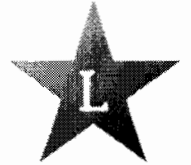

**World Water Forum College Grant Program
2007 Grant Proposals**



College

USC (7)

Faculty

Jiin~Jen Lee, Ph.D., P.E.

Project

Production of a Public Education Video for
Household Cross~Conenction Prevention



Civil and Environmental Engineering

USC Viterbi
School of Engineering

Southern California World Water Forum Grant Application
Innovative Conservation Research and Technology Grant Program
(WWFGP)

**Production of a Public Education Video for
Household Cross-Connection Prevention**



Signature

12/13/07

Date

Directing Faculty: Jiin-Jen Lee, Ph.D., P.E.
Student Manager: Xiuying Xing

University of Southern California
Foundation for Cross-Connection Control and Hydraulic Research

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Kaprielian Hall 200
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Make Check Payable to: University of Southern California
First Time – Global Project

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Project Managers

Table 1. Project Manager Contact Information

	Student Project Manager	Faculty Project Manager
Name	Xiuying Xing, M.S.	Jiin-Jen Lee, Ph.D, P.E.
Department	Department of Civil and Environmental Engineering (Address on the front page)	Department of Civil and Environmental Engineering (Address on the front page)
Telephone	213-740-0561	213-740-7865
Fax	213-740-8399	213-740-8399
E-mail Address	xiuyingx@usc.edu	jjlee@usc.edu

Organizational Background – Foundation for Cross-Connection Control and Hydraulic Research

The proposed research project will be administered through the Foundation for Cross-Connection Control and Hydraulic Research in the Department of Civil and Environmental Engineering at the University of Southern California. Students from the water resources engineering research group in the Department of Civil and Environmental Engineering will develop an educational video for residential cross-connection prevention with the guidance of Foundation staff.

Founded in 1944, the Foundation for Cross-Connection Control and Hydraulic Research has been a leader in cross-connection control. They work to solve cross-connection problems and educate the public of the hazards associated with cross-connections. Over the years, a number of products and services have been produced to help water utilities, health agencies, plumbing inspectors, private contractors, and the general public with cross-connection control efforts. The Foundation has developed a standard specification for backflow prevention assemblies and has an approval program for backflow prevention assemblies. The program is widely accepted and respected across the nation.

The Foundation publishes the Manual of Cross-connection Control and several other training tools, including educational videos. The Foundation has offered the *Course for the Training of Backflow Prevention Assembly Testers* since 1969. The Foundation has also offered the *Course for the Training of Cross-Connection Control Program Specialists* since 1987. At this time, the cross-connection control efforts across the nation have mainly been focused on system protection. The need for household cross-connection control has just begun to be

recognized. The findings of the study of *Prevalence of Cross-Connections in Household Plumbing System* in 2002~2003, funded by the US Environmental Protection Agency (EPA) and conducted by the Foundation for Cross-Connection Control and Hydraulic Research at USC, provided the impetus to educate the general public on cross-connections in household plumbing systems.

The proposed research will also benefit the participating graduate and undergraduate students in their education and research programs as they gain first hand knowledge on dealing with public perception and public acceptance of the issues related to solving cross-connection problems. This experience will help them prepare to solve the complicated water resources problems faced by modern society.

Project Description

Potable water is protected very carefully before it reaches residential users. Cross-connections occur when potable water systems connect to non-potable substances and sources. Cross-connections happen frequently. Water purveyors, large industrial water users, and business owners receive cross-connection prevention training and accept the need for protecting the water distribution system. However, cross-connections in household plumbing can degrade a residential system's water quality.

The Foundation for Cross-Connection Control and Hydraulic Research at the University of Southern California conducted onsite surveys in 2002-2003 for the US EPA. The surveys revealed that 95.7% of households had direct or indirect cross-connections to a health hazard. The findings of the study recommended that water agencies increase their public education efforts regarding residential cross-connections.

This project proposes to create a public educational video on identifying and correcting household cross-connection problems. Homeowners deserve to know what is going on within their household water system. The proposed educational video will provide simple cost-effective solutions to remove cross-connection problems associated with residential plumbing.

The proposal can be demonstrated by answering the following questions.

1. What is a cross-connection?

Cross-connections are the links where it is possible for contaminating materials to enter a potable water supply system from wastewater systems or other contaminated sources. The contaminant enters the potable water system when the pressure of the polluted source exceeds the pressure of the potable source.

Unsound plumbing practices and product defects can increase the probability of contaminating public drinking water through cross-connections. Understanding the risks associated with cross-connections, such as preventable illness, requires increased public education on cross-connections.

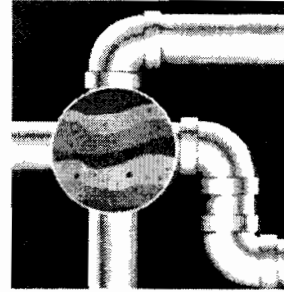


Figure 1. Illustration of a cross-connection

2. What kinds of cross-connections may exist in household?

Established regulations and programs prevent cross-connections in public water supply systems, commonly referred to as "system protection". However, once the water enters homes, there are common problems that may arise due to improper changes in, or misuse of, the household plumbing system. Contaminants can be introduced through sinks and tanks, toilets, irrigation systems, hose bibs, boilers, car washes, etc. The examples of household cross-connections and their corrections are illustrated in Figure 2.

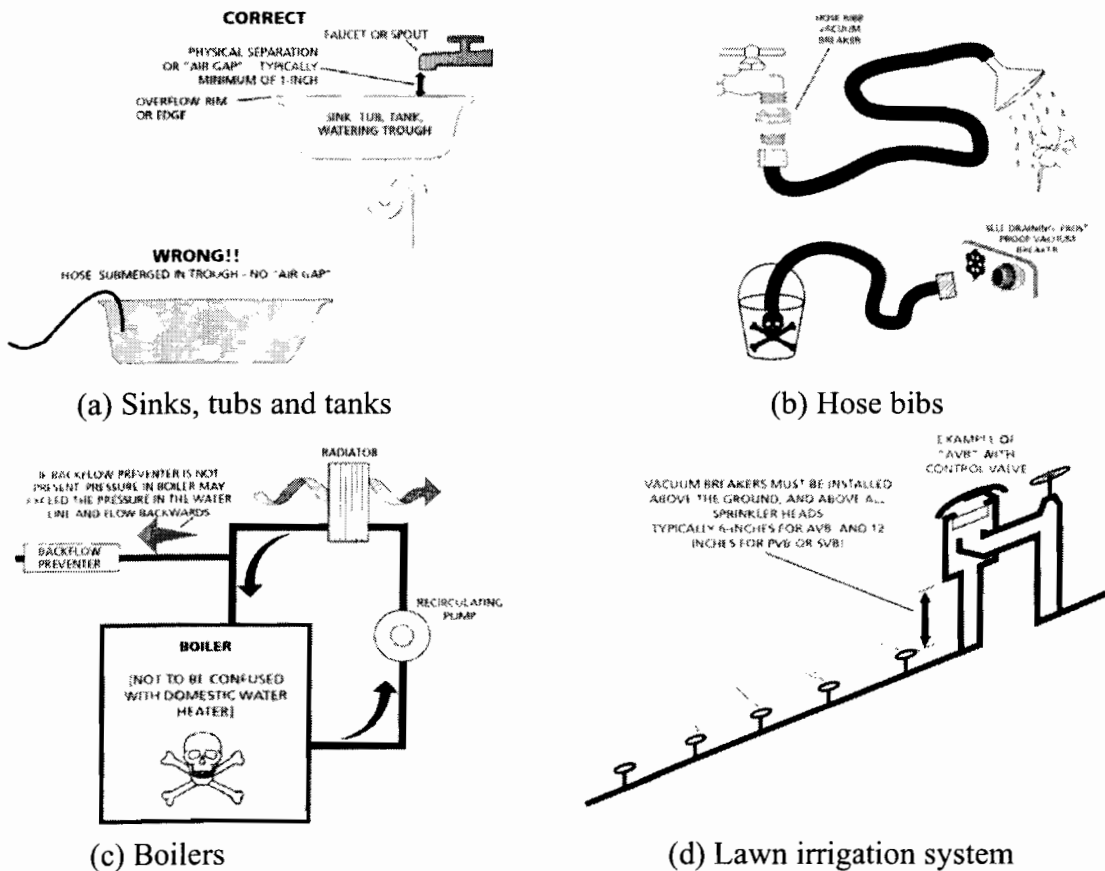


Figure 2. Examples of household cross-connections and their corrections

The brochure *Prevalence of Cross-Connections in Household Plumbing System* published by Foundation for Cross-Connection Control and Hydraulic Research on Feb.3, 2004, provided the information for Figure 2. The brochure is available for download at <http://www.usc.edu/dept/fccchr/frd.html>.

For sinks, tubs and tanks, an air gap is necessary to prevent the backflow of contaminated water. Chemically treated water in the heating and cooling water system is a very dangerous cross-connection source. Irrigation systems make watering the lawn or garden much easier, but if not properly constructed, contaminants may backflow into the drinking water system. The hose bibs are used to hook up a garden hose to dilute pesticides and herbicides, water the plants, wash the car, clean out the gutters, fill the swimming pool, etc. However, every time a garden hose connects to a hose bib, the end of the water line is extended and experiences greater danger of contamination.

3. Are people aware of those household cross-connections?

Most people are unaware of household cross-connections. The Foundation for Cross-Connection Control and Hydraulic Research at the USC conducted onsite surveys in 2002-2003 for the US EPA. The study surveyed 188 single-family residential homes in four contiguous Mid Western urban/suburban communities for potential cross-connections in the home. The survey then assessed whether cross-connections in the home could result in exposure to contaminants that would cause diarrhea or gastrointestinal illness.

The surveys revealed that on average, 73% of water uses were unprotected, constituting cross-connections. Approximately 96% of households had direct or indirect cross-connections to a health hazard. Although this is a large percentage, the greatest concern was with the 9.6% of the homes having a direct cross-connection to a health hazard. Of all the homes surveyed, 91% contained unprotected hose bibs, which are considered indirect cross-connections to a health hazard due to the potential for connecting hose bibs to any substance within reach of a hose. Sixty-one percent of the homes contained unprotected cross-connections involving toilets, with 8.8% being direct cross-connections.

The study recommended that water agencies increase their efforts in the area of public education on residential cross-connections.

4. What can we do to protect the community?

Education plays an important role in the field of water supply protection and is the most effective way to help homeowners protect themselves and the water supply system from risks associated with cross-connections.

- ✓ People need to know how hydraulic and pollution factors combine to produce a sanitary hazard in the presence of a cross-connection.
- ✓ People must realize that reliable and simple standard backflow prevention devices and methods are available to prevent dangerous direct connections.
- ✓ The public should understand that the hazards resulting from direct connections greatly outweigh the convenience or cost reductions gained by neglecting cross-connection control.

The objective of this project is to produce an educational video to inform homeowners of the potential hazards of cross-connections between potable water supply systems and other uses. The video will last about 40 minutes and will focus on three subjects:

- 1) An introduction will explain the mechanisms of cross-connection and backflow problems, as well as the hazards resulting from direct cross-connections. Previous household cross-connection incident data and examples will be presented. Photos and animations will illustrate the problem, making it easy to understand. (Approximately 15 minutes)
- 2) The video then will provide guidance in identifying unprotected cross-connections in household plumbing systems, along with simple and cost-effective ways to control household cross-connections. (Approximately 15 minutes)
- 3) Finally, the video will provide guidance on approved products and proper use of these products to prevent cross-connection contamination of potable water systems. The Foundation for Cross-Connection Control and Hydraulic Research at USC has already collected much of this information. (Approximately 10 minutes)

Project Cost Estimation

Table 2. Project Tasks, Timeline, and Costs

Time Line	Task Description	Project Manager		Technical Writer		Technical Supporter		Costs
		Hrs	\$/hr	Hrs	\$/hr	Hrs	\$/hr	
	Over head							\$1,000
04/01/08~ 06/30/08	Video content preparation and narrative writing, photo taking and animation development	50	\$20	50	\$20	20	\$20	\$2,400
07/01/08~ 08/31/08	Primary video production	40	\$20	40	\$20	40	\$20	\$2,400
09/01/08~ 09/30/08	Collecting suggestions from MWD or other departments and agencies	10	\$20	10	\$20	0	\$20	\$400
10/01/08~ 11/30/08	Video revision and final production	30	\$20	30	\$20	30	\$20	\$1,800
	Equipment rental and/or purchasing – camera, video camera, and other technical supply for video production							\$2,000
	Video Narration - professional narrator or narrator from MWD *							\$800
	Consulting fee – Collecting suggestions from other departments and agencies							\$500
	Office supplies – paper, pens, software supporting							\$1,700
	Transportation fee – going out for photo taking, material preparing and consulting							\$500
	Totals	130		130		90		\$13,500
Funding Sources								
	Grant Funds Requested from MWD							\$10,000
	Foundation for Cross-Connection Control and Hydraulic Research at USC **							\$3,500
								The graduate research assistantships for the students involved are supported by the Foundation **

* This project requires a professional narrator. MWD can provide the narrator, or the project team will hire one for this specific project.

** The student project manager, technical writer, and technical support are all graduate research assistants, financially supported by the Foundation for Cross-Connection Control and Hydraulic Research at USC. The Foundation will cover part of the student salary for this project.

Potential Water Supply Benefits

Water quality may be degraded by the cross-connections in household plumbing. The public still poorly understands this contamination source. Homeowner education benefits the regional water supply by eliminating sources of contamination that may affect many water system users.

Illustrative photos, animation, and narration will help the public easily understand the concept and process of cross-connections and contamination. The video can be played in individual homes, private and public agencies, community meetings, and even churches and supermarkets. Once homeowners realize the potential hazards, homeowners can immediately protect their individual potable water system. This project will contribute greatly to the ultimate goals of clean and safe water needed for healthy communities.

The training video will provide useful information to all water users within the Metropolitan Water District service area and is directly applicable for people across the nation and even throughout the world.

Project Management Team

The project team consists of a directing faculty member and three graduate research assistants in the Doctoral program for the Department of Civil and Environmental Engineering in the area of water resources. Resumes for the directing faculty and project manager are included at the end of the grant proposal. Table 3 contains the contact information for the project management team.

Directing Faculty – Dr. Jiin-Jen Lee, Ph.D., P.E.

Professor J.J. Lee has been on the USC faculty in Civil and Environmental Engineering for the last 37 years. He is also the director of the Foundation for Cross-Connection Control and Hydraulic Research (FCCCHR) at USC. At USC, he teaches undergraduate and graduate courses in fluid mechanics, hydraulic design, water resources engineering, and ocean and coastal engineering. He has served as an advisor for graduate students in water resources engineering and has guided twenty-five doctoral students to completion. Currently, Dr. Lee is supervising eight doctoral students in the water resources group in the areas of

surface water, ground water, and coastal waters.

Dr. J.J. Lee has been the director of the FCCCHR since 1985. During this time period, the supporting membership of FCCCHR has grown from 150 to 960, covering every region in the U.S. and a few foreign countries. He was the Principal Investigator for two major research projects on cross-connection control in recent years:

- 1) "Study of Cross-Connection in North American Water Supplies" (Sponsored by AWWA Research Foundation);
- 2) "Prevalence of Cross-connections in Household Plumbing System" (Sponsored by US Environmental Protection Agency).

His experience in cross-connection control will greatly benefit the study team to develop effective tool for educating the general public on household cross-connection problems.

Project Manager – Xiuying Xing, M.S.

Ms. Xing is a Ph.D. student in the water resources engineering group at the University of Southern California. She completed her Bachelor's degree and Master's degree at Tsinghua University in China. Before she came to USC, she earned a Master degree in Civil Engineering at the Ohio State University. She has worked on the data analysis of cross-connection incidents for the Foundation for Cross-Connection Control and Hydraulic Research, from which she gained plenty of knowledge on cross-connections and the hazards related.

Technical Writer – Bennington Willardson, M.S., P.E.

Mr. Willardson completed his Bachelor's degree in Civil and Environmental Engineering at Utah State University and then continued to pursue a Master's degree in Civil Engineering-Water Resources from Utah State University. He is an employee of the Los Angeles County Department of Public Works and is studying for his Ph.D. in Water Resources at the University of Southern California.

Technical Supporter – Hyoung-Jin Kim, M.S.

Mr. Kim completed his B.A. in Mechanical Engineering at Hanyang University and an M.S. degree in Aerospace and Mechanical Engineering at the University of Southern California. He is currently studying for a Ph.D. in Civil and Environmental Engineering at USC. He has served as a field tester for the Lab of the Foundation of Cross connection & Hydraulic Research since 2000. He is the technical support staff for this project.

Table 3. Team Contact Information

Name	E-mail	Phone	Responsibility
Dr. Jiin-Jen Lee	jjlee@usc.edu	(213) 740-7865	Technical Guidance and Expense Control
Xiuying Xing	xiuyingx@usc.edu	(213) 740-0561	Video Production
Bennington Willardson	willards@usc.edu	(626) 458-6117	Technical Writer
Hyoung-Jin Kim	hyoungjk@usc.edu	(213) 740-0561	Technical Supporter

Resume of JIIN JEN LEE, PH.D., P.E.

Professor of Department of Civil and Environmental Engineering, USC
Director of Foundation for Cross-Connection Control and Hydraulic Research, USC

Kaprielian Hall 200 Los Angeles, CA 90089-253 1
Phone: 213-740-7865
FAX: 213-740-8399
E-mail: jjlee@usc.edu

Education:

Ph.D., Civil Engineering 1970 California Institute of Technology Pasadena, California

Master of Science, Civil Engineering 1967 Utah State University Logan, Utah

Bachelor of Science, Civil Engineering 1962 National Taiwan University Taipei, Taiwan

Professional experience:

Professor of Civil and Environmental Engineering (1982-present)
Director, Foundation for Cross-Connection Control and Hydraulic Research
(1985-present) University of Southern California Los Angeles, CA

Teaches graduate and undergraduate courses in water resources engineering, hydromechanical engineering and fluid mechanics, ocean and coastal engineering. Responsible for the academic program in hydraulics and water resources engineering. Research activities cover surface and ground water flow, hydrodynamic modeling of coastal environment, hydraulic transients, computer and laboratory modeling of ocean wave-structure interactions.

Consulting experience includes serving as consultant for a number of local and national engineering firms/public agencies on computer modeling of coastal regions, hydrological analysis, oil spill analysis, wave structure interaction, and wave energy extraction.

Visiting Associate, Civil Engineering (sabbatical leave).
1980-1981 California Institute of Technology, Pasadena, CA

Research on interaction of finite amplitude wave and currents, laser-doppler velocimetry application for measurement of wave kinematics and portable breakwater application in the near shore environment.

Associate Professor (1975-1982)/Assistant Professor (1970-1975)
1970-1982 University of Southern California Los Angeles, CA

Teaches graduate and undergraduate courses in fluid mechanics, hydraulic engineering, water resources engineering and ocean and coastal engineering. Research in wave propagation, wave transformation, generation and propagation of tsunami, ocean measurements and computer modeling of hydrodynamics problems.

Resume of Xiuying Xing

Department of Civil and Environmental Engineering
University of Southern California
3620 S. Vermont Avenue
Kaprielian Hall 229
Los Angeles, CA 90089-2531
Tel: (213) 740-0561
Email: xiuyingx@usc.edu

Education:

Currently, she is studying for her Ph.D. in Department of Civil and Environmental Engineering at University of Southern California, Los Angeles, CA.

Master of Science, Civil Engineering
2004 Ohio State University Columbus, OH

Master of Engineering, Hydraulics and River Dynamics
2002 Tsinghua University Beijing, China

Bachelor of Engineering, Fluid Machinery and Fluid Engineering
1999 Tsinghua University Beijing, China

Research Experience:

Research Assistant
2002-2004 Ohio State University Columbus, OH

Research on wave bottom boundary layer physics and energetics based sediment transport modeling in nearshore. The study focuses on improving the modeling of beach scale bed load sediment transport due to waves over a flat bed. The small scale wave bottom boundary layer equation under arbitrary wave forcing is solved analytically with a zero-order eddy viscosity closure scheme. Three temporally and spatially varying eddy viscosity assumptions were considered. Predictions of bed stress from the three analytical boundary layer models are used for the formulations in three separate bed load flux models.

Research Assistant
1999-2002 Tsinghua University Beijing, China


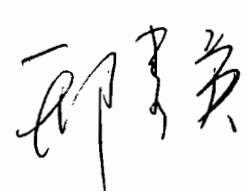
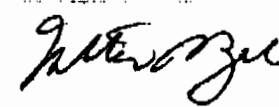
Research on numerical modeling for 3D unsteady seepage flow & contamination transport in ground water. Both seepage flow and the consequent contamination transport were simulated, the saturated zone and the unsaturated zone of the heterogeneous domain were combined to be solved with the finite element method.

Numerical modeling studies on the topics of "Fractional step finite element method for three-dimensional incompressible flows", and "Numerical simulation of 2D density flow with free surface".

Post-It® Fax Note	7671	Date	12-12-07	# of pages	4
To	JJ Lee	From	Walter Zeisl		
Co./Dept.	USC	Co.	LADWP		
Phone #		Phone #	213 367-1342		
Fax #	213 740-8399	Fax #	213 364-1400		

Approved for Proposed Fund Grant

Signature Block

	NAME	SIGNATURE	DATE
Project Director	<p>Dr. J.J. Lee</p> <p>Professor in Department of Civil and Environmental Engineering, USC</p>		12/13/07
Student Project Member	<p>Xiuying Xing</p> <p>Graduate Student in Department of Civil and Environmental Engineering, USC</p>		12-13-07
Member Agency Representative	<p>Walter Zeisl</p> <p>Manager of Environmental Communications and Educational Services, LADWP</p>		12-12-07



Southern California Water Utilities Association

Founded by Walter O. Weight 1896-1994

Telephone: (626) 287-8029
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BARBARA CARRERA
San Gabriel County Water District

SECRETARY/ TREASURER
JEANNETTE VAGNOZZI
City of La Verne

CONTROLLER
BRIAN BOWCOCK
Civiltec

December 10, 2007

SCWWFGP Committee
700 North Alameda Street
Los Angeles, CA 90012-2944

RE: Production of a Public Education Video for Household Cross-Connection Prevention

Dear SCWWFGP Committee:

We have reviewed the grant proposal submitted by the student group from the Department of Civil and Environmental Engineering at the University of Southern California for the production of an educational video for viewing by the general public on the prevention of household cross-connections.

We are pleased to offer this letter of endorsement for the project. Household cross-connection problems are becoming more and more important due to the difficulty of regulation enforcement. Educating the general public using the avenue of an education video will be most effective and will provide information and guidance for domestic water users in an easily understandable way. The video will be very helpful to water users and to the local water agencies. It will definitely help to protect clean and safe water, and thus maintain a healthy community.

It is our belief that this proposed project is worthwhile for water and environmental protection and for public health. Thank you for considering the proposal and for encouraging water conservation efforts and protection.

Yours truly,

Ken Deck
President, Southern California Water Utility Association (SCWUA)
General Manager, Rowland Water District
3021 S. Fullerton Road
Rowland heights, CA 91748