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SUPERIOR COURT OF THE STATE OF CALIFORNIA

FOR THE COUNTY OF TULARE

CITY OF LOS ANGELES; COUNTY SANITATION DISTRICT NO. 2 OF LOS ANGELES COUNTY; ORANGE COUNTY SANITATION DISTRICT; RESPONSIBLE BIOSOLIDS MANAGEMENT, INC.; R&G FANUCCHI, INC.; SHAEN MAGAN, both individually and d/b/a HONEY BUCKET FARMS and TULE RANCH/MAGAN FARMS; WESTERN EXPRESS, INC.; SIERRA TRANSPORT, INC.; CALIFORNIA ASSOCIATION OF SANITATION AGENCIES,

Plaintiffs,

v.

COUNTY OF KERN; KERN COUNTY BOARD OF SUPERVISORS,

Defendants.

Case No. Civ. 242057

DECLARATION OF PROFESSOR IAN L. PEPPER, PH.D., SUPPORTING PLAINTIFFS' MOTION FOR PRELIMINARY INJUNCTION

Hearing: June 9, 2011
Dep't: 10
Hearing Judge: Hon. Lloyd L. Hicks
Action filed: January 26, 2011
Trial date: Not set

Declaration of Professor Ian L. Pepper, Ph.D.

I, Ian L. Pepper, declare as follows:

1. The following facts and opinions are true to my own personal knowledge and if called as a witness I could so testify.
2. I am a tenured professor in the Department of Soil, Water and Environmental Science of the College of Agriculture and Life Sciences of the University of Arizona in Tucson, Arizona. I am also Director of the Environmental Research Laboratory of the University of Arizona, where I maintain my office and laboratory, and I am Director of the University of Arizona National Science Foundation Water and Environmental Technology Center, the only such Center of its kind in the United States. I have taught and researched at the University of Arizona since 1977 and have been a full professor since 1988. I originally received a Ph.D in soil microbiology from Ohio State University in 1975.
3. My area of expertise is within the discipline of environmental microbiology, specifically evaluating what happens to chemical and microbial contaminants in soil, water, municipal waste, and air environments. I have been elected Fellow of: the American Society of Agronomy, the Soil Science Society of America, the American Academy of Microbiology, and the American Association for the Advancement of Science. I have also served on six National Academy of Sciences Committees including one on: "Earth Materials and Health," and another on "Biosolids Applied to Land: Advancing Standards and Practices." I have researched and published widely in the fields of environmental science, microbiology, and land application of biosolids, including 7 books, 58 book chapters and 138 peer reviewed articles. I have also undertaken numerous speaking engagements on land application of biosolids at national and international scientific and professional conferences.
4. I have studied land application of biosolids for over 35 years and published landmark papers on the risks from *Staphylococcus* aureus, bioaerosols, antibiotic resistant bacteria and endotoxin in sewage sludge. My research interest coincides with the expansion of biosolids recycling in the United States, and in particular the development of the Part 503 regulations by the United States

Environmental Protection Agency, which govern land application. I have conducted many research studies on biosolids and land application, with an emphasis on collecting data in the field from active land application sites. Much of this research has been at land application sites with arid and semi-arid climates and environments, similar to Kern County, California. My current Curriculum Vitae is attached to this Declaration.

5. My work has evaluated both the benefits and potential hazards of land application of biosolids. As discussed below, the benefits of land application include recycling primary and secondary plant nutrients, improving soil quality, and providing a safe and sustainable use for large quantities of solid residuals from wastewater treatment plants. I have studied potential hazards including the fate of trace amounts of certain chemicals potentially found in biosolids, including organics, inorganics, and metals. I also have studied the fate of biological components of biosolids, including human pathogenic (disease causing) microorganisms, which can include certain bacteria and viruses. In particular, these studies have looked at routes of exposure of chemical and biological contaminants via air, soil, and water, to off-site communities. These studies have resulted in 60 peer reviewed publications on biosolids and land application.

6. Some of my work since 2002 has included:

   a. Zerzghi, H., C.P. Gerba, and I.L. Pepper. (2010) Long-term effects of land application of Class B biosolids on soil chemical properties. *J. Res. Sci. Technol.* 7:51-61.
   b. Zerzghi, H., C.P. Gerba, J.P. Brooks, and I.L. Pepper. (2010) Long-term effects of land application of Class B biosolids on the soil microbial populations, pathogens and activity. *J. Environ. Qual.* 39:402-408.
   c. Zerzghi, H., J.P. Brooks, C.P. Gerba, and I.L. Pepper. (2010) Influence of long-term land application of Class B biosolids on soil bacterial diversity. *J. Appl. Microbiol.* 109:698-706.
   d. Pepper, I.L., J.P. Brooks, R.G. Sinclair, P.L. Gurian, and C.P. Gerba. (2010) Pathogens and indicators in United States Class B biosolids: National and historic distributions. *J. Environ. Qual.* 39:2185-2190.
   e. Gerba, C.P., N. Castro-del Campo, J.P. Brooks, and I.L. Pepper. (2008) Exposure and risk assessment of *Salmonella* in recycled residuals. *Wat. Sci. Technol.* 57:1061-1065.
   f. Tanner, B.D., J.P. Brooks, C.P. Gerba, C.N. Haas, K.L. Josephson, and I.L. Pepper. (2008) Estimated occupational risk from bioaerosols generated during land application of Class B biosolids. *J. Environ. Qual.* 37:2311-2321.
   g. Pepper, I.L., H. Zerzghi, J.P. Brooks, C.P. Gerba. (2008) Sustainability of land application of Class B biosolids. *J. Environ. Qual.* 37:58-67.
   h. Brooks, J.P., C.P. Gerba, and I.L. Pepper. (2007) Diversity of aerosolized bacteria during land application of biosolids. *J. Appl. Microbiol.* 103:1779-1790.
   i. Castro-del Campo, N., I.L. Pepper, and C.P. Gerba. (2007) Assessment of *Salmonella*typhimurium growth in Class A biosolids and soil/biosolid mixtures. *J. Res. Sci. & Technol.* 4:83-88.
   j. Brooks, J.P., P.A. Rusin, S.L. Maxwell, C. Rensing, C.P. Gerba, and I.L. Pepper. (2006)

k. Occurrence of antibiotic-resistant bacteria and endotoxin associated with the land application of biosolids. *Can. J. Microbiol.* 53:616-622.
l. Cheng, L., A.S. Chetochine, I.L. Pepper, and M.L. Brusseau. (2006) Influence of DOC on MS-2 bacteriophage transport in a sandy soil. *Water Air Soil Pollut.* 178:315-322.
m. Brooks, J.P., B.D. Tanner, C.P. Gerba, and I.L. Pepper. (2006) The measurement of aerosolized endotoxin from land application of Class B biosolids in Southeast Arizona. *Can. J. Microbiol*. 52:150–156.
n. Chetochine, A., M.L. Brusseau, C.P. Gerba, and I.L. Pepper. (2006). Leaching of phage from Class B biosolids and potential transport through soil. *Appl. Environ. Microbiol*. 72:665–671.
o. Pepper, I.L., J.P. Brooks, and C.P. Gerba. (2006) Pathogens in Biosolids. In: *Advances in Agronomy*. D.L. Sparks (ed.) Elsevier Science/Academic Press, San Diego, CA. pp. 1–41.
p. Brooks, J.P., B.D. Tanner, C.P. Gerba, D.N. Haas, and I.L. Pepper. (2005). Estimation of bioaerosol risk of infection to residents adjacent to a land applied biosolids site using an empirically derived transport model. *J. Appl. Microbiol*. 98: 397–405.
q. Tanner, B.D., J.P. Brooks, C.N. Haas, C.P. Gerba, and I.L. Pepper. (2005) Bioaerosol emission rate and plume characteristics during land application of liquid Class B biosolids. *Environ. Sci. & Technol.* 39:1584-1590.
r. Brooks, J.P., B.D. Tanner, K.L. Josephson, C.N. Haas, C.P. Gerba, and I.L. Pepper. (2005b). A National study on the residential impact of biological aerosols from the land application of biosolids. *J. Appl. Microbiol.* 99:310-322.
s. Zaleski, K.J., K.L. Josephson, C.P. Gerba, and I.L. Pepper. (2005). Potential regrowth and recolonization of *Salmonella* and indicators in biosolids and biosolid amended soil. *Appl. Environ. Microbiol.* 71:3701–3708.
t. Rusin, P., S. Maxwell, J. Brooks, C. Gerba, and I. Pepper. (2003) Evidence for the absence of *Staphylococcus aureus* in land applied biosolids. *Environ. Sci. Technol.* 37:4027–4030.

7. I originally provided a Declaration in 2006 on the environmental conditions related to biosolids recycling at Green Acres Farm in Kern County, California. My 2006 Declaration was prepared based on my knowledge and experience with land application of biosolids including peer reviewed literature; and on an extensive review of data and literature specific to Green Acres Farm in Kern County, California. This review included both summary reports and individual data. Green Acres Farm and the Los Angeles Bureau of Sanitation that generates the biosolids used at Green Acres have generated an unusually large amount of data regarding the quality and uses of biosolids, more than is required by applicable EPA, California and Kern County regulations. Documents that I reviewed included:

a. Land Application of Biosolids Summary Reports, prepared by RBM
b. Summary Field Reports, prepared by RBM
c. Cumulative Pollutant Summaries, prepared by RBM
d. Achieving Exceptional Quality Biosolids, prepared by City of Los Angeles, Department of Public Works, Bureau of Engineering and Bureau of Sanitation, re: Hyperion Treatment Plant and Terminal Island Treatment Plant
e. Biosolids Program Table of Sampling and Testing Requirements Overview under Federal Part 503 EPA Regulations and local Kern County requirements
f. 2001-2005 Annual Reports for Green Acres, prepared by RBM
g. Annual (December) Report for Assessment of Biosolids for Hyperion and Terminal Island Treatment Plants for 2001-2005
h. Monthly Progress Report: Biosolids Program Management, prepared by City of Los Angeles (March 2006)
i. Application of Biosolids Site Maintenance and Management Plan, Revised April 2006, prepared by RBM
j. 1996 NAS Report: *Use of Reclaimed Water and Sludge in Food Crop Production*
k. 2002 NAS Report: *Biosolids Applied to Land Advancing Standards and Practices*

These reports provide extensive data on the metal and microbiological content of the biosolids that have been land applied.

8. I also visited Green Acres Farm on August 24, 2006, where I observed the land application operations including the trucking, unloading, spreading and incorporation of biosolids. I traveled throughout the Farm and viewed fields in various stages of crop production and observed the irrigation system. I interviewed workers at Green Acres, including farmers, the land application contractor, and City of Los Angeles personnel who supervise operations and regulatory compliance. I was provided access to and reviewed work files, including work sheets for calculation of agronomic rates (the amount of biosolids that can be applied to a particular field).

9. Since that 2006 Declaration I have reviewed additional data and reports including:

a. City of Los Angeles Biosolids Environmental Management System Reports for 2007, 2008, and 2009.
b. Biosolids Annual Report for Hyperion Wastewater Treatment Plant for 2007, 2008, and 2009.
c. Biosolids Program Monthly Reports for July, August, and September 2010.
d. Responsible Biosolids Management Reports on Green Acres Farm for 2007, 2008, 2009, and 2010.

In addition, I interviewed the farm manager, Steve Stockton of RBM, Inc. on January 4, 2011.

10. Since 2006, two beneficial changes have been made at Green Acres Farm: first, biosolids are now disked into the soil rather than ploughed, which mixes the biosolids more efficiently into the

soil; and second, biosolids are now usually incorporated into the soil within 45 minutes of application, and within the 3 hour requirement of new air quality regulations. Green Acres Farm also has maintained a strong compliance record for all regulations governing land application. My review of the data did not reveal any violations of EPA regulations governing land application.

11. I have been asked to provide a Declaration that states my scientific opinions regarding the environmental and public health impacts of allowing Green Acres Farm to continue to operate while this case is heard. I understand that this Declaration will be used in support of Plaintiffs' Motion for Preliminary Injunction in which the City of Los Angeles and other Plaintiffs will ask that the Kern County Ban on land application be stayed to allow Green Acres Farm to continue to land apply biosolids while this case is considered.

12. Based on current data and practices at the farm, my research on land application, and the peer-reviewed literature in the field, my opinion is that land application of biosolids at Green Acres Farm is in accord with best management practices, presents negligible environmental or public health risks, and benefits the soil and vegetation at the Farm. This is consistent with my 2006 opinion that the Farm was well run and environmentally beneficial, and the data since 2006 has supported that opinion.

13. My opinions on the operations and effects of land application of biosolids at Green Acres Farm in Kern County are summarized below:

    a. Green Acres Farm workers efficiently and quickly land apply biosolids and incorporate them into the soil within 3 hours, which is important for reducing any risk of the spread of pathogens and for reducing odors. Tractor trailers loaded with biosolids from the City of Los Angeles enter from the highway directly to the fields and promptly begin land application.

    b. Based on multiple factors, Green Acres Farm is a good location for the land application of biosolids. These factors include distance from the nearest urban center, dry and hot climate, soil type, subsurface hydrology and depth to groundwater. There are no abutting residential dwellings that could be exposed to wind-blown contaminants from the farm.

c. Soils at Green Acres consist of the Cajon, Chino, Traver and Pond soil series. These soils are moderately to heavy-textured and are generally alkaline. While not ideal for maximizing crop production, the clay content and high pH of the soil help reduce mobilization and transport of trace metals and organic contaminants that may be introduced into the soil by biosolids. Nitrate transport would be limited to the depth of wetting provided by irrigation and the limited rainfall that occurs in this arid climate. In addition, a hard pan located two to four feet beneath the soil surface occurs beneath much of the site, which further impedes leaching of nitrate or other contaminants that might become mobile. Finally, the depth to groundwater is great, more than 70-100 feet below the ground surface. Therefore risks to the community from groundwater contamination is minimal.

d. The nature of the biosolids applied at Green Acres -- Class A "Exceptional Quality (EQ)" under EPA Part 503 standards -- ensures that metal concentrations are low, and pathogens non-detectable. The data collected by City of Los Angeles demonstrate that metal concentrations in the biosolids are well below EPA EQ standards, and data on cumulative metal build-up in the soils at Green Acres are well within Part 503 limits and show a high level of safety. Title 22 organics such as PCB arochlors and dioxin, are also monitored quarterly to ensure low concentrations in biosolids. The Class A, EQ biosolids also ensure that risks to local communities from aerosolized pathogens (bacteria or viruses that become airborne) are negligible. My extensive work on bioaerosols at many land application sites has demonstrated a low potential for aerosolization of pathogens, even at sites that use Class B biosolids that contain measurable amounts of pathogens.

14. Based on the above data and observations, and my experience with hundreds of land application sites, including many similar to Green Acres, I conclude that if land application of Class A EQ biosolids at Green Acres Farm continues during the period of an injunction there is negligible risk to human health or the environment. In fact, the use of biosolids over the last 16 years at Green Acres has plainly improved the soil quality and the farm is producing good crops without threatening human health or the environment.

15. My conclusions that Green Acres Farm is a safe and sustainable land application site is consistent with both my prior work and the considerable scientific literature on biosolids over the last few decades. Much of this literature was surveyed, analyzed, and discussed in two Committees of the National Academy of Sciences that produced reports in 1996 and 2002. I served on the 2002 Committee and am familiar with its work and report, *Biosolids Applied to Land: Advancing Standards and Practices*. The task of this committee was to re-evaluate the scientific basis of the Part 503 rule specifically with respect to human health protection. The first "overarching finding" of the Committee was that "there is no evidence that the Part 503 rule has failed to protect public health." However the committee also stated that "additional work is

needed," and identified many areas to improve the data and understanding of biosolids and their constituents and land application. I supported the Committee's call for additional research to further strengthen and advance the science underlying federal biosolids regulations. In fact I have been a leader in developing additional data since the report was issued and I have been engaged in researching many of the areas identified by the Committee in 2002. This includes several recent studies, and specifically one study that evaluated 20 years of continuous land application resulted in the publication: "Sustainability of land application of Class B biosolids" (J. Environ. Qual. 37:58-67 (2008)). This study concluded that, if the Part 503 EPA regulations were followed, then land application was sustainable with minimal risk to human health. Additional papers from this study showed that:

a. pathogens did not persist in soil, even after 20 years of land application
b. endocrine disruptors such as 4 nonylphenol and estrone were rapidly degraded in soil
c. beneficial microbial activity and diversity increased in soils receiving the biosolids
d. beneficial inputs of essential plant nutrients resulted in increased soil organic matter and carbon sequestration improving soil health (J. Environ. Qual. 39:1-7; J. Res. Sci. Technol. 7:51-60; J. Appl. Microbiol. 109:698-706)

16. The data, practices and environmental conditions at Green Acres Farm are consistent with and similar to the long-term biosolids farms that were studied and reported on in these peer-reviewed studies. Occasionally, allegations have been made or hypotheses offered that certain chemical and biological contaminants might exist in biosolids and pose a significant hazard to human health or the environment. Data collected in many studies in which I have participated and other published data do not support these allegations. Examples are illustrated below.

a. Hypothesis: The "Time Bomb Theory" propagated the idea that metals from land application accumulate in soils, and following biodegradation of soil organic matter, result in a flood of bioavailable toxic metals.
   Fact: Metals attach firmly to mineral elements of the soil through sorption mechanisms and in fact become less bioavailable with time. *See,* Rufus Chaney, *Trace Metal Movement: Soil-Plant Systems and Bioavailability of Biosolids-Applied Metals in Sewage Sludge: Land Utilization and the Environment* (1994).

b. Hypothesis: *Staphylococcus aureus* is an active biological agent in biosolids that results in community infections following land application.
Fact: *S. aureus* does not survive wastewater treatment and is not found in biosolids (Rusin et al., 2003. *Env. Sci. Technol.* **37**:4027–4030).

c. Hypothesis: Human pathogens are emitted into the air and then transported off-site and infect residents in local communities.
Fact: Pathogens mostly stay attached to biosolids and those emitted into the air are generally inactivated so that the risk to residents is negligible. (Brooks et al., 2005. *J. Appl. Microbiol.* **98**:397–405).

d. Hypothesis: Endotoxin emitted into the air from land application of biosolids poses a risk to human health.
Fact: The majority of endotoxin emitted into the air during land application are soilborne organisms that would be emitted by tractor operations with or without biosolids (Brooks et al., 2006. *Can. J. Microbiol.* **52**:150–156).

e. Hypothesis: Neighbors of land application sites have suffered injuries, illness or even death caused by the biosolids.
Fact: Our NAS Committee reviewed several of these allegations and found no data or corroborated evidence linking injuries to proximity to land application sites, and no plausible hypothesis has been published that supports the necessary elements of scientific causation. EPA also reviewed many of these allegations and came to the same conclusion as the NAS Committee.

17. Farms that use biosolids as a fertilizer and soil conditioner can sometimes be unpopular in their communities due to the public's lack of accurate information regarding biosolids and superficial speculation regarding sewage sludge. The work of thousands of scientists, wastewater treatment engineers, and other professionals in biosolids and agriculture, however, has established rigorous standards for land application that ensure safety.

18. My observations at Green Acres Farm and my review of the literature demonstrate that land application at this site poses negligible risk to the neighboring communities. Moreover, land application at Green Acres is likely to be sustainable and actually improve soil due to enhanced total soil organic carbon concentrations, which result in superior soil physical properties including soil structure, and enhanced populations of beneficial soil microorganisms. Such benefits from long-term land application of biosolids were observed and documented in our twenty year old land application study at the University of Arizona. Therefore, in summary, I find the Green Acres land application operation to be a sustainable ecosystem that actually benefits the Kern County environment.

I declare under penalty of perjury pursuant to the laws of the State of California that the foregoing facts are true and correct.

Executed this 20th day of April 2011 in Tucson, Arizona.

Ian L. Pepper

EXHIBIT 1

CURRICULUM VITA OF

Ian L. Pepper, Director
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Environmental Research Laboratory
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Email: ipepper@ag.arizona.edu
Ph: (520) 626–3328

DATE OF BIRTH October 5, 1946

PLACE OF BIRTH Tonypandy, Wales, United Kingdom

EDUCATION

1975 Ph.D. in Soil Microbiology, The Ohio State University, USA
1972 M.S. in Soil Biochemistry, The Ohio State University, USA
1970 B.Sc. in Chemistry, University of Birmingham, Great Britain

MAJOR RESEARCH INTERESTS

Environmental microbiologist specializing in the molecular ecology of soils, potable water and municipal wastes.

- Water quality and "smart water distribution systems"
- Fate and transport of microbial pathogens in soil, air, and water
- Land application of biosolids

PROFESSIONAL EXPERIENCE

2009–Present	Director, National Science Foundation Water and Environmental Technology Center, The University of Arizona
2008–Present	Professor and Research Scientist, Community, Environment and Policy, College of Public Health, The University of Arizona
2007–Present	Professor and Research Scientist, Department of Agricultural and Biosystems Engineering, The University of Arizona
1999–2009	Director, National Science Foundation Water Quality Center, The University of Arizona.
2001–Present	Director, Environmental Research Laboratory, The University of Arizona
1993–1998	Chair, Undergraduate Program in Environmental Science, Department of Soil, Water and Environmental Science, The University of Arizona.
1993–Present	Investigator, Center for Toxicology, The University of Arizona.
1988–Present	Professor and Research Scientist, Departments of Soil, Water and Environmental Science, and Microbiology and Immunology, The University of Arizona.
1981–1988	Associate Professor and Associate Research Scientist, Departments of Soil and Water Science, and Microbiology, The University of Arizona.
1977–1981	Assistant Professor and Assistant Research Scientist, Department of Soil, Water and Engineering, The University of Arizona.
1975–1976	Post-Doctoral Research Associate, Washington State University.

HONORS AND AWARDS—NATIONAL AND INTERNATIONAL

2011–2012	Chair **Committee on Challenges and Opportunities for International Science at the U.S. Geological Survey**
2010	**Environmental Quality Research Award**, American Society of Agronomy
2010–2014	Chair **Division 4.2 Soils, Food Security and Human Health**, International Union of Soil Science
2009–2011	Invited Member **National Academy of Sciences Committee: Research Associateship Program Review Committee**
2009	**Quentin Mees Outstanding Research Award in Water Science,** Arizona Water Association
2009–2014	Awarded **National Science Foundation Water and Environmental Technology Center**
2007–2010	Invited member **Committee on Environmental Microbiology of the Public and Scientific Affairs Board (PSAB)**, Second Term
2006	Fellow, **American Association for the Advancement of Science**
2005	Awarded **EPA/Department of Homeland Security Center for Advancement of Microbial Risk Assessment (CAMRA)** (Co-investigator)
2004–2009	Awarded **National Science Foundation Center on Water Quality** *(renewal)*
2004–2005	Invited member **National Academy of Sciences Committee: Research Priorities for Earth Science and Public Health**
2001–2007	Invited member **Committee on Environmental Microbiology 'American Society for Microbiology'**
2004–2006	Invited member **National Academy of Sciences Committee: U.S. National Committee for Soil Science (USNC/SS)** (Second Term)
2001–2003	Invited member **National Academy of Sciences Committee: U.S. National Committee for Soil Science (USNC/SS)** (First Term)
2001–2002	Invited member **National Academy of Sciences Committee: National Research Council Committee on Toxicants and Pathogens in Biosolids**
2001	Invited member **National Science Foundation United States/Egypt Workshop on Microbial Ecology**
2000	Member **Environmental Protection Agency, FIFRA Science and Advisory Panel**
2000	Invited member of **National Aeronautics and Space Administration (NASA) Committee on Development of Handling Protocols for Environmental Samples from Mars**
1999–2004	Awarded **National Science Foundation Center on Water Quality**
1994	Fellow, **Soil Science Society of America**
1994	Fellow, **American Society of Agronomy**
1994	Chair, **Soil Biology and Biochemistry Division of Soil Science Society of America**
1992	Fellow, **American Academy of Microbiology**
1983	**CIBA-GEIGY Award**—a National award for excellence in research and teaching

HONORS AND AWARDS—STATE AND UNIVERSITY

1997–2001	Member Faculty Senate, The University of Arizona
1994	Researcher of the Year, College of Agriculture, The University of Arizona
1992	Outstanding Research Team Award, College of Agriculture, The University of Arizona
1986–1992	Invited member of the Arizona State Advisory Committee for Best Management Practices
1979	Gamma Sigma Delta Junior Faculty Award. An award for excellence in agricultural science

FUNDED GRANTS

2010	134,000	National Science Foundation, Water and Environmental Technology Center Private Sector Funds
2009	600,000	Water Environment Research Foundation
2009	300,000	Water Reuse Foundation
2009	1,240,000	National Science Foundation, Water and Environmental Technology Center
2009	226,000	National Science Foundation, Water and Environmental Technology Center Private Sector Funds
2008	258,995	National Science Foundation, Water Quality Center Private Sector Funds
2007	335,738	National Science Foundation, Water Quality Center Private Sector Funds
2006	662,994	National Science Foundation, Water Quality Center Private Sector Funds
2005	10,000,000	EPA/Department of Homeland Security Center for Advancement of Microbial Risk Assessment (CAMRA) (Co-Investigator)
2005	462,991	National Science Foundation Water Quality Center Private Sector Funds
2004	602,742	National Science Foundation Water Quality Center Private Sector Funds
2004	20,000	Research Experience for Teachers, National Science Foundation. Principal Investigator
2004	150,000	Regulatory Networks of Halophiles Utilized for Remediation of Co-Contaminated Industrial Effluents. National Science Foundation Supplemental Funding, TIE Project with Questor, Queens University, Belfast Northern Ireland. Co-principal Investigator.
2004	265,000	An I/UCRC for Water Quality National Science Foundation (5-year *renewal*). National Science Foundation, The University of Arizona. Principal Investigator.
2003	433,229	National Science Foundation Water Quality Center Private Sector Funds
2003	18,000	Research Experience for Undergraduates, National Science Foundation. Principal Investigator.
2002	466,172	National Science Foundation Water Quality Center Private Sector Funds
2001	180,000	Regulatory Networks of Halophiles Utilized for Remediation of Co-Contaminated Industrial Effluents. National Science Foundation Supplemental Funding, TIE Project with Questor, Queens University, Belfast Northern Ireland. Co-principal Investigator.
2001	24,000	Cry Me A River—Arizona's Riparian Areas in Danger. National Science Foundation. Principal Investigator.
2001	386,445	National Science Foundation Water Quality Center Private Sector Funds
2000	189,651	National Science Foundation Water Quality Center Private Sector Funds
2000	500,000	Gene Enhanced Remediation of Co-Contaminated Soils. NIEHS. Principal Investigator.
1999	135,120	National Science Foundation Water Quality Center Private Sector Funds
1999	350,000	An I/UCRC for Water Quality National Science Foundation. National Science Foundation, The University of Arizona. Principal Investigator.
1998	158,088	National Science Foundation Water Quality Center Private Sector Funds
1998	75,000	EPA STAR Fellowship for Scot Dowd. Co-Principal Investigator.
1997	10,000	A Planning Grant for a National Science Foundation Industry/University Cooperative Research Center. National Science Foundation. Principal Investigator.
1997	469,913	Role of Metal Bioavailability in *In Situ* Bioremediation of Metal and Organic Co-Contaminated Sites. Department of Energy. Co-Principal Investigator.
1997	228,750	PCR Based Detection of Cytopathogenic and Noncytopathogenic Viruses in Water. Environmental Protection Agency. Principal Investigator.
1997	53,000	Agricultural Sludge Utilization. Pima County. Principal Investigator.
1996	75,000	EPA STAR Fellowship for Timberley Roane. Co-Principal Investigator.

1996	191,896	Rapid PCR Based Monitoring of Infectious Enteroviruses in Drinking Water. American Water Works Association Research Foundation. Principal Investigator.
1996	124,810	Characterization of the Microflora of Households. Lysol Products. Principal Investigator.
1995	52,000	Agricultural Sludge Utilization. Pima County. Principal Investigator.
1994	769,620	Biodegradation Within Metal/Organic Contaminated Soils. NIEHS. Principal Investigator.
1994	350,000	Mamala Bay Hawaii—Detection of Pathogens in Marine Waters. Mamala Bay Research Commission. Co-Principal Investigator.
1994	118,415	Characterization of the Microflora of Households. Lysol Products. Principal Investigator.
1994	108,000	National Needs Graduate Fellowships in Water Sciences. Principal Investigator.
1994	31,000	Agricultural Sludge Utilization. Pima County. Principal Investigator.
1993	59,685	Agricultural Sludge Reclamation. Pima County. Principal Investigator.
1993	54,839	Use of PCR to Improve Ultrapure Water Testing in the Semi-Conductor Industry Center for Microcontamination. University of Arizona. Principal Investigator.
1992	51,931	Use of PCR to Improve Ultrapure Water Testing in the Semi-Conductor Industry Center for Microcontamination. University of Arizona. Principal Investigator.
1992	52,000	Agricultural Sludge Utilization. Pima County. Principal Investigator.
1991	325,437	Gene Transfer in Soils. NIEHS. Principal Investigator.
1991	42,500	Agricultural Sludge Utilization. Pima County. Principal Investigator.
1991	132,000	Health Risks Associated with Bacterial and Viral Pathogens in Groundwater. Arizona Disease Control Research Commission. Principal Investigator.
1990	92,166	Agricultural Sludge Utilization. Pima County. Co-Principal Investigator.
1990	79,516	Molecular Methods for Evaluation of Microbial Quality of Groundwater. USDA. Principal Investigator.
1989	180,000	Gene Probe Detection of Pathogens in Sewage Sludge. USGS. Principal Investigator.
1988	116,000	Agricultural Sludge Utilization—Evaluation of Pathogens. Pima County. Co-Principal Investigator.
1987	115,000	Agricultural Utilization of Sewage Sludge. Pima County. Co-Principal Investigator.
1986	105,000	Agricultural Sludge Reclamation. Pima County. Co-Principal Investigator.
1985	204,469	Use of Recombinant DNA Techniques to Improve the Competitiveness of Bean Rhizobia. AID. Principal Investigator.
1985	102,311	Agricultural Utilization of Municipal Sewage Sludge. Pima County. Co-Principal Investigator.
1985	17,200	Biological Control of Cotton Seedling Disease by Fluorescent Pseudomonads. Monsanto. Principal Investigator.
1984	15,000	Optimization of Inoculation Response by *Leucaena Leucocephala* in Veracruz Mexico. AID. Principal Investigator.
1982	10,572	Use of Zeolite as a Medium for Turfgrass Growth. Anaconda Mining. Principal Investigator.
1981	21,000	Reclamation of Wastewater by a Zeolite-Turfgrass Filter. Anaconda Mining. Principal Investigator.
1981	87,982	Isolation and Evaluation of Inoculants for Woody Legumes in Veracruz, Mexico. AID. Principal Investigator.
1979	79,500	Isolation of New Nitrogen Fixing Organisms from Desert Legumes. USDA. Principal Investigator.

1978	105,397	Water Reclamation by Use of Soil Turfgrass Filters. Arizona Water Resources. Principal Investigator.
1977	91,219	Water Requirements for Urban Lawns. Arizona Water Resources. Co-Principal Investigator.
1977	45,000	Nitrogen Fixation Efficiency of Cowpeas and Mungbeans in Saline Alkaline Soils. AID. Co-Principal Investigator.

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1985 Shoushtari, N.H. and I.L. Pepper. Mesquite Rhizobia Isolated from the Sonoran Desert. I. Physiology and Effectiveness. Soil Biol. Biochem. 17:797–802.

1984 Kneebone, W.R. and I.L. Pepper. Luxury Water Use by Bermudagrass. Agron. J. 76:999–1002.

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1984 Babiker, H. and I.L. Pepper. Microbial Production of Ethylene in Desert Soils. Soil Biol. and Biochem. 16:559–564.

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1982 Kneebone, W.R. and I.L. Pepper. Consumptive Water Use by Sub-Irrigated Turfgrasses Under Desert Conditions. Agron. J. 74:419–423.

1982 Borrelli, J., L.O. Pochop, I.L. Pepper, W.R. Kneebone, R.E. Danielson, W.E. Hart and V.B. Younger. Calibrations for Blaney Criddle Coefficients for Western Turfgrasses. J. Irrig. Drainage Div., ASCE 107:333–341.

1981 Vigue, G.T., I.L. Pepper and D.F. Bezdicek. Effects of Cadmium on Nitrogen Fixation by Field Beans. J. Environ. Qual. 10:87–89.

1981 Pepper, I.L., E.L. Anderson, W.R. Kneebone and R.J. Drake. Reclamation of Wastewater by Means of a Soil-Turf Filter. II. Removal of Phosphorus, Boron, Sodium and Chlorine. J. Water Pollut. Control Fed. 53:1408–1412.

1981 Anderson, E.L., I.L. Pepper and W.R. Kneebone. Reclamation of Wastewater by Means of a Soil-Turf Filter. I. Nitrogen Removal J. Water Pollut. Control Fed. 53:1402–1407.

1980 Drake, R.J., I.L. Pepper, G.V. Johnson and W.R. Kneebone. Design and Testing of a New Microlysimeter for Leaching Studies. Agron. J. 72:397–398.

1978 Pepper, I.L. and R.H. Miller. Comparison of the Oxidation of Thiosulfate and Elemental Sulfur by Two Heterotrophic Bacteria and *Thiobacillus thiooxidans*. Soil Science 126:9–14.

1976 Pepper, I.L. and R.H. Miller. Microbial Inorganic Polyphosphates: Factors Influencing their Accumulation in Soil. Soil Sci. Soc. Am. J. 40:872–875.

Books

2008 Maier, R.M., I.L. Pepper, and C.P. Gerba. A Textbook of Environmental Microbiology, 2nd Edition. Elsevier Science, San Diego, CA.

2006 Pepper, I.L., C.P. Gerba and M.L. Brusseau. Environmental and Pollution Science, 2nd Edition. Elsevier Science/Academic Press. San Diego, CA.

2004 Pepper, I.L. and C.P. Gerba. Environmental Microbiology: A Laboratory Manual, 2nd Edition. Elsevier Science/Academic Press. San Diego, CA.

2004 Artiola, J.F., M.L. Brusseau, and I.L. Pepper. Environmental Monitoring and Characterization. Academic Press. San Diego, CA.

2000 Maier, R.M., I.L. Pepper, and C.P. Gerba. A Textbook of Environmental Microbiology. Academic Press. San Diego, CA.

1996 Pepper, I.L., C.P. Gerba, and M.L. Brusseau. Pollution Science. Academic Press. San Diego, CA.

1995 Pepper, I.L., C.P. Gerba, and J.W. Brendecke. Environmental Microbiology: A Laboratory Manual. Academic Press. San Diego, CA.

Chapters

2008 Maier, R.M., I.L. Pepper, and C.P. Gerba. Introduction to Environmental Microbiology. *In* Environmental Microbiology, 2nd Edition. Elsevier Science, San Diego, CA. pp. 3–7.

2008 Roane, T.M., R.M. Maier, and I.L. Pepper. Microorganisms. *In* Environmental Microbiology, 2nd Edition. Elsevier Science, San Diego, CA. pp. 10–35.

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2008 Pepper, I.L. and S.E. Dowd. Aeromicrobiology. *In* Environmental Microbiology, 2nd Edition. Elsevier Science, San Diego, CA. pp. 83–102.

2008 Pepper, I.L., C.P. Gerba, and R.M. Maier. Environmental Sample Collection and Processing. *In* Environmental Microbiology, 2nd Edition. Elsevier Science, San Diego, CA. pp. 137–155.

2008 Roane, T.M., I.L. Pepper, and R.M. Maier. Microscopic Techniques. *In* Environmental Microbiology, 2nd Edition. Elsevier Science, San Diego, CA. pp. 157–171.

2008 Gerba, C.P. and I.L. Pepper. Cultural Methods. *In* Environmental Microbiology, 2nd Edition. Elsevier Science, San Diego, CA. pp. 173–189.

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2008 Newby, D.T., I.L. Pepper, and R.M. Maier. Microbial Transport. *In* Environmental Microbiology, 2nd Edition. Elsevier Science, San Diego, CA. pp. 367–385.

2008 Roane, T.M., C. Rensing, I.L. Pepper, and R.M. Maier. Microorganisms and Metal Pollutants. *In* Environmental Microbiology, 2nd Edition. Elsevier Science, San Diego, CA. pp. 427–448.

2008 Gerba, C.P. and I.L. Pepper. Wastewater Treatment and Biosolids Reuse. *In* Environmental Microbiology, 2nd Edition. Elsevier Science, San Diego, CA. pp. 509–536.

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2008 Pepper, I.L., C.Y. Choi, and C.P. Gerba. Microorganisms and Bioterrorism. *In* Environmental Microbiology, 2nd Edition. Elsevier Science, San Diego, CA. pp. 565–574.

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2006 Pepper, I.L. and M.L. Brusseau. Physical-Chemical Characteristics of Soils and the Subsurface. *In* Environmental and Pollution Science, 2nd Edition. Elsevier Science/Academic Press, San Diego, CA. pp. 13–23.

2006 Pepper, I.L. and K.L. Josephson. Biotic Characteristics of the Environment. *In* Environmental and Pollution Science, 2nd Edition. Elsevier Science/Academic Press, San Diego, CA. pp. 58–77.

2006 Walworth, J. and I.L. Pepper. Physical Contaminants. *In* Environmental and Pollution Science, 2nd Edition. Elsevier Science/Academic Press, San Diego, CA. pp. 123–131.

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2006 Glenn, E.P., J. Waugh and I.L. Pepper. Ecosystem Restoration and Land Reclamation. *In* Environmental and Pollution Science, 2nd Edition. Elsevier Science/Academic Press, San Diego, CA. pp. 334–348.

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2004 Gerhart, V.J., W.J. Waugh, E.P. Glenn, and I.L. Pepper. Ecological Restoration. *In* Environmental Monitoring and Characterization. Elsevier Science/Academic Press, San Diego, CA. pp. 357–375.

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2000 Maier, R.M., I.L. Pepper, and C.P. Gerba (eds). Introduction to Environmental Science. *In* Environmental Microbiology. Academic Press. San Diego, CA. pp. 1–6.

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2000 Pepper, I.L. Beneficial and Pathogenic Microbes in Agriculture. *In* Environmental Microbiology. R.M. Maier, I.L. Pepper, and C.P. Gerba (eds), Academic Press. San Diego, CA. pp. 425–446.

1998 Burr, M.D. and I.L. Pepper. Characterization of Bacteria by DNA Fingerprinting. *In* Microbial Characterization of Aquifers. S.D. Pillai (ed.), Academic Press, San Diego, CA. pp. 79–94.

1998 Pepper, I.L. and K.L. Josephson. Molecular Ecology of Soil. *In* Soil Microbiology: Environmental and Agricultural Perspectives. D. Sylvia, J. Fuhrman, D. Hartel and D. Zuberer (eds.), Marcel Dekker, New York. pp. 168–186.

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1996 Pepper, I.L. The Interdisciplinary Role of Soil Science within the University Environmental Science Arena. *In* The Role of Soil Science in Interdisciplinary Research. R.J. Wagonet and J. Bourma (eds.), SSSA Special Publications, Madison, Wisconsin. pp 75–87.

1996 Pepper, I.L., T.M. Straub, and C.P. Gerba. Detection of Microorganisms in Soils and Sludges. *In* Nucleic Acid Amplification Methods for the Analysis of Environmental Samples. G.A. Toranzos (ed.) Technomic Publ. Lancaster, PA. pp 95–111.

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1996 Pepper, I.L. Abiotic Characteristics of Soil. *In* Pollution Science. I.L. Pepper, C.P. Gerba and M.L. Brusseau (eds.), Academic Press, San Diego, CA pp 9–18.

1996 Brendecke, J.W. and I.L. Pepper. The Extent of Global Pollution. *In* Pollution Science. I.L. Pepper, C.P. Gerba and M.L. Brusseau (eds.), Academic Press, San Diego, CA pp 3–8.

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1994 Pepper, I.L. Plasmid Profiles. *In* Methods of Soil Analysis, Part 2—Microbiological and Biochemical Properties. ASA, CSSA, SSSA, Madison, WI., pp 635–645.

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1993 Pepper, I.L. and C.F. Mancino. Irrigation of Turfgrass with Effluent Water. *In* Handbook of Crop Stress. M. Pessarakli. (ed.), Marcel Dekker, Inc., N.Y., N.Y. pp 623–642.

1991 Pepper, I.L. Physiological Adaptation of Rhizobia to Improve Nitrogen Fixation in Desert Environments. *In* Desert Development Part 1: Desert Agriculture, Ecology and Biology. A. Bishay and H. Dregne (eds.), Harwood Academic Publishers, New York, NY, pp. 293–305.

1991 Pepper, I.L. and R.P. Upchurch. Nitrogen Fixation by Desert Legumes Associated with Rhizobia. *In* Semiarid Lands and Deserts: Soil Resource and Reclamation. J. Skujins (ed.), Marcel Dekker, Inc., NY, NY, pp. 443–467.

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1990 Pepper, I.L. and D.F. Bezdicek. Root Microbial Interactions and Rhizosphere Nutrient Dynamics. *In* Crops as Enhancers of Nutrient Use. V.C. Baligar and R.R. Duncan (eds.), Academic Press, Inc. pp 375–410.

BOARD OF DIRECTORS

2004 Invited member Board of Directors, Tohono Chul Park

2001 Invited member Board of Directors, Tucson Regional Water Council

PROFESSIONAL SOCIETY MEMBERSHIPS

American Academy of Microbiology
American Association for the Advancement of Science
American Society of Agronomy
American Society for Microbiology
Gamma Sigma Delta
International Water Association
Soil Science Society of America
Water Environment Federation

INTERNATIONAL EXPERIENCE

2007 Workshop on Potable Water Distribution Systems, Paris, France

2004 10th International Symposium on Microbial Ecology (ISME), Cancun, Mexico.

2000 Invited participant to workshop on Molecular Detection of Pathogens in Guatemala City, Guatemala.

1999 Invited participant for Memorandum of Agreement between University of Sonora, Mexico and University of Arizona.

1999 Invited United Nations Consultant for 2 week Workshop on Polluted Soils in Bucharest Romania.

1998 Invited participant for Memorandum of Agreement between Vietnam Ministry of Education and University of Arizona.

1997 Invited participant to workshop on Environmental Microbiology in Panama City, Panama.

1994 Invited participant to workshop on Molecular Detection of Pathogens in Sau Paulo, Brazil.
1993 Invited participant to workshop on Molecular Detection of Pathogens, Buenos Aires, Argentina.
1987 Invited participant to "Maxi-Linkage Program" between the University of Arizona and the American University of Cairo.
1985 Invited participant to workshop on Nitrogen Fixation in Maui, Hawaii
1981–1985 Principal investigator for two research projects funded by AID in Veracruz, Mexico
1983 As part of the CIBA-GEIGY Award I visited and was exposed to most facets of agriculture in Switzerland. The visit lasted ten days and was undertaken by seven national award winners from different agricultural disciplines.
1981 Invited participant to workshop on Nitrogen Fixation in Cali, Columbia

SCHOLARLY PRESENTATIONS AND INVITED SEMINARS

2010 15th European Biosolids and Organic Resources Conference, Leeds, UK
2010 IWA Specialty Conference, Lisbon Portugal
2010 2010 University of Florida, Gainseville, FL
2010 Imperial College, London
2010 Northwest Biosolids Conference, Lake Chelan, Washington
2010 World Congress Soil Science, Brisbane Australia
2010 University of Adelaide, Australia
2010 AWA Biosolids Specialty Conference V, Sydney, Australia
2010 AZ Water Conference, Glendale, AZ
2009 14th European Biosolids and Organic Resources Conference, Leeds, UK
2009 World City Forum 2009, Incheon, Korea
2009 Sustainable Management and Technology of Sludges, Harbin, China
2009 15th International Symposium on Health-Related Water Microbiology, Naxos Island, Greece
2009 5th Canadian Residuals & Biosolids Conference, Ontario Canada
2009 Arizona Water Reuse 2009 Conference, Flagstaff, AZ
2009 AWPCA 82nd Annual Conference, Glendale, AZ
2009 WERF Meeting, Alexandria, VA
2009 Northwest Biosolids Conference, Blaine, WA
2009 ASM 109th General Meeting, Philadelphia, PA
2008 WEFTEC Conference, Chicago, IL
2008 National Academies Symposium: Global Connections Between Earth Sciences, Health and Policy
2008 13th European Biosolids and Organic Resources Conference, Manchester, UK
2008 AAAS Annual Conference, Boston, MA
2008 Northwest Biosolids Management Conference, Portland, OR
2008 Australian Water Association Specialty Conference, Adelaide, Australia
2008 10th International Water Distribution System Analysis Conference, Kruger National Park, South Africa
2008 Department of Soil, Water and Environmental Science, The University of Arizona, Tucson, AZ
2007 Arizona Water and Pollution Control Association, Prescott, AZ
2007 Department of Agricultural and Biosystems Engineering, The University of Arizona, Tucson, AZ
2007 Ohio State University, Columbus, OH
2007 6th Conference on Wastewater Reclamation and Reuse for Sustainability, Antwerp, Belgium
2007 Northwest Biosolids Management Association, Lake Chelan, WA
2007 SSSA Annual Meeting, New Orleans, LA
2007 12th European Biosolids and Organic Resources Conference, Manchester, UK
2007 USDA CSREES Water Conference, Savannah, GA

2006 AAAS Annual Conference, St. Louis, MO
2006 EPA Biosolids Exposure Measurement Workshop, Cincinnati, OH
2006 IWA Specialty Conference, Moscow Russia
2006 8th Annual National Biosolids Conference/Workshop, Potomac, MD
2006 18th World Congress of Soil Science, Philadelphia, PA
2005 Annual Biosolids Management Conference, Guelph, Ontario
2005 Federal Bio-Chem Conference, Vienna, VA
2005 Northwest Biosolids: The Cutting Edge, Lake Chelan, WA
2005 10th European Biosolids and Organic Residuals Conference, Wakefield United Kingdom
2004 9th European Biosolids Conference, Wakefield United Kingdom
2004 NAS Report—Biosolids Applied to Land: Advancing Standards and Practices, Baltimore, Maryland
2004 Horizontal Gene Transfer Workshop, Warrenton, Virginia
2004 2004 Annual Biosolids Management Conference, Portland, Oregon
2004 WEF Conference, Salt Lake City, Utah
2004 Sustainable Organic Resources Partnership: Bioaerosols from Organic Wastes, Piccadilly, London United Kingdom
2003 8th European Biosolids Conference, Wakefield, United Kingdom
2003 Invited participant to Biosolids 2003 Conference, Trondheim, Norway
2003 Consortium for the Study of Rapidly Urbanizing Regions, Water Dialogue, Arizona State University, Phoenix, Arizona
2003 9th Billings Land Reclamation Symposium, Billings, Montana
2003 California Association of Sanitation Agencies, 2003 Mid-Year Conference, Palm Springs, California
2003 2003 Annual Biosolids Management Conference, Chelan, Washington
2003 WEF Conference, Baltimore, Maryland
2003 WEFTEC 2003 Pre-Conference Workshop, Los Angeles, California
2003 WERF Research Summit, Washington, DC
2002 WHO Symposium on HPC Bacteria in Drinking Water, Geneva, Switzerland.
2002 WEFTEC Conference, Chicago, Illinois
2001 AMSA's 2001 Summer Conference *The Biosolids Challenge...Ensuring Success*. Milwaukee, Wisconsin
2001 NIEHS Conference on Application of Technology to Chemical Mixture Research. Fort Collins, Colorado
2001 Stephen F. Austin State University. Nacogdoches, Texas
2001 Invited participant to National Science Foundation United States/Egypt Workshop on Microbial Ecology, Cairo Egypt
2000 America Water Works Association Research Foundation (AWWARF). Boulder, Colorado
2000 NASA Workshop. Bethesda, Maryland
2000 Third Annual Agricultural Research and Education Exhibition. Washington, DC
1999 Department of Civil Engineering. University of Arizona, Tucson, Arizona
1999 American Society of Microbiology. Chicago, Illinois
1999 Remediation Workshop. Braila, Romania
1999 University of California. Riverside, California
1998 Department of Plant Pathology. University of Arizona, Tucson, Arizona
1998 University of Minnesota. Minneapolis, Minnesota
1998 University of Texas. El Paso, Texas
1998 NIEHS Environmental Health and Safety Symposium, Tucson, Arizona
1998 Montana State University. Bozeman, Montana
1998 Department of Microbiology and Immunology. University of Arizona, Tucson, Arizona
1997 American Society of Microbiology. Miami Beach, Florida
1997 University of Panama. Panama City, Panama

1997 University of North Carolina. Chapel Hill, North Carolina
1996 World Bank. Washington, DC
1996 American Water Works Water Quality Technology Conference. New Orleans, Louisiana
1996 University of South Florida. St. Petersburg, Florida
1995 Soil Science Society of America. Detroit, Michigan.
1994 University of Sao Paulo, Sao Paulo, Brazil.
1993 University of Buenos Aires, Buenos Aires, Argentina.
1993 Conference on Water Quality in the Western Hemisphere, San Juan, Puerto Rico.
1992 Department of Plant Pathology. University of Arizona, Tucson, Arizona.
1991 American Society of Microbiology. Las Vegas, Nevada.
1990 5th International Symposium on Molecular Genetics of Plant-Microbe Interactions. Interlaken, Switzerland.
1990 Arizona Water Pollution Conference. Tucson, Arizona.
1990 American Society of Microbiology Conference on Biotechnology. Chicago, Illinois.
1990 American Society of Microbiology. Dallas, Texas.
1990 American Water Works Water Quality Technology Conference. Orlando, Florida.
1990 New Mexico State University. Las Cruces, New Mexico.
1989 Beltsville Symposium XIV. Beltsville, Maryland.
1988 International Conference on Release of Genetically Engineering Microorganisms. Cardiff, Wales.
1987 Second Desert Development Conference. Cairo, Egypt.
1987 Department of Plant Pathology. University of Arizona, Tucson, Arizona.
1987 AID Review of Biological Nitrogen Fixation Program. Raleigh, North Carolina.
1987 Second International Conference on Desert Development in Cairo, Egypt.
1986 Symposium on the Molecular Genetics of Plant-Microbe Interactions at McGill University, Montreal, Canada
1986 Department of Biochemistry, University of Arizona, Tucson, Arizona.
1985 American Society of Agronomy, Chicago, Illinois.
1985 AID Workshop on Nitrogen Fixation, Maui, Hawaii.
1984 Symposium on Role of Microorganisms in Agriculture at Wye College, University of London
1981 Irrigation Association Technical Conference, Salt Lake City, Utah.
1981 Department of Microbiology, University of Arizona, Tucson, Arizona.
1980 Eleventh Desert Agricultural Conference, Phoenix, Arizona.
1978 American Society of Golf Course Architects Foundation. Chicago, Illinois.

INVITED REVIEWER ON NATIONAL RESEARCH PANELS

American Water Works Association Research Foundation
National Research Initiative, Competitive Grants Program
National Science Foundation
U.S. Department of Agriculture
U.S. Department of Energy
U.S. Environmental Protection Agency
U.S. Geologic Survey

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Canadian Journal of Microbiology
Environmental Science and Technology
Journal of Applied Bacteriology
Journal of Applied Microbiology
Journal of Chemical Engineering
Journal of Environmental Quality
Journal of Microbiological Methods
Microbial Ecology
Plant and Soil, Water, Air, and Soil Pollution
Soil Biology and Biochemistry
Soil Science Society of America
Soil Science

STUDENTS RECEIVING GRADUATE DEGREES UNDER I.L. PEPPER

Student	Degree	Year
Hashim Babika	Ph.D.	1983
Greg Ferguson	Ph.D.	1984
Nastoran Shoustari	Ph.D.	1985
Jack Watson	Ph.D.	1985
Maribeth Miller	Ph.D.	1988
Suresh Pillai	Ph.D.	1989
Timothy Straub	Ph.D.	1993
Judy Way	Ph.D.	1993
Kelly Reynolds	Ph.D.	1995
Mark Burr	Ph.D.	1996
Elizabeth Marlowe	Ph.D.	1999
Timberley Roane	Ph.D.	1999
Scott Dowd	Ph.D.	2000
Deborah Newby	Ph.D.	2000
Terry Gentry	Ph.D.	2003
John Brooks	Ph.D.	2004
Benjamin Tanner	Ph.D.	2004
Huruy Zerzghi	Ph.D.	2008
Monisha Banerjee	Ph.D.	2009
Elizabeth Anderson	M.S.	1978
Michael O'Neill	M.S.	1978
Jack Watson	M.S.	1978
Hashim Babiker	M.S.	1979
Sam Negudu	M.S.	1979
Maribeth Miller	M.S.	1980
Cindy Salo	M.S.	1985
Alan Hayes	M.S.	1988
Julia Neilson	M.S.	1988
Masahiro Shishido	M.S.	1988
Christina Soares	M.S.	1990

Student	Degree	Year
Timothy Straub	M.S.	1991
Jeff Brendecke	M.S.	1992
Eileen Jutras	M.S.	1994
Felicia Blackmer	M.S.	1999
Elizabeth Marlowe	M.S.	2000
Jeff McQuaid	M.S.	2000
Christine Stauber	M.S.	2000
Paul Fanta	M.S.	2002
Alexandra Chetochine	M.S.	2003
Kathleen Zaleski	M.S.	2004
Elizabeth Scott	M.S.	2008

INSTRUCTION—Formal Courses Taught

Year	Semester	Course #	Course Title	Level	Enrollment
2010	Fall	SWES 426/526	Environmental Microbiology Lab	Undergrad/Grad	15
2010	Spring	SWES 305	Pollution Science	Undergrad	51
2009	Fall	SWES 426/526	Environmental Microbiology Lab	Undergrad/Grad	15
2009	Spring	SWES 305	Pollution Science	Undergrad	47
2008	Fall	SWES 426/526	Environmental Microbiology Lab	Undergrad/Grad	8
2008	Spring	SWES 305	Pollution Science	Undergrad	32
2007	Fall	SWES 426/526	Environmental Microbiology Lab	Undergrad/Grad	12
2007	Spring	SWES 305	Pollution Science	Undergrad	20
2006	Spring	SWES 305	Pollution Science	Undergrad	28
2005	Fall	SWES 426/526	Environmental Microbiology Lab	Undergrad/Grad	15
2005	Spring	SWES 305	Pollution Science	Undergrad	20
2004	Fall	SWES 426/526	Environmental Microbiology Lab	Undergrad/Grad	20
2004	Spring	SWES 305	Pollution Science	Undergrad	16
2003	Fall	SWES 426/526	Environmental Microbiology Lab	Undergrad/Grad	25
2003	Spring	SWES 305	Pollution Science	Undergrad	35
2002	Fall	SWES 426/526	Environmental Microbiology Lab	Undergrad/Grad	20
2002	Spring	SWES 305	Pollution Science	Undergrad	32
2001	Fall	SWES 426/526	Environmental Microbiology Lab	Undergrad/Grad	18
2001	Spring	SWES 305	Pollution Science	Undergrad	13
2000	Fall	SWES426/526	Environmental Microbiology Lab	Undergrad/Grad	20
2000	Spring	SWES 305	Pollution Science	Undergrad	30
1999	Fall	SWES 426/526	Environmental Microbiology Lab	Undergrad/Grad	13
1999	Spring	SWES 546	Environmental Biotechnology	Grad	11
1999	Spring	SWES 305	Pollution Science	Undergrad	26
1998	Fall	SWES 426/526	Environmental Microbiology Lab	Undergrad/Grad	18
1998	Spring	SWES 305	Pollution Science	Undergrad	36
1997	Fall	SWES 426/526	Environmental Microbiology Lab	Undergrad/Grad	26
1997	Spring	SWES 546	Environmental Biotechnology	Grad	16
1997	Spring	SWES 305	Pollution Science	Undergrad	49

Year	Semester	Course #	Course Title	Level	Enrollment
1996	Fall	SWES 426/526	Environmental Microbiology Lab	Undergrad/Grad	30
1996	Spring	SWES 305	Pollution Science	Undergrad	32
1995	Fall	SWES 426/526	Environmental Microbiology Lab	Undergrad/Grad	22
1995	Spring	SWES 546	Environmental Biotechnology	Grad	15
1995	Spring	SW 305	Pollution Science	Undergrad	42
1995	Summer	SW 197	Horizons Unlimited	Undergrad	8
1994	Fall	SW 426/526	Environmental Microbiology Lab	Undergrad/Grad	32
1994	Spring	SW 305	Pollution Science	Undergrad	28
1994	Summer	SW 197	Horizons Unlimited	Undergrad	9
1993	Fall	SW 426/526	Environmental Microbiology Lab	Undergrad/Grad	31
1993	Spring	SW 546	Environmental Biotechnology	Grad	17
1993	Summer	SW 197	Horizons Unlimited	Undergrad	8
1992	Fall	SW 426/526	Environmental Microbiology Lab	Undergrad/Grad	27
1992	Summer	SW 197	Horizons Unlimited	Undergrad	10
1991	Fall	SW 435/535	Soil Microbiology	Undergrad/Grad	16
1991	Spring	SW 604	Biochemistry of Rhizosphere	Grad	10
1990	Fall	SW 435/535	Soil Microbiology	Undergrad/Grad	18
1989	Fall	SW 435/535	Soil Microbiology	Undergrad/Grad	21
1989	Spring	SWE 604	Biochemistry of Rhizosphere	Grad	7
1988	Fall	SWE 435/535	Soil Microbiology	Undergrad/Grad	17
1987	Fall	SWE 435/535	Soil Microbiology	Undergrad/Grad	9
1987	Spring	SWE 555	Biochemistry of the Rhizosphere	Grad	8
1986	Fall	SWE 435/535	Soil Microbiology	Undergrad/Grad	19
1985	Spring	SWE 555	Biochemistry of the Rhizosphere	Grad	11
1985	Fall	SWE 435/535	Soil Microbiology	Undergrad/Grad	22
1984	Fall	SWE 435/535	Soil Microbiology	Undergrad/Grad	24
1983	Fall	SWE 435/535	Soil Microbiology	Undergrad/Grad	17
1983	Spring	SWE 555	Biochemistry of the Rhizosphere	Grad	5
1982	Fall	SWE 435/535	Soil Microbiology	Undergrad/Grad	7
1981	Fall	SWE 602	Soil-Plant Relations	Grad	26
1980	Fall	SWE 602	Soil-Plant Relations	Grad	30
1980	Spring	SWE 604	Organic Matter Micronutrient Interactions	Grad	15
1979	Fall	SWE 602	Soil-Plant Relations	Grad	24
1978	Fall	SWE 302	Soil-Plant Relations	Grad	20
1978	Spring	SWE 200	Basic Soils	Undergrad	72
1977	Fall	SWE 302	Soil-Plant Relations	Grad	30
1977	Fall	SWE 200	Basic Soils	Undergrad	80

CONSULTING

Arthur Beard Engineers, Tucson, Arizona
El Conquistador Country Club, Tucson, Arizona
Environmental Engineers, Tucson, Arizona
GLHN Engineers, Tucson, Arizona
United Nations
World Bank