J., Tchobanoglous, G., and Darby, J. (1999) *Impact of Upstream Wastewater Treatment Process Type on Downstream UV Disinfection Performance*, Water Environment Research Foundation, Project 96-CTS-3.

Blatchley, E. R., Emerick, R. W., Hargy, T., Hoyer, O., Hultquist, R. H., Sakaji, R. H., Scheible, O. K., Schmelling, D. C., Soroushian, F., and Tchobanoglous, G., (2000), *Ultraviolet Disinfection Guidelines for Drinking Water and Water Reuse*, National Water Research Institute, American Water Works Association Research Foundation.

Loge, F. J., K. Bourgeois, R. W. Emerick, and J. L. Darby (2001) Variations in the Water Quality Parameters Influencing UV Disinfection Performance: Relative Impact of Filtration. *Journal of Environmental Engineering*, 127(9): 832-837.

**Sacramento Regional Wastewater Treatment Plant UV Disinfection Performance.** Investigated the impact of particle size distribution impacts on UV disinfection performance for Sacramento Regional Wastewater Treatment Plant. Research involved developing a new computer aided photographic method of determining the particle size distribution of wastewater.

**UV Equipment Validation Testing** on (1) the Trojan Technologies® Swift 4L12, (2) the Trojan Technologies® UV 3000+ (2) Trojan Technologies® UV 2000, and (3) Fisher Porter UV disinfection systems.

**United States Environmental Protection Agency, Biological Virus Removal Within Intermittently Dosed Fixed Growth Filters.** Project involved development of a biological virus degradation process for the production of unrestricted recycled water for on-site reuse.

**Water Environment Research Foundation (Project 96-CTS-3) Impact of Upstream Wastewater Treatment Process Type on Downstream UV Disinfection Performance.** Project involved determining wastewater treatment process impacts and developing a fundamental stochastic model describing the ability of UV disinfection to inactivate pathogens.

**Water Environment Research Foundation (Project No. 91-WWD-1) Comparison of UV Irradiation to Chlorination for Achieving Optimal UV Performance.** Project involved developing an empirical mathematical model for predicting UV disinfection performance.

**Caltrans New Stormwater Treatment Processes.** Investigated/developed new treatment processes for removing nitrogen and phosphorous from stormwater for Caltrans. Project involved development, construction, and operation of pilot treatment facilities treating highway runoff in the Lake Tahoe basin.

## **Wastewater Treatment**

### **City of Lincoln Wastewater Treatment and Reclamation Facility.**

Process Design Manager in charge of process development for a tertiary (Title 22 unrestricted reuse) wastewater treatment and reclamation facility for the City of Lincoln. This treatment facility is the first in Northern California to be designed specifically to comply with California Toxics Rule regulatory requirements (toxic contaminant limitations) and receiving water limits related to effluent dominated streams. The treatment process consists of a headworks, Kruger® nitrification/ denitrification, clarification, priority pollutant maturation ponds, dissolved air flotation algae removal, coagulation/flocculation, granular medium filtration, UV disinfection, and effluent reaeration.

### **City of Ceres, CA., Salt Accumulation Analysis.**

Project Manager/Engineer for a salt accumulation analysis related to land discharge of effluent for Ceres, CA. This analysis consisted of developing a groundwater hydraulic model for determining long-term salt impacts to groundwater related to a proposed groundwater replenishment project.

Loge, F. J., Emerick, R. W., Ginn, T. R., and Darby, J. L. (2001) Association of Coliform Bacteria with Wastewater Particles: Impact of Operational Parameters of the Activated Sludge Process. *Water Research*, 36(2002):41-48.

Swift, J., Emerick, R. W., Scheible, K., Soroushian, F., Putnam, L. R., and Sakaji, R. (2002) *Treat, Disinfect, Reuse*, Water Environment and Technology, Vol. 14, No. 11.

Emerick, R. W., Swift, J., Sakaji, R. (2003) *Treat, Disinfect, Reuse - Part II*. Water Environment and Technology, Vol. 15, No. 3.

**Proceedings/Presentations**

Emerick, R.W., Sundaram V., Enloe, J., and Shumaker, S.E. (2009) Pilot Testing MF-Ozone-BAC Process Train for Removal of EDCs, PPCPs, and Other Emerging Contaminants of Concern, 2009 AWWA Research Symposium, Austin, TX.

Sundaram V., Emerick, R.W., Borroum, Y. and Shumaker, S.E. (2008) Cost Effectiveness and Environmental Benefits of Combined Ozonation-UV System for Water Reclamation and Surface Water Discharge, Proceedings of the Water Environment Federation 81st Annual Technical Exhibition and Conference, Chicago, IL.

Emerick, R. W., and Darby, J. L. (1993) Ultraviolet Light Disinfection of Secondary Effluents: Predicting Performance based on Water Quality Parameters, *WEF Disinfection Spec. Conf. Proc.*, Whippany, NJ, pp. 175-186, May 23-25 (Invited Speaker).

Emerick, R.W., Loge, F.L., Darby, J. L., and Tchobanoglous, G., Proposed UV Disinfection Equipment Testing Protocol to Demonstrate Compliance with the California Reclamation Criteria, 1998 *Proceedings of the Water Reuse Annual Conference*, Monterey, CA, June 4-5, 1998 (Invited Speaker).

Loge, F. J., Emerick, R. W., Darby, J. L., and Tchobanoglous, G. (1998) Factors Influencing the Performance of a UV Disinfection System in Reclaimed Wastewater Effluent, *Proceedings of the Water Reuse Annual Conference*, Monterey, CA, June 1998.

Emerick, R.W., Loge, F.L., Darby, J. L., and Tchobanoglous, G., Impact of Particles with Embedded Coliform Bacteria on Ultraviolet Light Disinfection, Water Environment Federation 71<sup>th</sup> Annual Conference and Exposition, Orlando, FL, October 3-7, 1998 (Invited Speaker).

Tchobanoglous, G., Emerick, R.W., Loge, F., and Darby, J. (1998) Seeing the Light, Environmental Protection, August: 24-26.

Emerick, R.W., Darby, J., and Heath, M., Swaim, P., Jacangelo, J., Loge, F., Emerick, R., and Tchobanoglous, G. (1995) Comparative Costs of Chlorination/Dechlorination and UV Radiation, Proceedings of the Water Environment Federation Annual Conference, Miami, FL, October.

Emerick, R. W., Tchobanoglous, G., and Darby, J. L. (1997) Use of Sintered Glass as a Medium in Intermittently Dosed Wastewater Filters: Removal and Fate of Virus, *Proceedings of the Water Environment Federation 70<sup>th</sup> Annual Conference and Exposition*, 6: 1-8, Chicago, IL, October 18-22 (Invited Speaker)

Loge, F. J., Emerick, R. W., Williams, C., Kido, W., Tchobanoglous, G., and Darby J. L. (1997) Impact of Particle Associated Coliform on UV Disinfection Performance, *Proceedings of the Water Environment Federation 70<sup>th</sup> Annual Conference and Exposition*, 1: 271-276, Chicago, IL, October 18-22

Tchobanoglous, G., Loge, F., Emerick, R., and Darby J. L. Application of the WERF Model for Designing a UV System for Disinfecting Wastewater, UV Disinfection Workshop at the Water Environment Federation 70<sup>th</sup> Annual Conference and Exposition, Chicago, IL, October 18, 1997

Removal of Virus Within Intermittently Dosed Biological Filters, Water Reuse Foundation's Annual Water Reuse Research Conference, June 3-4, Monterey, CA (Invited Speaker).

Tchobanoglous, G., Emerick, R.W., Loge, F., and Darby, J. (1999) Recent Developments in Ultraviolet Disinfection, United States Environmental Protection Agency 6<sup>th</sup> National Drinking Water and Wastewater Treatment Technology Transfer Workshop, Kansas City, MO, August 2-4.

Emerick, R.W., Tchobanoglous, G. (1999) Secondary Effluent Compliance with Contemporary Effluent Limitations, California Water Environment Federation Northern Regional Training Conference, September 20-21, Monterey, California (Invited Speaker).

Emerick, R.W., Loge, C., Williams, C., and Darby, J. (1999) Modeling the Inactivation of Particle Associated Coliform Bacteria Exposed to UV Light, *Proceedings of the Water Environment Federation 72nd Annual Conference and Exposition*, New Orleans, LA (Invited Speaker).

Loge, F. J., Emerick, R. W., Tchobanoglous, G., and Darby, J. (1999) Design and Optimization of Upstream Treatment Processes to Improve the Performance of Ultraviolet Disinfection Facilities at Sacramento Regional Wastewater Treatment Plant. Publication of the Center For Environmental and Water Resources Engineering, UC Davis, No. 99-1, 1999.

Emerick, R.W., Soroshian, F., Tchobanoglous, G. (2000) Standardizing UV Equipment Performance Validation, Proceedings of UV 2000: A Technical Symposium, Jan 27-28, Costa Mesa, CA (Invited Speaker).

## Vijay Sundaram

Process Chemical Engineer

### Education

M.S., Environmental Engineering (Water Quality), University of Cincinnati, Cincinnati

B.Tech., Chemical Engineering, University of Madras, Chennai, India

### Presentations and Publications

Emerick, R.W., Sundaram V., Enloe, J, and Shumaker, S.E. (2009) Pilot Testing MF-Ozone-BAC Process Train for Removal of EDCs, PPCPs, and Other Emerging Contaminants of Concern, 2009 AWWA Research Symposium, Austin, TX.

Sundaram V., Emerick, R.W., Enloe, J, and Shumaker, S.E. (2008) Pilot Testing MF-Ozone-BAC Process Train for Removal of EDCs, PPCPs, and Other Emerging Contaminants of Concern, 2008 Emerging Contaminants Symposium, California Groundwater Resources Association, San Jose, CA.

Sundaram V. and Shumaker, S.E. (2008) Pilot Testing for Pharmaceutical Treatment, American Water Works Association CA/NV Section Fall Conference, Reno, NV.

Sundaram V., Emerick, R.W., Borroum, Y. and Shumaker, S.E. (2008) Cost Effectiveness and Environmental Benefits of Combined Ozonation-UV System for Water Reclamation and Surface Water Discharge, Proceedings of the Water Environment Federation 81st Annual Technical Exhibition and Conference, Chicago, IL.

Vijay has 5 years of water and wastewater research and design experience. He has two years of experience as an on-site contract research engineer at the United States Environmental Protection Agency's (U.S. EPA's) National Risk Management Research Laboratory (NRMRL). He specializes in organic and inorganic microcontaminant removal, and the design of physical-chemical and biological treatment processes including membrane filtration, ozonation, advanced oxidation, adsorption, and chlorination.

### Applied Research Experience

**MF-Ozone-BAC Pilot Testing at Reno-Stead Water Reclamation Facility, Reno, NV.** Process Engineer in charge of developing and implementing Membrane Filtration (MF)-Ozonation-Biological Activated Carbon (BAC) pilot testing at the Reno-Stead Water Reclamation Facility. The pilot testing is conducted to determine the effectiveness of MF-Ozone-BAC process train in removing over 300 Endocrine Disrupting Chemicals (EDCs), Pharmaceuticals and Personal Care Products (PPCPs), and other contaminants of concern. The effectiveness of BAC process in removing Biodegradable Dissolved Organic Carbon (BDOC) and producing an effluent suitable for groundwater recharge applications is being investigated.

As part of this work, Vijay performed technical evaluation and process optimization on Membrane Filtration, and Ozonation systems via an extensive literature review on advanced treatment processes, groundwater recharge regulations, and impacts of EDCs and PPCPs on the environment.

### **National Risk Management Laboratory, U.S. EPA, Cincinnati, OH.**

Investigated the effectiveness of sol-gel synthesized titanium dioxide nanoparticles in removing arsenic to a concentration of less than 10 µg/L. Provided site-specific technical support for U.S. EPA funded heavy metal treatment and acid mine drainage projects and field activities. Performed statistical validation of sulfate quantification methods used for analysis of acid mine drainage. Prepared a comparative evaluation of various process technologies for removal of heavy metals based on efficiency and cost.

### **Wastewater Treatment Research Laboratory, University of Cincinnati, Cincinnati, OH.**

Investigated the effectiveness of electrochemical oxidation treatment in removing colorants. Evaluated the performance of cation-exchange membranes in improving the efficiency and reducing power consumption. Evaluated the environmental impact of treated effluents using Microtox toxicity analysis.

**Presentations and  
Publications**

DiGiorgio J.B., Sundaram, V.  
(2008) Water Conditioning  
Technology, California Water  
Environment Association  
35th Annual Pretreatment,  
Pollution Prevention and  
Stormwater (P3S) Conference  
and Exhibition, Long Beach,  
CA.

Reisman, D.J., Sundaram, V., Al-  
Abed S.R., and Allen D.,  
(2007) Statistical Validation of  
Sulfate Quantification  
Methods used for Analysis of  
Acid Mine Drainage. *Talanta*,  
71:1, 303-311.

Jegadeesan, G., Sundaram, V.,  
Choi, H., Dionysiou, D.D.,  
and Al-Abed, S.R., (2006)  
Arsenic Removal using  
Titanium Dioxide  
Nanoparticles Synthesized  
with Sol-Gel Methods,  
Proceedings of the American  
Chemical Society 232nd  
Annual Conference, San  
Francisco, CA.

Al-Abed S.R., Reisman, D.J.,  
Sundaram, V., (2006)  
Measurement and  
Quantification of Sulfates in  
Mining Influenced Water,  
Hard Rock 2006, Tucson,  
AZ.

Sundaram, V., Kupferle, M.J.  
(2005) Electrolytic Treatment  
of Textile Wastewater:  
Effluent Toxicity Assessment  
and Implications, Proceedings  
of the Water Environment  
Federation 78th Annual  
Technical Exhibition and  
Conference (WEFTEC),  
Washington, DC.

Sundaram, V., Kupferle, M.J.  
(2005) Indirect  
Electrochemical Treatment of  
Textile Wastewater: Influence  
of Design and Operational  
Parameters on Color  
Removal. 2005 American  
Institute of Chemical  
Engineers National Meeting,  
Cincinnati, OH.

## Summary of Water Reuse Projects Specifically Involving CECs

### MF-Ozone-BAC Pilot Testing at the Reno-Stead Water Reclamation Facility

#### Project Members:

Robert W. Emerick Ph.D., P.E., Principal Investigator

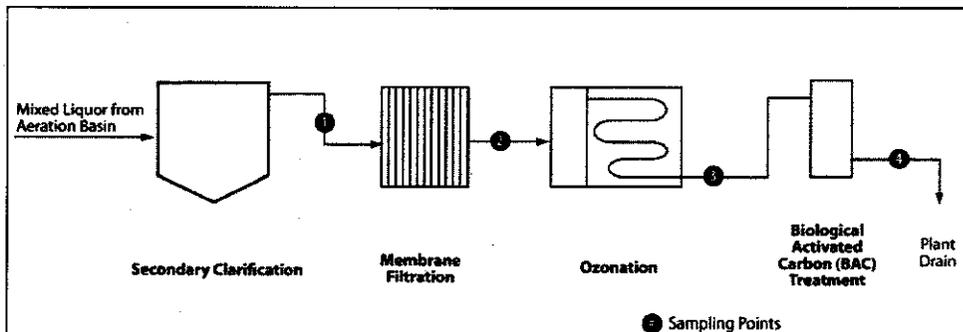
Vijay Sundaram, Lead Process Chemical Engineer

#### Description:

Subsurface storage of treated wastewater is a potentially viable means of effluent banking for subsequent reuse. Concerns with treated wastewater recharge include salinity built-up, EDCs, PPCPs, and other wastewater-derived organics. The MF-RO-UV-Peroxide process utilized for treatment of emerging contaminants is energy intensive, potentially increases effluent corrosivity, and generates a relatively large reject stream containing high concentrations of salts and other harmful contaminants that requires further treatment and disposal. The MF-Ozone-BAC process train is being pilot-tested on secondary effluent at the Reno-Stead Water Reclamation Facility (RSWRF), Reno, Nevada in an effort to develop an alternative treatment approach equivalent to or superior to MF-RO-UV-Peroxide in many reuse situations. MF-Ozone-BAC process consumes less power, does not generate a reject stream, and does not increase effluent corrosivity. Over 300 analytes are being quantified. Approximately 120 of these compounds are emerging contaminants as identified by the California Department of Public Health for effluent recharge of groundwater.

This comprehensive study presents the wastewater community with in-depth knowledge about an advanced process train which: 1) does not generate a reject stream; 2) does not cause disturbance to the ionic stability of the effluent; 3) reduces post-treatment biofilm growth potential; and 4) is sustainable: consumes less energy and requires less O&M effort than other alternatives. Some of the important aspects of this ongoing research pertinent to water reuse in California includes; 1) possible TOC interference with ozonation from the media used as part of microbial challenge testing; 2) accurate acclimation of BAC; 3) determining currently available most reliable commercial analytical labs and method for CEC quantification; 4) addressing difference between lab-scale and continuous flow pilot scale results; 5) development of multiple barrier approach for providing greater reliability and public acceptance; and 6) assessing all contaminants listed in CDPH draft groundwater recharge regulations.

#### Process Train:



**Multi-Barrier Treatment:**

Constituents	Treatment Process*				
	ASP	MF	Ozone	BAC	Final Disinfection
Nitrogen Compounds	✓	✓		? <sup>**</sup>	
Total Suspended Solids and Turbidity	✓	✓		?	
Pathogens (Coliforms)		✓	✓		✓
Total Metals	✓	✓		?	
Total Organic Carbon (TOC)	✓	✓	✓	✓	
Soluble Biodegradable Organic Matter (BOM)	✓			✓	
EDCs (Hormones)	✓	✓	✓	?	
PPCPs (Pharmaceuticals)	✓	✓	✓	?	
Taste, Odor and Color			✓	✓	
Reduction of THM Formation Potential	✓		✓	✓	
Reduction of Biofilm Growth Potential	✓			✓	

<sup>\*\*</sup>Results unknown from literature, but will be studied as part of this project.

**Side-by-Side Comparison of Advanced Treatment Process Train:**

Parameter	Treatment Process*	
	MF-RO-UV-Peroxide	MF-Ozone-BAC
Energy Use	Consumes 3-4 times more energy	Consumes less energy
Reject Stream	Generates reject that requires additional disposal steps	None
Sustainability	Maintenance intensive, and 10-20% loss of water resource	Highly sustainable
EDCs	Comparable	Comparable
PPCPs	Comparable	Comparable*
Salinity	Reduces salinity	Salinity unchanged
Effluent Corrosivity (leaching potential)	Increases the effluent corrosivity	Effluent corrosivity unchanged

\*Results unknown from literature for flame retardants, but will be studied as part of this project.

## **Washoe County Conceptual Level Regional Reclaimed Water Plan**

### **Project Members:**

Robert W. Emerick, Ph.D., P.E., Principal Investigator

John Enloe, P.E., Co-Principal Investigator

### **Description:**

Objectives addressed as part of the North Valleys Initiative include: 1) updating existing or establishing new reuse ordinances; 2) addressing public health protection responsibilities; 3) recommending and implementing new water rights policies, 4) obtaining local and State regulatory buy-in for expanded use of reclaimed water (residential irrigation/storage options/ASR); 5) recommending and implementing more consistent reclaimed water rate structures (connection and O&M fees); 6) addressing technical challenges (storage options, effluent management plans, cross-connection control, inspection, etc.); 7) recommending administrative roles (i.e., does each utility manage their own system or does one entity oversee the whole reclaimed system?); and 8) developing a community outreach program to gain broad support for the program.