PLUMBING TAC

WITHOUT COMMENTS

Proposed Code Modifications

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TAC: Plumbing

Total Mods for **Plumbing** in **Approved as Modified: 1**

Total Mods for report: 7

Sub Code: Fuel Gas

P7202

1

Date Submitted	11/6/2018	**Section**	8	**Proponent**	Jonathan Sargeant
Chapter	8	**Affects HVHZ**	No	**Attachments**	No

TAC Recommendation Approved as Modified
Commission Action Pending Review

Comments

General Comments No   **Alternate Language** No

Related Modifications

Summary of Modification

Update LC 1/CSA 6.26 from 2013 to 2018. The 2018 standard contains language for arc-resistant CSST not contained in the 2013 standard.

Rationale

Current language under consideration includes an update to address installation of arc-resistant CSST. The CSST standard, LC-1, must also be updated so that the version of the standard referenced includes testing criteria for arc-resistant CSST.

Fiscal Impact Statement

Impact to local entity relative to enforcement of code

Standard update only. No impact.

Impact to building and property owners relative to cost of compliance with code

Standard update only. No impact.

Impact to industry relative to the cost of compliance with code

Standard update only. No impact.

Impact to small business relative to the cost of compliance with code

Standard update only. No impact.

Requirements

Has a reasonable and substantial connection with the health, safety, and welfare of the general public

Standard update only. No impact.

Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction

Correlates with proposed changes to address arc-resistant CSST.

Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities

Standard update only. No impact.

Does not degrade the effectiveness of the code

Standard update only. No impact.

Mod 7202 including A1

IFGC:

LC 1/CSA 6.26-~~13~~18 Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing (CSST) . …………………..… . . . 403.5.4

IRC:

LC1/CSA 6.26-~~13~~18 Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing (CSST) G2414.5.3

Alternate Language

1st Comment Period History

7202-A1

Proponent Jonathan Sargeant **Submitted** 1/4/2019 **Attachments** Yes

Rationale

Alternate language amends the proposal by updating the language in the IRC as well as the language in the IFGC.

Fiscal Impact Statement

Impact to local entity relative to enforcement of code

Standard update only - No impact anticipated.

Impact to building and property owners relative to cost of compliance with code

Standard update only - No impact anticipated.

Impact to industry relative to the cost of compliance with code

Standard update only - No impact anticipated.

Impact to Small Business relative to the cost of compliance with code

Standard update only. No impact.

Requirements

Has a reasonable and substantial connection with the health, safety, and welfare of the general public

Standard update only - No impact anticipated.

Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction

Standard update only - No impact anticipated.

Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities

Standard update only - No impact anticipated.

Does not degrade the effectiveness of the code

Standard update only - No impact anticipated.

1st Comment Period History

P7202-G1

Proponent Jonathan Sargeant **Submitted** 1/2/2019 **Attachments** No

Comment:

Upon review I noticed that the same standard update is necessary in Chapter 44 of the IRC:

"LC1/CSA 6.26—13 Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing (CSST) . . . .
.G2414.5.3"

I hope if this change is successful in the IFGC that staff can update the standard in the IRC as well.

IFGC:

LC 1/CSA 6.26-~~13~~18 Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing (CSST) 403.5.4

IRC:

LC1/CSA 6.26—~~13~~18 Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing (CSST) G2414.5.3

LC 1/CSA 6.26-~~13~~18 Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing (CSST) . ……………………….. . . . 403.5.4

TAC: Plumbing

Total Mods for **Plumbing** in **Approved as Submitted: 4**

Total Mods for report: 7

Sub Code: Plumbing

P7194

Date Submitted	11/7/2018	**Section**	419.5	**Proponent**	Gary Kozan
Chapter	4	**Affects HVHZ**	No	**Attachments**	Yes

TAC Recommendation Approved as Submitted
Commission Action Pending Review

Comments

General Comments **No** **Alternate Language** **No**

Related Modifications

Summary of Modification

Restores the option of providing cold water to hand-washing facilities

Rationale

Early editions of the FBC-Plumbing included a Florida-specific provision which allowed cold tap water to be delivered from hand-washing lavatories. This provision sunsetted with the Fifth (2014) Edition, and was never submitted for renewal. Current code requires tempered water (85-110 deg. F) to be delivered from all hand-washing facilities.
Scientific studies have proven that the water temperature for hand-washing has no impact on the efficacy of removing bacteria. A Center for Disease Control and Prevention (CDC) study sums it up best - "The temperature of the water does not appear to affect microbe removal; however, warmer water may cause more skin irritation and is more environmentally costly." CDC also lists a favorable Legionella bacteria growth range of 90-113 deg. F.
The cost of providing hot water systems to serve public lavatories can be significant. Because of the extremely low flow rates and infrequent usage, the Energy Code mandates a maximum distance of only 2 feet of ½-inch piping from the public lavatory faucet to the heated water supply pipe. The designer is left to choose between using multiple tankless water heaters, or a serpentine hot water circulation system. The initial costs and maintenance costs associated with either option can be considerable.
There is a simple solution. According to research conducted by the National Renewable Energy Laboratory, the average cold water temperatures in water distribution mains is calculated to be between 73.2 deg. F (Tallahassee) to 82.4 deg. F (Miami.) That is just slightly below the code definition of tempered water. By allowing the designer the option of providing cold tap water to public handwashing facilities, much of the hot water piping system can be eliminated, resulting in significant cost savings and energy savings. The risk of Legionella would be reduced. And Florida would again benefit from a proven practice that is simple, economical, and sustainable.

Fiscal Impact Statement

Impact to local entity relative to enforcement of code

No cost impact to code enforcement

Impact to building and property owners relative to cost of compliance with code

Building maintenance costs would go down by the elimination of additional water heaters and/or circulating systems provided for hand-washing fixtures

Impact to industry relative to the cost of compliance with code

Plumbing system costs would go down by the elimination of additional water heaters and/or circulating systems provided for hand-washing fixtures

Impact to small business relative to the cost of compliance with code

No impact to small business

Requirements

Has a reasonable and substantial connection with the health, safety, and welfare of the general public

Restores the previous Florida code option of providing cold tap water for hand-washing facilities

Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction

Provides less expensive option for hand-washing facilities, while minimizing the growth of Legionella bacteria

Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities

Provides an additional cold water option for hand-washing facilities

Does not degrade the effectiveness of the code

Actually improves the effectiveness of the code by providing a more economical and sustainable option

1st Comment Period History

P7194-G1

Proponent Gary Kozan **Submitted** 1/4/2019 **Attachments** Yes

Comment:

I am attaching a recent article from Plumbing Engineer magazine which speaks directly to the issues regarding room temperature lavatories.

419.5 ~~Tempered w~~Water for public hand-washing facilities. Cold or *Tempered water* shall be delivered from lavatories and group wash fixtures located in public toilet facilities provided for customers, patrons, and visitors. *Tempered water* shall be delivered through an *approved* water-temperature limiting device that conforms to ASSE 1070/ASME A112.1070/CSA B125.70 or CSA B125.3.

By Duane Jonlin, FAIA

The Room-Temperature Lavatory

There is one provision in both the Uniform Plumbing Code (UPC) and International Plumbing Code (IPC) that endangers public health and bloats construction budgets: the requirement to provide hot water at all public lavatories.

The idea that you should "always wash your hands with warm soapy water" has been repeated for decades by federal agencies, health department restaurant placards, and hospital regulations, and is embedded in the model plumbing codes. We would generally have no reason to question such a universal truism, especially one that falls into the sacred category of "things that Mom told us."

However, research demonstrates not only that handwashing hygiene is equally effective using cold water or hot, but also that the distribution system for hot water provides an environment that supports the growth of bacteria. The concurrent increases in construction cost, carbon emissions and operating costs from hot water handwashing may pale in importance when compared with the public health hazards, but are themselves significant.

Perhaps without realizing it, you, and millions like you, have already vetted the concept of room-temperature handwashing water many times. The water in the uninsulated section of piping between the circulating hot water and the lavatory rapidly cools towards room temperature, while most users only run the water for 4 – 6 seconds, not nearly enough to draw hot water all the way from the circulating loop to the tap. It may be that few users of public lavatories would even notice this change.

It's important to point out that there is no need to prohibit hot-water handwashing; individual developers and institutions should be able to decide for themselves whether providing hot water is worth any additional risk and expense. Facility directors of buildings that primarily serve healthy adults may decide that the risks of maintaining the status quo are acceptably small, while the directors of other facility types may opt for room-temperature handwashing. Allowing the responsible party to make an informed choice is what's urgently needed.

Hand hygiene

Bacteria and other microorganisms primarily spread among building occupants by hand contact with surfaces, which is why healthcare facilities have lavatories, sanitizer dispensers, and surgical sinks everywhere one looks. Although in recent years many individuals have become hyper-vigilant about touching restroom door handles, all the building's other door handles are equally contaminated, not to mention the elevator buttons, handrails, and touchscreens. Periodic handwashing does dramatically reduce the bacteria count on your hands, at least until the next time you touch something, but the temperature of that water has no impact at all. (What is important for hygiene is to use soap, and to continue scrubbing your hands for 15 - 20 seconds. Only a fraction of hand-washers has been observed to stick with it for the full 20 seconds, long enough to sing through the "Happy Birthday" song twice.)

Few people appeared to have been paying much attention to this issue until a new code provision was inserted in the 2015 International Energy Conservation Code (IECC), severely limiting the volume of water that can be held in the pipe between a public lavatory and the circulating hot water loop. The intention to get hot water to the users more quickly, so that the reduced flow time would reduce water heating energy use. As the new code was adopted around the country however, this provision was found to be more disruptive and expensive than expected, and has been provoking considerable resistance among contractors. While individual mini-tank or demand water heaters at each cluster of lavatories could also be used to comply, those solutions would involve considerable cost.

Searching for economical ways to comply with this code provision, designers began questioning whether we really need to provide hot water in the first place. The code mandates hot water at lavatories because it's been widely believed to be important for hygiene. As noted above however, each researcher studying the influence of water temperature on handwashing has arrived at the same conclusion; washing one's hands in cold or room temperature water removes bacteria just as effectively as washing them in warm or hot water – the water temperature itself is irrelevant. In fact, use of higher-temperature water increases skin irritation, providing a more vulnerable substrate for formation of bacterial colonies, and potentially causing people such as nurses who should wash their hands often to reduce their handwashing frequency and intensity.

"Nosocomial infections" are infections acquired while in a hospital, and they're a serious source of liability and hazard for these facilities. ("Nosocomial" could translate from Latin as "Please call my lawyer.")

Deaths and hospitalizations from nosocomial infections in hospitals are orders of magnitude more common than those from fire, even though fire safety is rigorously enforced in hospital design. Meanwhile, Legionella and other organisms thrive in the pipes and mixing valves that supply that warm water for the very handwashing that's intended to prevent disease transmission in the first place. The optimal temperature range for Legionella growth extends 20°F above and below our human body temperature of 98.6°F – clearly not a coincidence – so not only is the provision of hot water unnecessary for personal hygiene, a delivery temperature of 110°F is just right for the growth of microorganisms in plumbing systems. Those who simply rinse their hands under warm tap water without using soap could actually end up increasing the bacteria count on their hands.

Energy waste and operational expenses

The public health hazard created by the code requirement for hot water at lavatories should be sufficient reason to abandon that rule. However, utility bills and carbon pollution considerations provide another strong argument. The heating, reheating and pumping of hot water to the lavatories throughout a building constitutes a modest portion of total building energy use, but the fact that this is often wasted energy, doing more harm than good, makes it a perfect candidate to be an energy efficiency measure.

However, the current plumbing codes prohibit this. As lavatories are typically the most numerous fixtures on a building's hot water system, heating and pumping energy use will drop significantly when they're removed. The combined expenses of utility bills, annual maintenance, periodic repairs, leakage risks, and eventual equipment replacement adds up, especially where this is an unnecessary system in the first place.

Construction cost

A complex system is required to properly heat and circulate water to all the lavatories in a hospital, high school, or office tower: boiler, pumps, piping, insulation, mixing valves, controls, and more. All these components consume space – space in mechanical rooms, ceiling cavities and plumbing chases, as well as service access. If the lavatories were to provide room-temperature water instead, the use of distributed mini-water heaters at kitchens and showers might be a sensible option for serving the modest number of remaining fixtures, so that the entire central system could then be eliminated. If on the other hand a client still prefers to install a circulating hot water system, the length and size of insulated piping required for the building would be reduced, as would the boiler and pump sizes.

System selection

The best system choice for providing "room-temperature" water might depend on your location. In the American South and other locations where year-round water utility supply temperatures are already within the range of typical room temperatures, water can flow directly to the lavatories.

In northern climates where incoming water temperatures are too cold for comfortable handwashing, especially in winter, one easy option would be to allow the water to reach room temperature in a tempering tank or oversized pipe. However, the best strategy for these climates might be to incorporate a drain water heat recovery system. Most readers will be familiar with this technology – typically a copper supply pipe wrapped in a tight upward spiral around a section of vertical waste pipe, with the inner face of the copper pipe flattened to maximize contact area.

Liquids tend to adhere to the walls of vertical pipes while falling, so that enough of the heat transfers through the waste pipe to the incoming supply pipe that the "cold" water will reach room temperature without mechanical heating. This provides a simple, maintenance-free preheating system with no moving parts, resulting in significant cost savings. A side benefit of using drain water heat recovery is that the subsequent temperature lift for shower and kitchen water heating would be reduced, speeding up recovery times.

Optimal water temperature

For room-temperature lavatories, water should be delivered at temperatures low enough to prevent bacterial growth, while still warm enough to encourage thorough hand washing. Fortunately, the typical room temperature range of 68° to 75°F aligns nicely with the optimal handwashing water temperature range of 65° to 80°F.

80°F is the maximum safe temperature to prevent Legionella growth, while 65°F is a good minimum temperature range for handwashing comfort. Much below that temperature, tap water feels uncomfortably cold to users, which could discourage adequate handwashing. (For a related reference point, note that the minimum allowable water delivery temperature for laboratory emergency showers is 60°F.)

68°F is the minimum space heating capability required by the building code, while 75°F is the minimum cooling setpoint permitted for load calculations in the energy code, bracketing the "typical" indoor temperatures.

There are certainly situations for which warm water is still important for handwashing, specifically where the occupants' hands are likely to be greasy or heavily soiled, such as at repair garages, greenhouses, or art classrooms. Private lavatories in dwelling and sleeping units should also provide warm water, since they're used for additional grooming purposes. Beyond these, there are bound to be many other situations where warm water for handwashing is desirable.

Optional, not mandatory

For the above reasons, plumbing code change proposals submitted by Seattle to ICC and IAPMO in 2018 would not prohibit hot water for handwashing, but rather make it optional. Developers and facility managers would then be empowered to make their own decisions about whether hot water at lavatories is worth any additional cost, space, energy use, or health risks.

At the very least, this proposed change will allow that choice to be made, and give local health departments a legal basis on which to permit that choice. For the many cities and states with carbon reduction and energy efficiency goals, an option to dispense with hot water for handwashing would allow those jurisdictions to incentivize the choice to provide room temperature handwashing water.

Proposed code change language

Based on feedback received regarding the original code change proposals, the simplest formulation appears to be best. The following exception would be inserted at Sections 419.5 and 607.1 of the IPC, or Section 601 of the UPC.

Exception: Lavatories and other handwashing fixtures not serving dwelling or sleeping units are not required to provide hot water or tempered water.

The path forward

Any new code provision generally requires a cost/benefit analysis, to balance the increased construction costs of the proposal against future utility savings or public health protection. In this case however, all the costs and the benefits fall on the positive side of the ledger, seemingly making this an obvious choice for approval. Public health benefits with lower construction and operating costs – a slam-dunk! However, the proposal was swiftly and unanimously disapproved by both the ICC and IAPMO plumbing code committees.

A friendly engineer took this author aside after one of these debacles and said, "You know, you're asking a panel of plumbing professionals to approve something that'll cut into their business. The fact that it permits a smaller plumbing system makes it an uphill battle."

The IAPMO proposal is still on the table, through the public comment process (as Item 55), and beyond that are the individual state code processes. To succeed, either of these will need support from concerned design, construction and public health professionals. Change is always a challenging task, but the public health protection provided in this change makes it well worth the effort. ●

Duane Jonlin, FAIA, is the Energy Code and Energy Conservation Advisor for the City of Seattle Department of Construction and Inspections. He can be reached at Duane.Jonlin@seattle.gov.

References

- Centers for Disease Control and Prevention (2017), *Show Me the Science - How to Wash Your Hands*
- International Journal of Consumer Studies (2013), *The environmental cost of misinformation: why the recommendation to use elevated temperatures for handwashing is problematic*
- Infection Control Today (2017), *Cool Water as Effective as Hot for Removing Germs During Handwashing*
- Food Service Technology (2002), *Water temperature as a factor in handwashing efficacy*
- UK Health and Safety Executive
- Becker's Clinical Leadership and Infection Control
- Energy.gov (2018), *Drain Water Heat Recovery*

Centers for Disease Control and Prevention
CDC 24/7: Saving Lives, Protecting People™

Show Me the Science - How to Wash Your Hands

Keeping hands clean is one of the most important steps we can take to avoid getting sick and spreading germs to others. Many diseases and conditions are spread by not washing hands with soap and clean, running water. CDC recommends cleaning hands in a specific way to avoid getting sick and spreading germs to others. The guidance for effective handwashing and use of hand sanitizer was developed based on data from a number of studies.

Microbes are all tiny living organisms that may or may not cause disease.

Germs, or pathogens, are types of microbes that can cause disease.

Wet your hands with clean, running water (warm or cold), turn off the tap, and apply soap.

Why? Because hands could become recontaminated if placed in a basin of standing water that has been contaminated through previous use, clean running water should be used [1]. However, washing with non-potable water when necessary may still improve health [3]. The temperature of the water does not appear to affect microbe removal; however, warmer water may cause more skin irritation and is more environmentally costly [4-6].

Turning off the faucet after wetting hands saves water, and there are few data to prove whether significant numbers of germs are transferred between hands and the faucet.

Using soap to wash hands is more effective than using water alone because the surfactants in soap lift soil and microbes from skin, and people tend to scrub hands more thoroughly when using soap, which further removes germs [2,3,7,8].

To date, studies have shown that there is no added health benefit for consumers (this does not include professionals in the healthcare setting) using soaps containing antibacterial ingredients compared with using plain soap [9, 10]. As a result, FDA issued a final rule in September 2016 that 19 ingredients in common "antibacterial" soaps, including triclosan, were no more effective than non-antibacterial soap and water and thus these products are no longer able to be marketed to the general public. This rule does not affect hand sanitizers, wipes, or antibacterial products used in healthcare settings.

Lather your hands by rubbing them together with the soap. Be sure to lather the backs of your hands, between your fingers, and under your nails.

Why? Lathering and scrubbing hands creates friction, which helps lift dirt, grease, and microbes from skin. Microbes are present on all surfaces of the hand, often in particularly high concentration under the nails, so the entire hand should be scrubbed [11-15].

Scrub your hands for at least 20 seconds. Need a timer? Hum the "Happy Birthday" song from beginning to end twice.

Why? Determining the optimal length of time for handwashing is difficult because few studies about the health impacts of altering handwashing times have been done. Of those that exist, nearly all have measured reductions in overall numbers of microbes, only a small proportion of which can cause illness, and have not measured impacts on health. Solely reducing numbers of microbes on hands is not necessarily linked to better health [16]. The optimal length of time for handwashing is also likely to depend on many factors, including the type and amount of soil on the hands and the setting of the person washing hands. For example, surgeons are likely to come into contact with disease-causing germs and risk spreading serious infections to vulnerable patients, so they may need to wash hands longer than a woman before she prepares her own lunch at home. Nonetheless, evidence suggests that washing hands for about 15-30 seconds removes more germs from hands than washing for shorter periods [15, 17, 18].

Accordingly, many countries and global organizations have adopted recommendations to wash hands for about 20 seconds (some recommend an additional 20-30 seconds for drying):

- The Benefits of Hand Washing (http://www.hc-sc.gc.ca/hl-vs/iyh-vsv/diseases-maladies/hands-mains-eng.php)
- New Zealand. Step-by-Step Guide to Hand Washing (http://www.handhygiene.org.nz/index.php?option=com_content&view=article&id=7&Itemid=110)
- The Global Public-Private Partnership for Handwashing. Why Handwashing? (http://www.globalhandwashing.org/why/faq)
- World Health Organization. Guidelines on Hygiene in Health Care: A Summary [PDF – 64 pages] (http://whqlibdoc.who.int/hq/2009/WHO_IER_PSP_2009.07_eng.pdf)

Rinse your hands well under clean, running water.

Why? Soap and friction help lift dirt, grease, and microbes—including disease-causing germs—from skin so they can then be rinsed off of hands. Rinsing the soap away also minimizes skin irritation [15]. Because hands could become recontaminated if rinsed in a basin of standing water that has been contaminated through previous use, clean running water should be used [1, 12].While some recommendations include using a paper towel to turn off the faucet after hands have been rinsed, this practice leads to increased use of water and paper towels, and there are no studies to show that it improves health.

Dry your hands using a clean towel or air dry them.

Why? Germs can be transferred more easily to and from wet hands; therefore, hands should be dried after washing [15, 19]. However, the best way to dry hands remains unclear because few studies about hand drying exist, and the results of these studies conflict. Additionally, most of these studies compare overall concentrations of microbes, not just disease-causing germs, on hands following different hand-drying methods. It has not been shown that removing microbes from hands is linked to better health [16]. Nonetheless, studies suggest that using a clean towel or air drying hands are best [18, 20, 21].

References +

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Dairy, Food and Environmental Sanitation, Vol. 21, No. 12, Pages 997-1007

Handwashing Water Temperature Effects on the Reduction of Resident and Transient (*Serratia marcescens*) Flora when Using Bland Soap

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ABSTRACT

For many years, sanitarians have specified that hands be washed using warm or hot water to reduce cross-contamination risks, with various authors indicating temperatures between 38°C and 48.9°C. However, it has been suggested that these temperatures may contribute to skin damage when frequent handwashing is necessitated (in health care and food service). This study evaluates the bacterial reduction efficacy of water temperature during normal handwashing. The hands of two groups of four experimental subjects were soiled with sterile or contaminated substances (tryptic soy broth and hamburger meat). Uninoculated menstruum was used to study the effects of treatment temperatures on resident microflora reduction, while *Serratia marcescens*-inoculated menstruum was used to study treatment effects on transient microorganism reduction. Following contamination with appropriate media, one hand was immediately sampled to obtain baseline (control) data, using the "glove-juice" technique for microorganism recovery. Hands were then moistened with water at the assigned temperature (4.4°C, 12.8°C, 21.1°C, 35°C or 48.9°C), washed 15 s with bland soap, and rinsed 10 seconds at the same temperature as was used before; and the opposing hand was then sampled. Results indicate that water temperature has no effect on transient or resident bacterial reduction during normal handwashing when bland soap is used.

A peer-reviewed article.

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TABLE 1. Year 2000 Conference for Food Protection water temperature issues

Issue #	Submitter	Requested change from 110°F (43°C) minimum	Reasons given for change requested
2000-I-23	L. Wisniewski (Select Concepts)	"Warm Water"	1. Hand discomfort decreases frequency
2000-I-24	M. Scarborough (GA Dept. of Human Resources, Div. Publ. Health)	37.7°C (100°F)	1. No science (110°F vs. 100°F) 2. Plumbing code @100°F max. (safety concerns)
2000-I-25	J. Budd (Healthminder/ Sloan Valve Co.)	35°C (95°F)	1. No scientific basis 2. Max. soap efficacy at 35°C 3. Hand comfort 4. Hot water discourages hand washing
2000-I-26	E. Rabotoski (WI Conference Food Protection)	"Tempered" 85°F (29.5°C) to 110°F (43°C)	1. Hand discomfort 2. Possible scalding
2000-I-27	B. Adler (MN Dept. of Health)	Impose temp. range 110°F (43°C) to 130°F (54.4°C)	1. Need upper limit or subject to OSHA 2. Food workers don't wash 25 s so cannot scald
2000-I-28	F. Reimers (H.E.B. Grocery Co.)	"Tempered" to warm	1. No science 2. Max. soap efficacy 3. 110°F risks injury 4. Waste water as wait for temp. at 110°F

INTRODUCTION

A critical and thorough evaluation of a simple handwashing reveals numerous variables that must be considered to achieve maximum or appropriate degerming of the hands and fingernail regions. Numerous studies have explored topics such as type of soap (e.g., antibacterial vs. plain, liquid vs. bar), amount of soap and handwashing technique, nailbrush or sanitizer use, drying technique (e.g., cloth vs. paper towels, paper towels vs. air-drying), and application of hand sanitizers (post-wash liquids). Although studies indicate that these variables are crucial in achieving effective removal of transient bacteria from the hands under controlled testing conditions, testing to determine specific guidelines for water temperatures and flow rates is rarely mentioned in the scientific literature. Many of the currently employed handwashing practices may be based on untested traditions that could actually result in compromised skin health. With so many variables involved in such a "simple" procedure, it would make sense to explore and maximize all possible aspects of the process while minimizing negative collateral. This is especially important because many observations of food service workers have revealed what are considered poor habits in handwashing techniques. Studies indicate that handwashing compliance drops considerably without supervision and monitoring, or in situations where skin damage occurs. This further amplifies the need to strengthen knowledge of all variables that might improve or weaken daily handwashing prac-

TABLE 2. A comparison of resident flora and transient flora studies

	Resident flora	Transient flora
Test Laboratory	BioScience Laboratories	Silliker Research Laboratories
Location	Bozeman, MT	South Holland, IL
Study Director	D. Paulson J. Budd	V. Gangar
		M. Arenas
Test Subjects	Paid Volunteers	Laboratory Workers
No. Test Subjects	4 (3 Females, 1 Male)	4 (1 Female, 3 Male)
Test subjects age (range)	26 – 56	24 – 25
Test temperatures (°C)	4.4, 12.8, 21.1, 35, 48.9	4.4, 12.8, 21.1, 35, 48.9
Test temperatures (°F)	40, 55, 70, 95, 120	40, 55, 70, 95, 120
Test soil		
Tryptic soy broth (TSB)	1.0 ml (0.5 ml/hand)	1.0 (ml/hand)
ϒ- irradiated ground beef (GB)	3.0 grams (1.5 g/)	3.0 grams
Microbial inoculum	None	*S. marcescens*
No. test days/soil/	1	2
Temperature/ Subject		
Total data points/temperature	8	16
Mean baseline count Log_{10}		
TSB	6.05	6.91
GB	6.40	7.21
Amount of time massaged with TSB and GB	45 seconds	2 minutes
Amount of time TSB and GB air-dried	2 minutes	1 minute
Amount of soap used for handwashing	3 ml	3 ml

tices throughout the food and health care industries.

Two types of flora, transient and resident, exist on the hands. The transient flora are generally removed fairly easily. They do not have adhesion characteristics that hold them to the skin's surface *(8)* and are somewhat suppressed by secretions and competitive exclusion by normal resident flora. Resident flora are removed more slowly. Because of co-evolution, resident flora have adapted to conditions on the skin surface that cause rapid die-off of most transients. Invaginations such as the nail fold, hair follicles and sebum-producing sebaceous glands support a rich resident flora. Transient flora may consist of pathogens, spoilage bacteria or harmless environmental species. Under certain conditions transient flora can change status and become permanent residents. Resident flora as a rule are not pathogenic types. Frequent or prolonged exposure of the skin to microbial contamination in soils, skin damage or fissures provide portals of entry to deeper tissue and may result in the presence of many pathogenic bacteria among the resident species *(11,27)*.

Removal of viable bacteria, dirt and grease from the skin is accomplished by friction and surfactant action, which lowers surface tension. Alkaline detergent solutions remove bacteria from skin more efficiently than acid or neutral solutions do *(20)*, forming the basis for skin sampling solutions used in this study *(37)*.

Added to the aforementioned studies are the many references to warm or hot water use for handwashing from the Internet or popular press. These references are meant to provide information to food workers or consumers. Questions need to be answered regarding water temperature guidelines with respect to handwashing: Do soaps perform better depending on the water temperature for handwashing? Does hot water help cleanse the hands better than cool or plain tap water? What are the physiological changes of the skin when different temperature/soap combinations are used? Does water temperature make a significant difference in reducing the numbers of transient and/or resident bacteria on the hands?

The effective water temperature used for washing and rinsing hands has been under debate recently at the Year 2000 Conference for Food Protection. Six issues were brought before Council I with regard to FDA Food Code hand washing water temperature specifications. The 1999 Food Code *(36)* requires sinks used for handwashing to be equipped so as to be "capable of providing water of at least 43°C (110°F), accomplished through use of a mixing valve or a combination faucet." An outline summarizing the issues brought forth by the various submitters at the Year 2000 Conference, including requested changes and reasons given for those changes, is provided in Table 1.

All but one of the issue submissions requested temperature decreases with the intent of improving hand comfort, as the discomfort associated with higher temperatures results in decreases in hand washing frequency or compliance (I-23, I-25). Several submitters note a lack of scientific information on the subject (I-24, I-25, I-28). There is concern that a minimum handwashing temperature of 43°C (110°F) in addition to causing discomfort (I-23, I-26), will result in injury or scalding (I-28, I-24, I-26) and may even be in conflict with local plumbing codes (I-24). Two submitters point out that soaps currently available target maximum effectiveness at around 35°C (95°F) (I-25, I-28). Two submitters requested that the minimum temperature of 43°C (110°F) be changed to warm water (I-23, I-28) or that it be tempered to a range of 29.5°C (85°F) to 43°C (110°F). And finally, one submission (I-27) sought to place an upper temperature limit of 54.4°C (130°F), for fear that these regulations would be subject to OSHA scrutiny and criticism without a limit. Interestingly, it was noted in this submission, through reference to the Consumer Product Safety Commission, that second-or third-degree burns have been shown to occur in the elderly at temperatures not much over 43°C (110°F). Council I and the General assembly of voting delegates passed a recommendation to lower the Food Code water temperature minimum to 29.5°C (85° F).

The universe of food handling situations requiring effective personal hygiene runs from temporary handwash stations set up in produce fields to advanced state-of-the art kitchens used to produce extended-shelf-life ready-to-eat foods sold at retail. In many of these situations, it is difficult to provide water meeting strict temperature ranges. Further, it is difficult to manage and monitor food handlers to insure that the 43°C (110°F) temperature minimum is maintained during all handwashing activities. When subject to regulatory inspections, violations are given to food industry entities based on Food Code specifications. Therefore, in the interest of possibly increasing handwashing compliance or efficacy and clarifying the importance of this issue to enforcement authorities, handwashing studies were undertaken.

In a literature search for effect of water temperature on hygienic efficiency, only two experimental studies shed light on this issue. Both of these involved hand sampling studies, in which the objective was to remove and enumerate as many bacteria on the hands as possible, either as normal or transient flora. In hand scrubbing experiments, Price *(27)* found that at temperatures from 24°C (75.2°F) to 56°C (132.8°F) there was no difference in de-germing rate. Because he scrubbed hands with a brush for a specific period of time, each in turn in a series of sterile wash basins, he might have been capable of seeing differences upon counting the flora in each basin. After conducting over 80 experiments in a 9-year period, Price concluded that the largest variable in determining the rate of removal of bacteria from the hands was the vigorousness of scrubbing. Other factors, such as soap used or water temperature, were less important. In later hand sampling experiments implementing the glove juice method for recovery of microorganisms, no differences in isolation rates were seen at either 6°C (42.8°F) or 23°C (73.4°F) *(12)*. Although this information is inconclusive and does not answer questions concerning bacterial loads suspended in a confounding soil, they tend to indicate that there may not be a very great difference in efficacy over a range of temperatures from 6°C (42.8°F) to 56°C (132.8°F).

Various menstruum have been used for handwashing efficacy studies. For studies involving transient flora, the most often used soil is tryptic soy broth (TSB). Microorganisms exhibit good survivability, with even distribution of contaminating microorganisms into skin cracks, creases and invaginations being possible. Ground beef probably represents the most appropriate menstruum because of concern for risks of *E. coli* O157:H7 infection, but is only occasionally used *(30, 31)*. Numerous cases of foodborne illness have been tied to poor personal hygiene after ground beef preparation.

On the basis of all the information gained from the literature search and analysis, experiments were performed to determine if there was a superior temperature or range of temperatures for removal of bacterial contamination from hands during handwashing. This involved contaminating hands with marker bacteria and washing hands with soap and water, followed by counting resident and transient (marker) bacteria. Because it was realized that both the use of antimicrobial soap and drying with paper towels would confound and alter the effects of water temperature washing and rinsing, bland soap was used and hands were not dried with paper towels.

MATERIALS AND METHODS

This study was performed at BioScience Laboratories (for resident bacteria) and Silliker Research and Laboratory Services (for transient bacteria). Table 2 provides a comparison of methods used for testing in the two laboratories.

A stable pigmented strain of *Serratia marcescens* (SLR 1421) was used to simulate transient hand contamination. This organism is used frequently used in hand disinfection studies *(5, 22, 23, 24, 28)*.

Tryptic soy agar (TSA) and tryptone glucose yeast (TGY) agar spread plates, deionized water, sterile stripping fluid, Butterfield's phosphate buffer solution, phosphate buffer with 0.1% Triton X-100, TSB with 1% Tween and 0.3% lecithin, sterile latex-free surgical gloves, alcohol, and Ivory® liquid soap (non-antimicrobial) were used.

Subjects rinsed both hands under running tap water at the designated temperature, and shook off any excess. Three ml of Liquid Ivory® Soap was dispensed into the subjects' cupped hands and rubbed over all surfaces, including the lower third of forearms, making sure not to lose any soap. After complete soap dispersal, a small amount of tap water was added, and subjects lathered their hands and forearms vigorously for 15 s. Subjects then rinsed their hands and forearms for 10 s under running tap water maintained at a flow rate of 7.6 liters/min (2 gallons/min) at the designated temperature, after which they shook the hands two times to remove excess moisture. While still wet, the subjects' hands were gloved for sampling using the Glove Juice technique.

Glove juice sampling procedure

The effectiveness of bacterial reductions from the hands was evaluated using the glove juice recovery method as described in ASTM test methods *(4)*. Following the prescribed wash and rinse procedure, sterile, powder-free latex gloves were donned. Seventy-five ml of Sterile Stripping Fluid (aqueous phosphate buffer with 0.1% Triton) were instilled into the glove, the wrists were secured, and attendants massaged the hands through the gloves in a uniform manner for 60 s. Aliquots of the glove juice were removed and serially diluted in Butterfield's Phosphate Buffer solution containing 1.0% Tween 80 and 0.3% Lecithin as product neutralizers.

Enumeration

For normal (resident) bacteria, duplicate spiral plates were prepared from appropriate dilutions using TSA with product neutralizers. The plates were incubated at 30°C ± 2°C (86°F ± 2°F) for 48 h. Colonies were counted and the data recorded using the CASBA™ 4 plate-counting system.

For transient (*Serratia marcescens*) bacteria, Samples were spread on TGY agar following appropriate dilutions, and incubated at 35°C (95°F) for 24 to 48 h. Any pink colonies observed were considered to be *S. marcescens*, while the others were considered to be normal flora. The number of bacteria were tabulated using the following formula:

$$B = A[\sum x/n]^{10-D}$$

Where:

B = estimated number of microorganisms

A = portion volume = 75 ml (phosphate buffer added to glove)

$\sum x/n$ = average CFU per plate for

each dilution level

D = dilution level

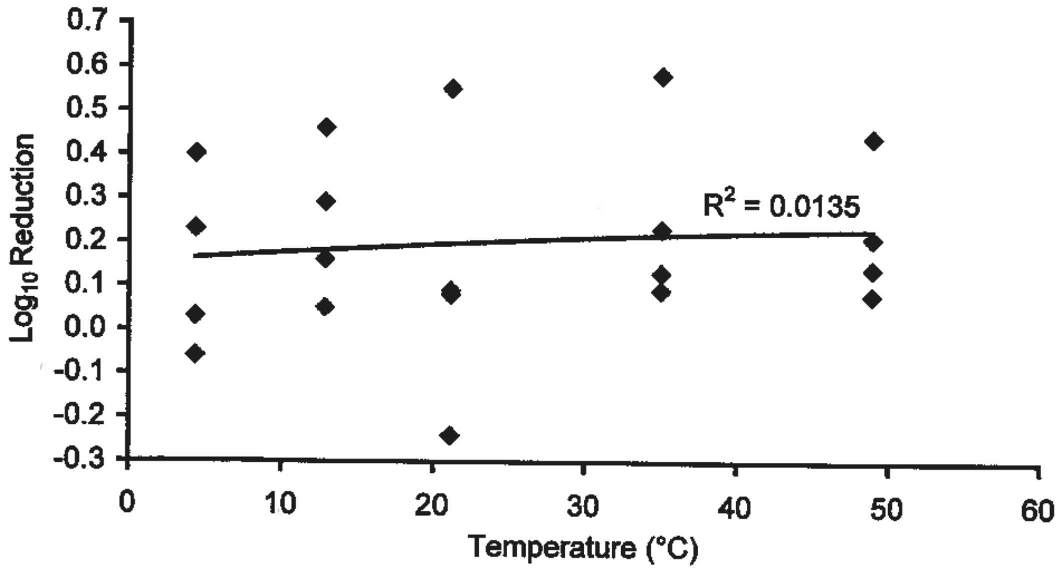
Subjects for normal (resident) flora experiment

The constant exposure of microbiology laboratory technicians to sanitizers and the necessity of disinfection provides the potential for high variability in the resident or "normal" flora and physiological condition of their hands and forearms. Working daily with various microorganisms that are not considered part of the normal (resident) skin flora (including agents used in their testing and evaluation) increases the susceptibility of these individuals to infection and skin damage. For this reason, volunteers were used to get a more accurate picture of the effects of water washing temperature on resident flora.

Between the ages of twenty-six and fifty-six four healthy subjects were selected, three females and one male. All subjects' hands and forearms were free from clinically evident dermatosis, injuries, open wounds, hangnails, or any other disorder that could compromise the subject and the study. Participation was restricted to individuals not currently using any topical or systemic antimicrobials, steroids, or other medication known to affect the resident microbial flora of the skin.

The "pre-test period, seven days prior to the testing portion of the study, was designed to generate optimum levels of resident flora for testing purposes. During this period, subjects were instructed to avoid using medicated soaps, lotions, deodorants and shampoos, as well as skin contact with solvents, detergents, acids and bases, or other

Figure 1. Handwashing efficacy (log_{10} reduction) for resident flora in TSB and selected water washing and rinsing temperature



products known to affect the microbial population of the skin. Avoidance of UV tanning beds and swimming or bathing in biocide-treated pools or hot tubs was mandatory. During this period, subjects were supplied with a personal hygiene kit, containing non-medicated soap, shampoo, deodorant, lotion, and rubber gloves to be worn when contact with antimicrobials, solvents, detergents, acids, or bases could not be avoided. For subjects' safety, leaving the lab once the testing began was prohibited.

Testing period of normal (resident) flora

Each subject was utilized for approximately one-half hour every other day of the test period, excluding weekends and holidays (a total of ten test days per subject). Subjects were instructed to avoid washing their hands for two hours prior to testing, and fingernails were trimmed to a free-edge of less than 1 mm if not already done. All jewelry was removed from the hands and arms prior to washing.

Testing of normal (resident) flora with TSB

On each of the five test days, subjects had 1.0 ml (0.5 ml per hand) of TSB placed into their cupped hands in ten aliquots of approximately 0.1 ml. The broth was distributed evenly over both hands, not reaching above the wrists, by gentle continuous massage for 45 s. After a timed two-minute air dry, the non-dominant hand of each subject was sampled for baseline using the Glove Juice Sampling technique. Subjects washed their hands as previously described, and the other hand was then sampled using the Glove-Juice technique. These procedures were repeated each day, with the non-dominant hand being used for baseline sampling for each subject on each test day. The water temperature for the handwashes on each test day was adjusted for subjects to wash at a different temperature. Test days one through five were performed at the following water temperatures, respectively: 4.4°C (40°F), 12.8°C (55°F), 21.1°C (70°F), 35°C (95°F), and 48.9°C (120°F).

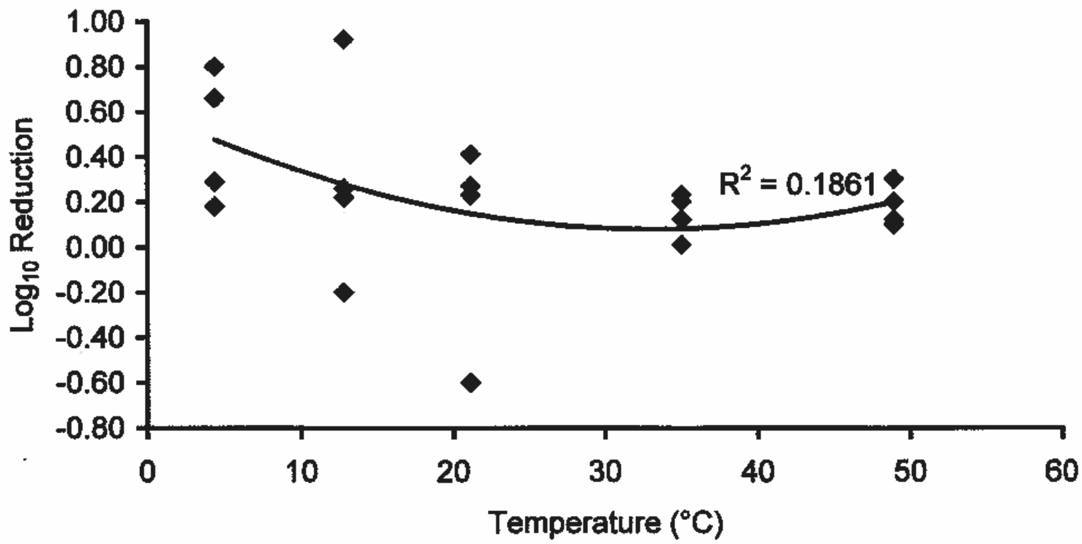
Testing of normal (resident) flora with ground beef

On each of five test days, subjects handled and smeared three grams of gamma-irradiated hamburger meat on their hands for two minutes. After a timed two-minute air dry, the non-dominant hand of each subject was sampled for baseline using the glove juice sampling technique. Subjects washed their hands as previously described, and the other hand was then sampled using the glove-juice technique. These procedures were repeated each day, with the non-dominant hand being used for baseline sampling for each subject on each test day. Wash and rinse temperatures were each day identical to those used for the resident flora with TSB testing.

Testing of transient flora with TSB and gamma-irradiated ground beef

Four laboratory workers, one female and three males, twenty-four to twenty-five years of age, were chosen for this experiment. Testing was performed over a four-week

Figure 2. Handwashing efficacy ($\log_{10}$ reduction) for resident flora in ground beef at selected water washing and rinsing temperatures



period in order to alternate left and right hands for baseline readings for each temperature and inoculum. Testing procedures for the ground beef were identical to testing for normal (resident) flora, with the addition of 1 × 10^8 *S. marcescens*. Testing with TSB was similar to the tests for transient flora, with the following exceptions: the addition of 1 × 10^8 *S. marcescens*, a two-minute massage period of broth into the hands, and a one-minute drying period. Subjects washed their hands as previously described, with the opposing hand being used for baseline on alternate days. Hands were washed as previously described, and the glove juice technique was utilized for recovery.

Methods of analysis of normal (resident) and transient bacteria

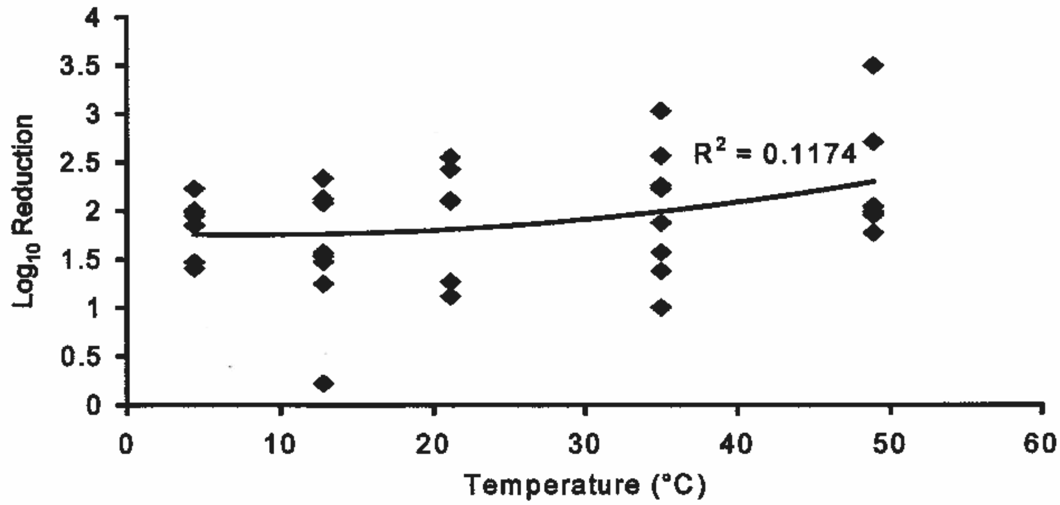
The plate count data collected from this study were evaluated using MiniTab® statistical computer software. Prior to performing a statistical analysis, exploratory data analysis was performed. Stem-leaf ordering, letter value displays, and box plots were generated. Geometric mean colony counts were obtained and log or % reductions in transient and normal flora were determined from these values through comparisons to baseline counts. The experiments were analyzed for significance using statistical ANOVA software. A series of two-sample Student *t*-tests were conducted using the 0.05 significance level for Type 1 (α) error and corrected for multiple comparisons on means.

RESULTS AND DISCUSSION

Because a number of submitters at the Conference for Food Protection brought forward the issue of skin injury and possible scalding at temperature above 43°C (110°F), a review of pertinent literature was undertaken to determine if facts support lowering of the temperature for reasons other than efficacy. The Consumer Product Safety Commission has noted that residential water heater thermostat settings should be set at 49°C (120°F) to reduce the risk of the majority of tap water scald injuries. Although the majority of scalding incidents in the home occur in children under the age of five and in the elderly, third-degree burns are known to result from a 2 s exposure to 66°C (150°F), 6 s at 60°C (140°F) and 30 s at 54.4°C (130°F) *(35)*. As we age, our skin becomes thinner, losing suppleness. This fact is important, as many seniors are now actively involved in the food industry. Due to the elder risk particularly, some have recommended that water be delivered from the tap at even lower temperatures, of less than 43°C (110°F) *(33)*.

The activity of soaps, friction, and rinsing become crucial because the temperatures recommended in handwashing water alone would not provide thermal destruction of pathogenic microorganisms. Relevant to the discomfort issue (brought forward as issues I-23 and I-26) is a study involving dishwashing soaps. In that study, participants could withstand only water temperatures of 43°C, 45°C, and 49°C (110°F, 113°F and 120°F), with tolerance levels related to discomfort peaking at one minute *(9)*. Even though this is considerably longer than the 10 to 25 s exposure period that would result from hand-wash-

Figure 3. Handwashing efficacy (log_{10} reduction) for transient flora (*S. marcescens*) in ground beef at selected water washing and rinsing temperatures



ing, it is indicative of the fact that temperatures from 43°C to 49°C (110° to 120°F) are at the discomfort threshold.

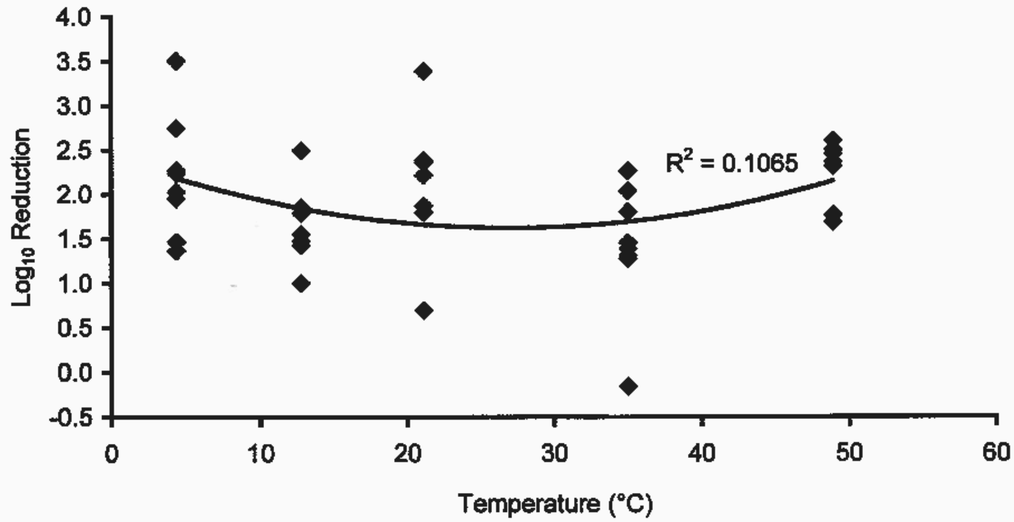
Appropriate handwashing duration (15 seconds) for this study was determined through review of various governmental agency recommendations and previous handwashing study observations (*1, 3, 10, 36*). Suggested lathering times by specific agencies are: the 1999 FDA Food Code (20 seconds) (*36*), the American Society for Testing and Materials (ASTM) (15 seconds) (*3*), The Association for Professionals in Infection Control and Epidemiology (APIC) (minimum of 10 seconds) (*10*), and The American Society for Microbiology (ASM) (a 10 to 15 s vigorous scrub) (*1*). Several studies support a washing duration of at least 10 seconds, with sufficient transient removal efficiency achieved by 30 seconds. A study by Stiles and Sheena (*32*) involving workers in a meat processing facility determined that a wash of 8 to 10 s was too short for adequate soil removal from the hands. A study by Ojajarvi (*21*) compared a 15 s and a two-minute wash, with the latter providing only an additional 3% transient bacterial reduction. Two observational studies were reviewed in the health care and food service industries to determine average durations in the real world. A study of nurses (*34*) revealed an average wash time of 21 s, while a survey of restaurant employees (*4*) showed that the average duration was 20 s.

After experiments were completed, log_{10} reductions of each individual handwashing were calculated by subtracting counts obtained after handwashing from baseline data. Statistical analysis using ANOVA, was performed, with no statistical difference seen between any set of handwashing and rinsing temperatures for normal (resident) or transient flora with either of the two contaminating soils. Figures 1 and 2 show log_{10} reduction results for the range of temperatures used in these experiments for normal (resident) flora soiled with TSB and with gamma irradiated ground beef, respectively. Four data points are provided at each temperature and soil. Two log_{10} reduction data points for both TSB and ground beef appear as negative for transient flora. Polynomial regression analysis was performed to display potential trends even though no statistical significance could be shown. In respect to normal (resident) flora, although rising temperature reduction efficacy seemed to increase slightly with TSB inocula, a slight decrease in efficacy was seen with ground beef. Resident TSB and ground beef R^2 values of 0.0135 and 0.1861, respectively, provide evidence of the lack of a relationship between the two variables.

Figures 3 and 4 show log_{10} reduction results for transient flora in TSB and gamma irradiated ground beef, respectively, at temperatures tested. Only one negative log_{10} reduction figure was observed. While polynomial regression showed a slight increase in efficacy with increasing temperature for ground beef inoculum, both high 48.9°C (120°F) and low 4.4°C (40°F) temperatures tended to have higher log_{10} reductions than the mid temperatures tested. Again, TSB and ground beef R^2 values of 0.1065 and 0.1174, respectively, provide evidence of a lack of relationship between the two variables.

The geometric mean log_{10} reduction for all transient flora experiments involving both TSB and ground beef inocula was 1.9,

Figure 4. Handwashing efficacy (log_{10} reduction) for transient flora (*S. marcescens*) in TSB at selected water washing and rinsing temperatures



whereas the resident flora log_{10} reduction was 0.2 for both menstruum. These log_{10} reduction figures are in agreement with results from other similarly performed studies of both resident *(6, 19)* and transient flora *(2, 7, 26)*.

A comparison of log_{10} reduction variability (as seen in Fig. 1-4) was reviewed for trends that could indicate increased or decreased variability with certain temperatures under specific inoculum conditions. Coefficient of variation values for each temperature group for both resident and transient flora as well as both menstruum were determined by obtaining the ratio of the standard deviations of each group to the mean log_{10} reductions. Figure 5 shows the coefficient of variation (expressed in percent) for each testing condition. Coefficients of variation are fairly consistent for transient flora, with resident flora data exhibiting a great deal of variation. Overall, there appeared to be a slightly lower variation in log_{10} reduction figures for the 48.9°C (120°F) temperature over the 35° C (95°F) group. Variability data from the 4.4°C (40°F) and 12.8°C (55°F) groups were similarly low, with variability for temperature ranges peaking at 21.1°C (70°F). Subjects freely commented that the water at a temperature of 4.4°C (40°F) was uncomfortable. In issues brought before the CFP, temperatures at or above 43°C (110°F) were argued to be uncomfortable. Taken together with the variability noted, it suggests that participants more consistently wash their hands when water temperatures are between 35°C (95°F) and 48.9°C (120°F).

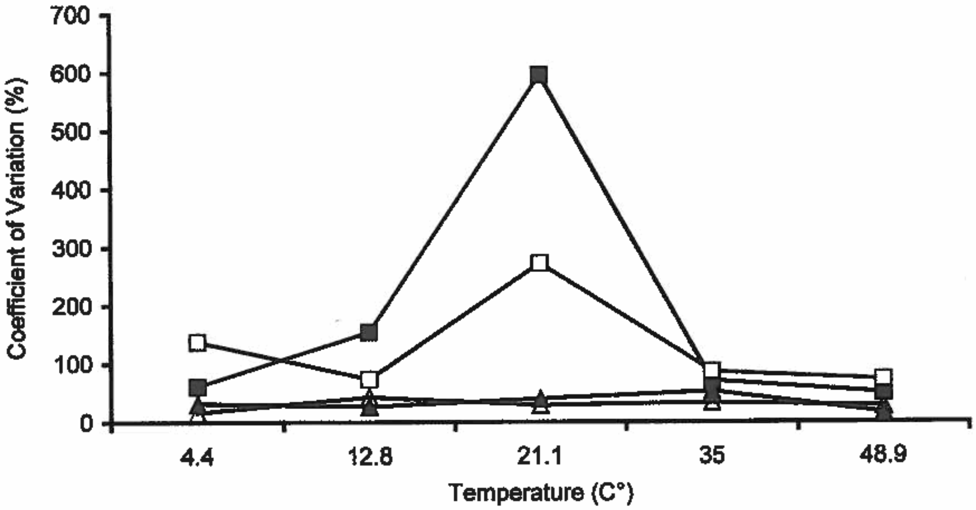
Friction has been identified as a key element in removing microbial contaminants from hands *(11, 27)*. Friction applied during the hand drying process is instrumental in finishing the process. Removal of transient flora appears to be even more friction dependent than removal of resident flora. Surfactant and antimicrobial compounds in soap are responsible for lifting soil and killing microorganisms suspended in the soil. When bland soap is used to wash hands, handwashing efficacy appears to be dependent on the effects of surfactant action of the soap along with friction applied during the washing and rinsing process. Rinsing also provides the necessary removal by dilution. To facilitate appropriate rinsing of the hands, some personal hygiene consultants have suggested the practice of using thicker, higher-viscosity soaps in larger doses, which would require a longer, more vigorous rinsing routine.

Price *(27)*, upon noticing that in his scrubbing experiments water temperature had little effect at de-germing of the skin, commented that water applied to the skin at a given temperature quickly reaches equilibrium with normal skin surface temperature unless hands are totally immersed.

Skin oils derived from sebum are liquid in the sebaceous gland and solidify on the skin surface. Beef tallow melts in the range of 35°C to 40°C (95°F to 104°F), while lard or butterfat are liquefied at temperatures around 30°C (86°F) *(15)*. If handwashing efficacy for both resident and transient floras embedded in both natural and artificially applied fats depended on thermal melting, then log_{10} reduction figures should have been greatest at the highest temperature and least at temperatures that cause these fats to congeal.

Fats such as tallow or lard are distinguished from oils in that oils are liquids at room temperature.

Figure 5. Coefficient of variation values (%) for handwashing $\log_{10}$ reduction of resident and transient flora with TSB and ground beef soils. Resident flora ground beef -■-, resident flora TSB -□-, transient flora TSB -▲-, transient flora ground beef -△-



Hand soap formulations are designed to lift soil through their foaming action, dispersing and solubilizing organic soils using detergent surfactants. Primary micelles are present, having hydrophilic and hydrophobic groups attached to the ends of the surfactant monomer. Soaps with multiple surfactants form mixed micelles, which increases efficiency with various soil mixtures. In water and organic soil mixtures, these form complex micelle structures around hydrocarbon moieties (encapsulation), resulting in microemulsions. Thus, the soap provides a "bridge" between the oily droplet and water, permitting the soapy water to "wash away" greasy material.

Price *(27)* described the contradictory aspect of soap, which tends to reduce surface friction. Soaps of his day were not the more developed formulas now available and used in this experiment. In the experiments described here, a 3-ml aliquot of bland soap was used to remove a total of one gram of TSB or three grams of ground beef. Use of lower quantities of soap would obviously provide lower surfactant effectiveness. The quantity of soap used for handwashing has the ability to affect handwashing efficacy, as shown by Larson *(14)*. Several studies *(13, 16, 17, 18, 19, 21, 25, 29, 31)* have used soap amounts in the range of 2.5 to 5.0 ml in their handwashing protocol. The higher levels are considered excessive, except in hospital infection control. Many food service operations set soap dispensers at 1 ml per pump, and employees often times use multiple pumps. As the experiments described here utilized 1.5 grams ground beef menstruum per hand, 3 ml of soap was chosen to represent an amount found to be significantly effective in an earlier study *(14)*. In that study, it was determined that 3-ml of soap provided greater bacterial reductions than did 1 ml for a liquid, nonantimicrobial soap. Observations of soap usage by health care employees in the hospital setting were also performed, as nine different departments, from labor and delivery to psychology, determined average soap use to be around 2.18 ml per incidence, compared to 3.5 by the general population *(14)*.

Surfactants in soap have surface tension lowering capabilities. The vigorous rubbing action of hands creates a rapid formation of surfaces and changing pressure gradients, which develop and increase micelle formation. The combined action of soap, friction and dilution appears to outweigh any advantage that temperature might have in the liquefying of fats, which would normally occur in the range of 30°C to 40°C (86°F to 104°F).

Many antimicrobials are inactivated by the presence of organic soils or soaps. Several writers have suggested that these antimicrobial ingredients present in soaps are not in contact with microorganisms long enough to provide sufficient antimicrobial action. Of the commonly used antimicrobial ingredients employed in soap products, only iodophors have been shown to exhibit temperature-dependent antimicrobial effects due to temperature-dependent dissociation constants for PVP and iodine present in the formulation. For these reasons, even if antimicrobial agents were present in soap, it is doubtful that water temperature would have a significant effect on overall hygienic efficiency. It should also be noted that under real-life conditions, hands would be dried (usually with paper towels) and that further bacterial reductions in the range of 1 $\log_{10}$ are seen, reducing any slight difference in efficacy with antimicrobial soaps.

ACKNOWLEDGMENTS

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TOWARDS DEVELOPMENT OF AN ALGORITHM FOR MAINS WATER TEMPERATURE

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ABSTRACT

Mains water temperature (T_{mains}) has significant influence on the energy consumption of water heating equipment. It is dominantly influenced by ambient temperature (T_{amb}). Since T_{amb} is roughly an annual sinusoid, T_{mains} is assumed to be a sinusoid whose mean value varies directly with annual average temperature $T_{amb,ann}$. Model parameters are based on water system physics and include: i) a constant offset from $T_{amb,ann}$; and ii) amplitude and phase which vary linearly with $T_{amb,ann}$. Available T_{mains} data indicate that the offset is ~6 °F, and that the amplitude is $\sim 0.4\Delta T_{amb}$ Uncertainties include: i) data quality issues, including bias of T_{mains} data from heat exchange with house air; ii) inherent spatial variations in mains networks, and iii) limited data sets. Future work includes acquiring quality data sets, testing the model in northern climates, and .refining parameter estimates.

1. INTRODUCTION

Mains water temperature (T_{mains}) is the temperature of the water supplied to the house piping from the water utility's distribution mains piping. T_{mains} affects energy consumption of all water heaters, and its accuracy is of interest. There will be some error (denoted δT_{mains}) in algorithms estimating T_{mains} at any site. δT_{mains} induces a corresponding error in a prediction of water heater energy. For a conventional storage tank water heater (WH) over a period Δt, differentiating the long-term tank energy balance with storage tank losses and manipulating yields:

$$\delta Q_{WH}/Q_{WH} = -[\delta T_{mains}/(T_{set}-T_{mains})][EF_{WH}/\eta_{burn}] \qquad (1)$$

For solar collectors, the temperature difference and incident radiation determine efficiency, as in Fig. 1. δT_{mains} induces an error in the inlet temperature, sliding the operating point along the efficiency curve, as in Fig. 1. Taking differentials of the linear form of the collector efficiency equation yields:

$$\delta\eta_{coll}/\eta_{coll} = -F_rU_l*\delta T_{mains}/(\eta_{coll}I) \qquad (2)$$

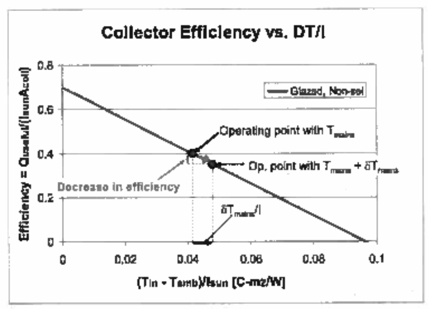

Fig. 1. Collector efficiency plot, showing the decrease in collector efficiency with $\delta T_{mains} > 0$.

Table 1 gives the uncertainty in annual energy calculations for the cases of Eqs. 1,2 with an assumed error of δT_{mains} =+3 °C. This value is the difference between the T_{mains} algorithm in (1) and the preliminary algorithm here (Sec. 4). Using values noted in Table 1, errors are 7%-9% in these two simple cases. Although not overwhelmingly large, these errors are large enough to motivate minimizing error in T_{mains} algorithms.

TABLE I. ANALYSIS SENSITIVITY TO T_{mains}

Analysis Result	Potential Error[1]
Conventional WH annual energy[2]	-7.1%
SWH annual savings[3]	-9.3%

1. Error from Eqs. 1,2, with δT_{mains} = 3 °C.
2. T_{set}=50°C;T_{mains}=10°C;EF_{tank}=.95 @V_{draw}=64 gal/day; η_{burn}=0.8.
3. $(F_rU_l)_{coll}$= 5 W/m^2°K; I_{avg} = 400 W/m^2; η_{coll}= 0.4.

Previous work in the solar community on T_{mains} has been limited, and the algorithms used in modeling tools have not been well-documented. Existing modeling algorithm types include: i) sinusoid fit to air-temperature data, as in (1); and ii) empirical fit, e.g., expressing $T_{mains,mon}$ as a polynomial in $T_{amb,mon}$ (2). Modeling T_{mains} as a sinusoid with parameters based upon local weather results from recognizing that i) T_{mains} is a strong function of T_{amb}; and ii) T_{amb} is roughly sinusoidal, as shown in Fig. 2. The sinusoid model in (1) calculates T_{mains} as:

$$T_{mains,ref(1)} = T_{amb,ann} + R\Delta T_{amb}\sin(\omega_{ann}t - \phi_{amb} - \phi_{mains}) \quad (3)$$

ΔT_{amb} is taken as $[(T_{mon,max} - T_{mon,min})/2]$, and the ratio R is taken as a constant at 0.05. The sinusoid algorithm developed in this study is similar in that T_{mains} has the same direct dependence on local $T_{amb,ann}$ and has amplitude proportional to ΔT_{amb}. The model presented here differs in form from Eqn. 3 by: i) adding in a constant offset (ΔT_{offset}); and ii) expressing R and ϕ_{mains} as linear functions of $T_{amb,ann}$. ΔT_{offset} accounts for factors (such as sun and plant transpiration) which cause the annual average surface temperature to differ from $T_{amb,ann}$. Dependence of R and ϕ on $T_{amb,ann}$ reflects expected consequences of burying pipes deeper in colder climates to prevent freezing.

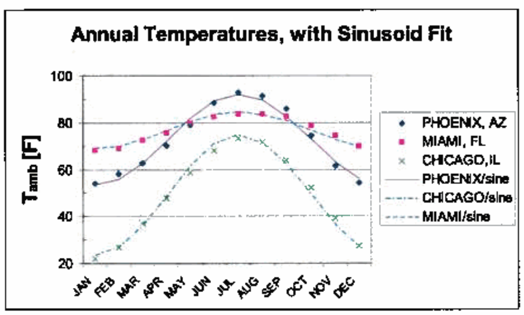

Fig. 2. Monthly air temperature data for three sites, with sine model fits based upon the average and extreme.

2. WATER NETWORKS: GENERAL ISSUES

A block diagram of a potable water supply system is shown in Fig. 3. It is complex, with many factors influencing the water temperature. T_{amb} is a dominant factor, heavily influencing water temperature at all stages of the system, as indicated in Fig. 3. For purposes here, it is useful to break the system into three parts: i) supply, including source, treatment, and storage; ii) mains, the mains distribution line from the storage tank to the house; and iii) house, the piping from mains to the house boundary, and the piping internal to the house. The quantity of interest here is T_{mains}.

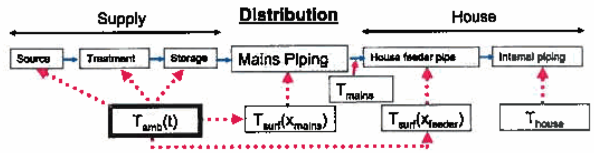

Fig. 3. Block diagram of a potable water supply system, showing importance of T_{amb} on T_{mains}.

2.1 Supply

System water supply comes from surface waters or from well water. Surface waters vary seasonally in temperature, with rivers varying more than lakes/reservoirs. Well water temperature beyond ~30 ft. is constant at the deep-ground temperature, which is close to $T_{amb,ann}$ (3). A local well with "short" piping to the house is a special case of the correlation here, for local wells, the sinusoid expressing annual variation would be dropped. Storage is usually in closed metal tanks exposed to the ambient air. For a well-mixed tank coupled to a constant T_{amb}, the time constant is of order one week, depending on tank size.

2.2 Mains Distribution Piping

The mains distribution piping subjects the water in the pipe to the dynamic influence of ground temperature at the depth to which the pipe is buried ($T_{grd}(z_{pipe},t)$), as in Fig. 4. Mains pipes are typically tens of miles long, and may be a complex maze of interconnecting pipes, valves and pumps, fed by multiple storage tanks supplied from a variety of sources. Modeling temperature in such a complex network would require a vast amount of dynamic information, and direct modeling is considered impractical. Nonetheless, solution of simplified problems may be useful to provide some insight into general features of distribution systems.

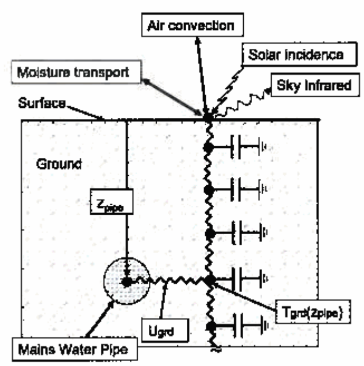

Fig. 4. Buried pipe schematic, with surface energy balance terms and schematic heat transfer model.

2.2.1 Spatial variation in T_{mains}. Generally, T_{mains} is a function of both time and position down the pipe leading from the storage tank, i.e., $T_{mains} = T_{mains}(x_{pipe}, t)$. Variation is due to ground interaction and other factors (such as different sources/storage tanks supplying different parts of the network). To illustrate the ground influence, consider the idealized problem of a single pipe at constant depth z_{pipe}, as shown in Fig. 4. Assume $T_{surf}(t)$ is uniform along the pipe length. If the ground capacitance is ignored and assumptions made as in Fig. 4, the temperature along the pipe is given as

$$T_{mains}(x_{pipe}) = T_{grd}(z_{pipe}) + [T_{mains\text{-}in} - T_{grd}(z_{pipe})]\exp(-x_{pipe}/x_0) \quad (4)$$

where $x_0 = (\rho_{water} c_p D_{pipe} v_{pipe} / 4U_{grd})$. Fig. 5 shows x_0 as a function of v_{pipe} for an 8" diameter pipe. Designs will limit $v_{pipe,max}$ to ~3 ft/sec at anticipated peak demand to avoid pipe-wall erosion. However, $v_{pipe,avg}$ might be 1/10th that value. At higher velocities and shorter distances, the water will not have come into equilibrium with the ground, and T_{mains} is in between T_{amb} and $T_{grd}(z_{pipe})$. At lower velocities/longer lengths, equilibrium between the water and the ground will be attained, and $T_{mains} = T_{grd}(z_{pipe})$.

Variation in T_{mains} throughout the distribution system is significant. Fig. 6 shows data taken across the metropolitan Denver area over a two-week period in Jan. 2007, a time period near the minimum point in T_{mains} where dT_{main}/dt should be small. The spread is ~10 °F. Data in figs. 9d, 9f (at paper's end) show that T_{mains} varies significantly within these two metropolitan areas also. The effect may partly or entirely be due to ground interaction. We conclude that: *a T_{mains} correlation can provide only an average across the water network. For any individual home, T_{mains} may differ from the correlation by up to ± 5 °F.*

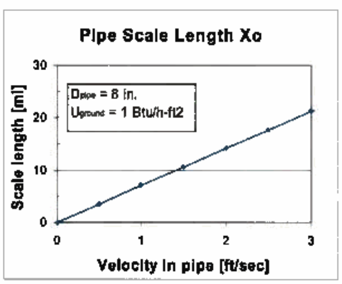

Fig. 5. Scale length x_0 for mains piping as a function of velocity in the pipe. x_0 is defined in Eqn. 4; it is the distance where $T_{mains} = T_{grd}(z_{pipe}) + (T_{mains\text{-}in} - T_{grd}(z_{pipe}))/e$.

2.2.2 Ground Temperature. An analytical solution to the ground temperature problem provides guidance for choice of the form of the correlation for T_{mains}. $T_{grd}(z_{pipe}, t)$ is determined by the ground surface temperature $T_{surf}(t)$ (3). If $T_{surf}(t)$ is given as a sinusoid [i.e., $T_{surf,ann} + \Delta T_{surf}\sin(\omega_{ann}t - \phi_{amb})$], then solution of the ground conduction boundary value problem (assuming no moisture convection or freeze/thaw occurs) is given by Eqn. 5 (from (3)):

$$T_{grd}(z,t) = T_{surf,ann} + R(z)\Delta T_{surf}\sin(\omega_{ann}t - \phi_{amb} - \phi_{lag}(z)) \quad (5)$$

where: $R(z) = \exp(-z/z_0)$, $z_0 = \sqrt{[2\kappa/\omega_{ann}]}$, $\kappa = k_{grd}/(\rho_{grd}c_{grd})$, and $\phi_{lag}(z) = z/z_0$.

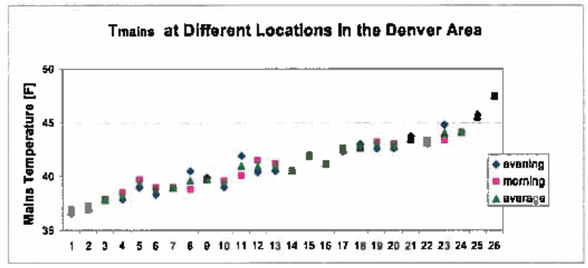

Fig. 6. Mains temperature at different locations in the same area. Data were taken in the Denver Metropolitan area, in mid-Jan. 2007.

Fig. 7 shows $T_{grd}(z_{pipe})$ plots at three depths from Eqn. 5 for Phoenix, Arizona. The curves show the progressive reduction in sinusoid amplitude and increased phase lag as depth increases.

$T_{surf}(t)$ is influenced by a number of factors, as indicated in Fig. 4. It is most strongly coupled with T_{amb}, but is affected by absorbed solar radiation, sky infrared fluxes, rainfall and water percolation, evapotranspiration from plants, snow cover, and freeze-thaw dynamics. In general, we expect

$$T_{surf,ann} = T_{amb,ann} + \Delta T_{offset} \text{ and } \Delta T_{surf} \approx \Delta T_{amb} \quad (6)$$

All the physical drivers but T_{amb} are lumped into the constant ΔT_{offset}. If solar radiation is the largest influence, as expected, we would expect ΔT_{offset} to be positive.

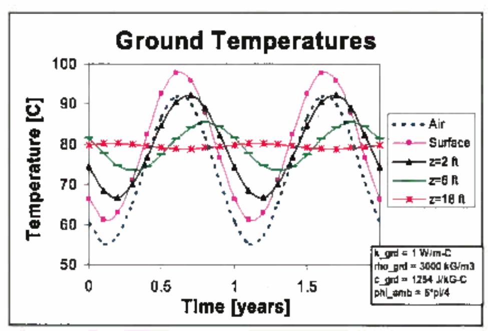

Fig. 7. Plot of $T_{grd}(z,t)$ vs. time for Phoenix, for a 2-year period. T_{amb}, T_{surf}, and T_{grd} at 3 depths are shown.

2.3 House piping

The feeder pipe from the mains to the house boundary may affect T_{mains}, mainly because there may be a very different surface temperature above the feeder pipe (e.g., under a lawn), as opposed to the mains pipe (e.g., under the street). The piping internal to the house generally has a significant affect on the temperature showing up at the end-use points (4), as illustrated in Fig. 8. After a period of several hour with no draws, the water in the house piping will be at temperature T_{house}. As in Fig. 8, the draw-off temperature T_{tap} starts out steady at T_{house}, until a volume of water ~equal to the volume of the upstream piping is drawn. T_{tap} then decays to T_{mains} after draw volume is ~1.5-2.0V_{piping} (4). *For a spot measurement, one should draw at the highest rate possible (e.g., bathtub tap) and wait until the temperature is stable (e.g., 3-5 minutes).* Data in Fig. 6 were ostensibly taken under this protocol.

When using a data-logger, T_{mains} data must be logged conditionally, i.e., data from the T_{mains} sensor reading is taken only when there is a draw. If not, the sensor average is near T_{house} and is meaningless. However, conditional logging still introduces a bias, especially for short draws. If a two minute draw occurs as in Fig. 8 and the data are conditionally averaged over the entire draw, the average T_{draw} value- when interpreted as T_{mains}- is skewed by about 15 °F. *With data loggers, one should not accept T_{mains} data until the draw has gone on for 5 min. or so.* It is not known how much this affect contaminates conditionally-logged T_{mains} data from various sources. Note that to accurately estimate the temperature coming into an end-use point (like a water heater), one must model the effect of the pipes between the feeder pipe take-off and the end-use point. Energy to warm or cool the mains water in the house pipes is provided by the house's HVAC systems, trading off with water heater energy. These effects are seldom modeled.

3. T_{mains} CORRELATION

The form of the correlation for $T_{mains}(T_{amb})$ should be a constant + sinusoid, since T_{amb} and T_{surf} are ~sinusoids:

$$T_{mains} = T_{mains,avg} + \Delta T_{mains}\sin(\omega_{ann}t - \phi_{amb} - \phi_{mains}) \qquad (7)$$

It is assumed that T_{amb} is at a minimum on January 15, implying ϕ_{amb} is to be taken as 104.8° (1.830 rads). The constant term is linear in $T_{amb,avg}$ with an offset similar to that used in Eqn. 6:

$$T_{mains,avg} = T_{amb,avg} + \Delta T_{offset} \qquad (8)$$

ΔT_{mains} and ϕ_{lag} are formulated from trends shown in Eqn. 5. The amplitude in Eqn. 5 is proportional to ΔT_{amb}, and decreases with increasing depth z. Since pipes are buried deeper the colder the climate, we expect R to decrease with decreasing $T_{amb,ann}$. Using a linear function and injecting a reference temperature ($T_{ref} \equiv 44$ °F) so that K_1 is the value of R at $T_{amb,ann} = T_{ref}$, one has:

$$\Delta T_{mains} = R\Delta T_{amb} = [K_1 + K_2(T_{amb,ann} - T_{ref})]\Delta T_{amb} \qquad (9)$$

Similarly, the phase lag ϕ_{mains} is expected to increase with increased z_{pipe}, as in Eqn. 5 and Fig. 7, and a similar linear expression for ϕ_{mains} is proposed (expecting $K_4 < 0$):

$$\phi_{lag} = K_3 + K_4(T_{amb,ann} - T_{ref}) \qquad (10)$$

ΔT_{offset} and $\{K_i, i=1,4\}$ are parameters to be determined by fitting to data sets for T_{mains} spanning a wide range of $T_{amb,ann}$.

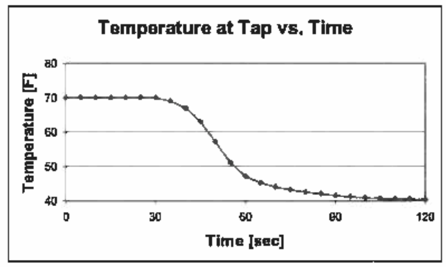

Fig. 8. Temperature at a cold water tap with draw, given no previous draw for several hours. After purging the upstream pipe volume, the tap outlet temperature transitions from T_{house} (~70 °F) to T_{mains} (~40 °F).

There is a practical difficulty in determining the values for the T_{amb} variables in Eqn. 7-10, because T_{amb} data should be coincident with the T_{mains} data. Ideally, T_{mains} data sets should provide $T_{amb}(t)$, overlapping the T_{mains} data (and also ideally extending back in time for a year or so). If average weather like TMY2 (5) is used for calculating T_{amb} values, a random error equal to the RMS variation of annual average temperature (~1 °C) is introduced. Data from other sources such as (6) could be used to get coincident T_{amb} data if not available from the data set directly.

4. DATA SETS AND CORRELATION COEFFICIENTS

Data sets used in this study are shown in Figs. 9a-9i (from (2), (7), and (8)). Local well-water sites in (7) were identified based upon T_{mains} being ~constant and were removed from the analysis. TMY2 data (5) was used for T_{amb} in all cases. The model results are also shown in Figs 9-17. The parameters of the model for the fit shown here are given in Table 2. RMS error between model and data across the sites in Figs. 9a-9i is ~4 °F. The model for the coldest climate (Fig. 9a, Duluth Minnesota) is low by ~13 °F. This may indicate affects of freeze-thaw or snow cover (which invalidate the simple ground model used in Sec. 2). However, other northern sites do not show similar poor fits. Otherwise, the model-data discrepancies are small, usually within 5 °F or so. Variation of R and ϕ_{lag} with $T_{amb,ann}$ is shown in Fig. 10. The ratio R ranges from ~0.35 (coldest) to ~0.7 (hottest) across the continental U.S. Similarly, the phase lag ϕ_{mains} ranges from about ~10° (hottest) to ~40° (coldest).

TABLE 2. PARAMETERS FOR T_{mains} CORRELATION

Parameter	Value
ΔT_{offset}	6.0 °F
K_1	0.4
K_2	+0.010 °F^{-1}
K_3	35 Deg
K_4	-0.01 Deg/°F

5. CONCLUSIONS AND FUTURE WORK

Results in common water heating analyses depend on T_{mains}, and typical uncertainty/error in T_{mains} can lead to ~10% error in calculations. Data show that T_{mains} varies along the distribution network by ±5 °F, implying that any simple T_{mains} algorithm can provide only an average value. From general consideration of water systems, it is concluded T_{mains} is heavily influenced by T_{amb}, which is sinusoidal. A sinusoidal correlation linear in $T_{amb,ann}$ is proposed, introducing several new parameters. The average value of T_{mains} is $T_{amb,ann}$ plus an offset $\Delta T_{offset} \approx 6$ °F. The amplitude is given as $R\Delta T_{amb}$, with $R \approx 0.4$ and R decreasing linearly with decreasing $T_{amb,ann}$. The phase lag between T_{mains} and T_{amb} decreases linearly with increasing $T_{amb,avg}$. Data from 9 areas in the U.S. were used to determine coefficients. It is not known if the data are biased by residual influence of T_{house} on T_{mains} data, but it is likely that is the case. This would show up as an increase in ΔT_{offset} (i.e., bias in the T mains algorithm). Additional data are being sought to test the algorithm form and reduce error in parameter estimates. The algorithm form may need to be modified for cold climates where ground freeze and snow cover exist in winter-time.

6. ACKNOWLEDGMENTS

The authors acknowledge funding from the U.S. Department of Energy's Solar Energy Technology Program, Solar Heating and Lighting (SH&L) sub-program, managed by Tex Wilkins and Glenn Strahs.

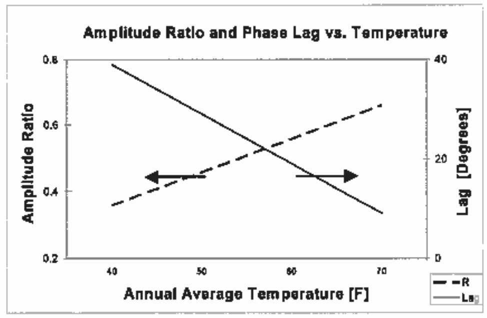

Fig. 10. Amplitude ratio R and phase lag ϕ_{lag} vs. $T_{amb,ann}$.

7. NOMENCLATURE

Symbols

A	Area of collector
c_p	Heat capacity at constant pressure
D	Pipe diameter
e	natural logarithms base, ~2.72
EF	Energy factor of tank ($Q_{to-load}/Q_{energy-in}$)
F_r	Heat removal factor in collector theory
k	Conductivity of soil
K	Constant in T_{mains} correlation
I	Solar irradiance in the plane of the collector
M	Mass (of water)
Q	Energy
R	Ratio of amplitudes, $\Delta T_{gnd}(z)/\Delta T_{surf}$
t	Time
T	Temperature
U	Loss coefficient
V	Volume contained in piping
x	Horizontal distance down the mains pipe
x_0	Scale length (1/e distance)
z	Vertical distance down from ground surface
z_0	Scale length for temperature decay (1/e distance)
Δ	Amplitude or difference
κ	k/ρc
η	Efficiency (collector or fuel conversion)
ρ	Density
ω	Angular frequency

Subscripts

amb	Ambient air dry bulb temperature
ann	Annual time period (one year period)
avg	Average value
burn	burner (for gas water heaters)
coll	Collector
i	Index for data points or correlation parameters
in	Inlet to pipe or end use
mains	Water in the mains distribution piping
mon	Month time period

offset	ΔT shift from $T_{amb,ann}$ in T_{mains} correlation
pipe	Mains distribution or house internal piping
ref	Reference temperature, ~ U.S. average
set	Set-point temperature of water heater
tap	End-use point in the house
WH	Water heater

8. REFERENCES

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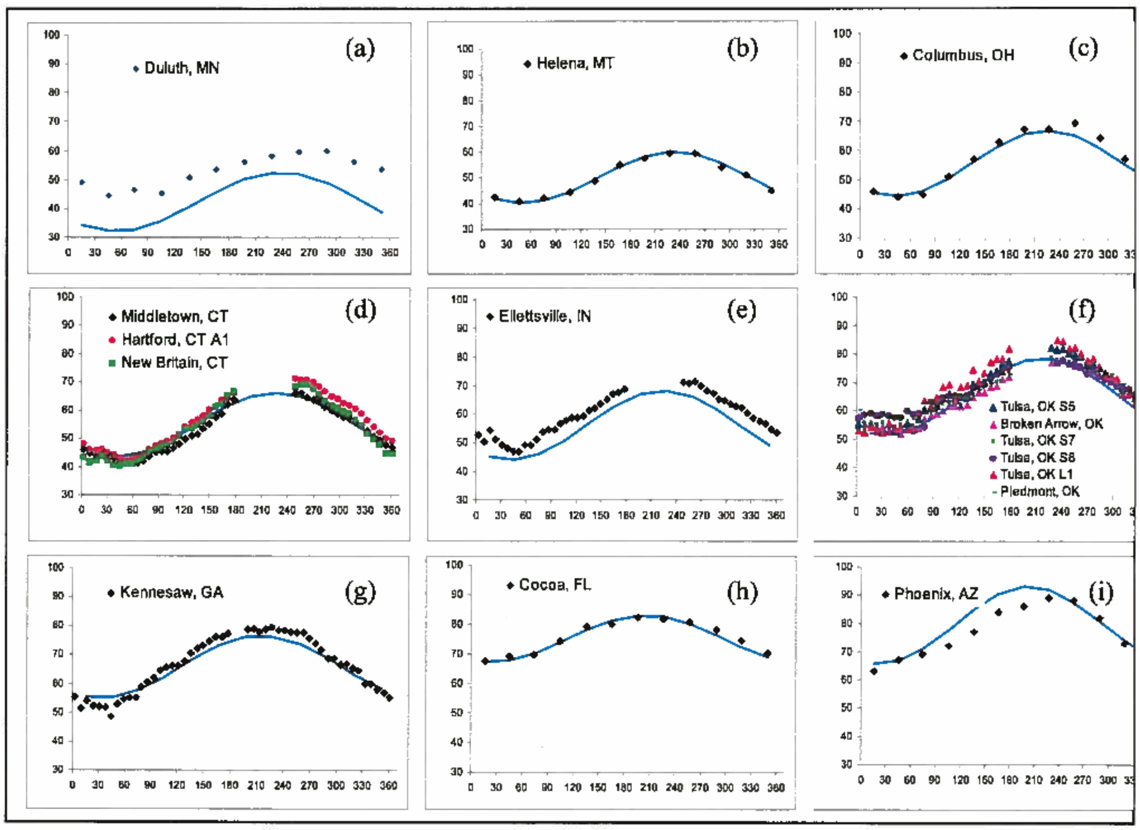
(8) Private communication from Tim Moss, Sandia National Laboratory, Albuquerque, NM.



Figs. 9a-9i. T_{mains} data over a year for 9 U.S. locations, with Julian Day on the x axis, and T_{mains} on the y axis, for all plots. Data are shown as symbols, and the T_{mains} correlation result is the blue curve, using TMY2 data to calculate the T_{amb} terms in Eqs. 7-10.

P8166

Date Submitted	12/14/2018	**Section**	403.1.3	**Proponent**	Mo Madani
Chapter	4	**Affects HVHZ**	No	**Attachments**	Yes

TAC Recommendation Approved as Submitted
Commission Action Pending Review

Comments

General Comments **No** **Alternate Language** **No**

Related Modifications

None

Summary of Modification

To clarify that the ratio established by potty parity is not required to be maintained for the additional fixtures provided in excess of the minimum required fixtures.

Rationale

Incorporating Commission's declaratory statements as required by 553.73(7)(d), Florida Statutes.

DS 2017-033

Fiscal Impact Statement

Impact to local entity relative to enforcement of code

There is no fiscal impact on the local entity relative to enforcement. The proposed code change provides for needed clarification to the code.

Impact to building and property owners relative to cost of compliance with code

There is no fiscal impact to building and property owners relative to the cost of compliance.

Impact to industry relative to the cost of compliance with code

There is no fiscal impact to industry relative to the cost of compliance.

Impact to small business relative to the cost of compliance with code

Has a reasonable and substantial connection with the health and safety and welfare of the general public.

Requirements

Has a reasonable and substantial connection with the health, safety, and welfare of the general public

Has a reasonable and substantial connection with the health and safety and welfare of the general public.

Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction

Strengthens or improves the code by making the code requirements clearer to the user.

Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities

Does not discriminate against materials, products, methods, or systems of construction.

Does not degrade the effectiveness of the code

Does not degrade the effectiveness of the code.

403.1.3 Potty parity. In assembly occupancies, restrooms which are open to the public must have a ratio of 3:2 water closets provided for women as the combined total of water closets and urinals provided for men, unless these are two or fewer such fixtures for men, in accordance with §553.86, *Florida Statutes*. The ratio established by potty parity is not required to be maintained for the additional fixtures provided in excess of the minimum required fixtures.

(No change to remaining text)

FILED
Department of Business and Professional Regulation
Deputy Agency Clerk
CLERK Brandon Nichols
Date 9/28/2017
File # 2017-07686

STATE OF FLORIDA
BUILDING COMMISSION

In the Matter of

ELITE CONSULTING SWFL

DS 2017-033

Petitioner.
_____________________________/

DECLARATORY STATEMENT

The foregoing proceeding came before the Florida Building Commission (Commission) by a Petition from Tatiana Gust, for Elite Consulting SWFL (Petitioner) that was received May 24, 2017. Based on the statements in the petition, the material subsequently submitted and the subsequent request by the Petitioner, the Commission states the following:

Findings of Fact

1. The Petition is filed pursuant to, and must conform to the requirements of Rule 28-105.002, Florida Administrative Code.

2. Petitioner's representative in this matter is Tatiana Gust, 2670 N. Horseshoe Dr., Suite 205, Naples, FL 34104.

3. Petitioner provides plan review, inspection, and consulting services for building projects. Petitioner is in the process of reviewing plans for a clubhouse in a private golf club community. The design professional wishes to include additional bathroom fixtures above the minimum amount required for the building's occupancy load.

4. Petitioner seeks clarification of Sections 403.1.3 and 403.3 of the Florida Building Code, Plumbing, 5th Edition (2014), with respect to the application of "potty parity" plumbing fixture requirements to its project.

5. Specifically, the Petitioner requests answers to the following questions based upon the project described within the petition for declaratory statement:

1. Are bathroom facilities located within a private membership clubhouse considered to be open to the public? Specifically, the verbiage qualifying the applicability of section 403.1.3 applies to the facility that we have described?

2. For the project in question, once the minimum number of required plumbing fixtures is provided in accordance with section 403.1 and section 403.1.3 of the 2014 Florida Plumbing Code based on the occupant load for the building, does the ratio established by potty parity have to be maintained for the additional fixtures provided in excess of the minimum requirements?

Conclusions of Law

6. The Commission has the specific statutory authority pursuant to Section 553.775(3)(a), Florida Statutes (2017) to interpret the provisions of the Florida Building Code by issuing a declaratory statement.

7. Section 403.1.3, Florida Building Code, Building, 5th Edition (2014), states:

> **Minimum number of fixtures**. Plumbing fixtures shall be provided for the type of occupancy and in the minimum number shown in Table 403.1. Types of occupancies not shown in Table 403.1 shall be considered individually by the code official. The number of occupants shall be determined by the Florida Building Code, Building. Occupancy classification shall be determined in accordance with the Florida Building Code, Building.

8. Section 403.1.3.1, Florida Building Code, Building, 5th Edition (2014), states:

> **Potty parity.** In assembly occupancies, restrooms which are open to the public must have a ratio of 3:2 water closets provided for women as the combined total of water closets and urinals provided for men, unless these are two or fewer such fixtures for men, in accordance with Section 553.86, Florida Statutes.
>
> **Exception:** This section does not apply to establishments licensed under Chapter 509, Florida Statutes, if the establishment does not provide meeting or banquet rooms which accommodate more than

150 people, and the establishment has at least the same number of water closets for women as the combined total of water closets and urinals for men.

9. Section 202, Florida Building Code, Plumbing, 5th Edition (2014), provides the following definitions:

PRIVATE. In the classification of plumbing fixtures, "private" applies to fixtures in residences and apartments, and to fixtures in nonpublic toilet rooms of hotels and motels and similar installations in buildings where the plumbing fixtures are intended for utilization by a family or an individual.

PUBLIC OR PUBLIC UTILIZATION. In the classification of plumbing fixtures, "public" applies to fixtures in general toilet rooms of schools, gymnasiums, hotels, airports, bus and railroad stations, public buildings, bars, public comfort stations, office buildings, stadiums, stores, restaurants and other installations where a number of fixtures are installed so that their utilization is similarly unrestricted.

10. In response to Petitioner's question 1, the answer is yes, pursuant to Sections 202 and 403.3, Florida Building Code, Plumbing, 5th Edition (2014), bathroom facilities located within the building in question are subject to the provisions applicable to public or public utilization plumbing fixtures.

11. In response to Petitioner's question 2, the answer is no; since the minimum number of required plumbing fixtures is provided in accordance with Sections 403.1 and 403.1.3, Florida Building Code, Plumbing, 5th Edition (2014), the ratio established by potty parity is not required to be maintained for the additional fixtures.

DONE AND ORDERED this 26th day of September, 2017, in Jacksonville, Duval County, State of Florida.

Richard S. Browdy
RICHARD S. BROWDY
Chairman, Florida Building Commission

NOTICE OF RIGHT TO APPEAL

Petitioner and all other interested parties are hereby advised of their right to seek judicial review of this Order in accordance with Section 120.68(2)(a), Florida Statutes (2017), and Florida Rules of Appellate Procedure 9.110(a) and 9.030(b)(1)(C). To initiate an appeal, a Notice of Appeal must be filed with the Agency Clerk, Department of Business and Professional Regulation, 2601 Blair Stone Road, Tallahassee, Florida 32399-2203 and with the appropriate District Court of Appeal not later than thirty (30) days after this Order is filed with the Clerk of the Department of Business and Professional Regulation. A Notice of Appeal filed with the District Court of Appeal shall be accompanied by the filing fee specified by Section 35.22(3), Florida Statutes (2017).

CERTIFICATE OF FILING AND SERVICE

I HEREBY CERTIFY that a true and correct copy of the foregoing order has been filed with the undersigned and furnished by U. S. Mail to the persons listed below this 28th day of September, 2017.

Brendan M. Nichols

Agency Clerk's Office
Department of Business and Professional Regulation
& Florida Building Commission
2601 Blair Stone Road
Tallahassee, Florida 32399-2203

Via U.S. Mail

Elite Consulting SWFL
Attn: Tatiana Gust
2670 N. Horseshoe Dr., Suite 205
Naples, FL 34104

Via Inter-Office or Email Delivery

Mo Madani, Planning Manager
Codes and Standards Section
Department of Business and Professional Regulation
2601 Blair Stone Road
Tallahassee, Florida 32399
Mo.Madani@myfloridalicense.com

Marjorie Holladay
Joint Administrative Procedures Committee
Pepper Building, Room 680
Tallahassee, Florida 32399-1300

PETITION FOR DECLARATORY STATEMENT
BEFORE THE FLORIDA BUILDING COMMISSION

DS 2017-033

Company: Elite Consulting SWFL
Address: 2670 N Horseshoe Dr, Suite 205
Naples, FL 34104

Name: Tatiana Gust
Title: Principal
Telephone: (239) 280-0570
Email: Tatiana@eliteSWFL.com

Statute(s), Agency Rule(s), Agency Order(s) and/or Code Section(s) on which the Declaratory Statement is sought:

2014 Florida Plumbing Code (FPC)
Section 403.1.3 Potty parity

Background:
Elite Consulting of SWFL is a private provider company as defined in the Florida Statutes 553.79. We provide plan review, inspections, and consulting services for building projects in the South West Florida area. We currently have a commercial project, which we are providing plan review and inspections services for. This project consists of the replacement of an existing clubhouse within a private golf club community. The new private membership clubhouse contains a dining room area, locker room area, reading area, and other amenities within the building. The building is classified as A3 with an occupant load of 450 occupants. Based in this occupant load the design professional determined that the required number of water closet/urinals is 2 male fixtures and 4 female fixtures per the Florida Plumbing Code section 403.1. This calculation also satisfies the ratio of 3:2 female to male number of WC/Urinals fixtures as required on section 403.1.3 of the Florida Plumbing Code.

To provide convenience for the club members, the design professional would like to provide additional WC/Urinals for both male and female. The proposed building is to have (8) fixtures for male and (6) fixtures for female. The club members that use the facility on a daily basis are majority male, and use the building while they play golf in the surrounding areas. There are also social events, such as holiday parties held at this facility where members can have additional guests.

In previous projects, the local building department has required us to maintain the ratio of section 403.1.3. for fixtures above the minimum required by the code. In working with the design professional, the question has risen about providing the minimum required by the code and what the criteria is for providing fixtures beyond the minimum requirements.

Also, during our study of the project another question came up with regards to "restrooms open to the public" since this is a qualifying statement for the applicability of section 403.1.3. Our client maintain that this is a private membership facility for the residents and guests of the subdivision that the clubhouse serves.

For the above mentioned reasons, Elite Consulting of SWFL, seeks clarification of these requirements as "substantially affected person" under the procedures set forth in F.S. 553.775.

Per the 2014 Florida Building Code, Building section 201.4 Terms not defined. Where terms are not defined through the methods authorized by this section, such terms shall have ordinarily accepted meanings such as the context implies.

Definition of Clubhouse per Merriam-Webster (1) a house occupied by a club or used for club activities, (2) locker rooms used by an athletic team, (3) a building at a golf course typically housing a locker room, pro shop, and restaurant.

Per 5th Edition of the Florida Plumbing Code

> **Section 403.1.3 Potty Parity.**
> In assembly occupancies, restrooms which are open to the public must have a ratio of 3:2 water closets provided for women as the combined total of water closets and urinals provided for men, unless these are two or fewer such fixtures for men, in accordance with Section 553.86, Florida Statutes.
>
> **Exception:** This section does not apply to establishments licensed under Chapter 509, Florida Statutes, if the establishment does not provide meeting or banquet rooms which accommodate more than 150 people, and the establishment has at least the same number of water closets for women as the combined total of water closets and urinals for men.

Per Florida Statutes 2016

> **F.S. 553.86** Public restrooms; ratio of facilities for men and women; application; incorporation into the Florida Building Code.—The Florida Building Commission shall incorporate into the Florida Building Code, to be adopted by rule pursuant to s. 553.73(1), a ratio of public restroom facilities for men and women which must be provided in all buildings that are newly constructed after September 30, 1992, and that have restrooms open to the public. This section does not apply to establishments licensed under chapter 509 if the establishment does not provide meeting or banquet rooms which accommodate more than 150 persons and the establishment has at least the same number of water closets for women as the combined total of water closets and urinals for men.

The exception presented under **2014 Florida Plumbing Code Section 403.1.3** does not seem to apply to the use that we are seeking interpretation for. References to sections are included below:

The 2016 Florida Statutes, Chapter 509 – Lodging and Food Service Establishments; Membership Campgrounds

F.S. 509.013 (4)(a) "Public lodging establishment" includes a transient public lodging establishment as defined in subparagraph 1. and a nontransient public lodging establishment as defined in subparagraph 2.

1. "Transient public lodging establishment" means any unit, group of units, dwelling, building, or group of buildings within a single complex of buildings which is rented to guests more than three times in a calendar year for periods of less than 30 days or 1 calendar month, whichever is less, or which is advertised or held out to the public as a place regularly rented to guests.
2. "Nontransient public lodging establishment" means any unit, group of units, dwelling, building, or group of buildings within a single complex of buildings which is rented to guests for periods of at least 30 days or 1 calendar month, whichever is less, or which is advertised or held out to the public as a place regularly rented to guests for periods of at least 30 days or 1 calendar month.

F.S. 509.013 (5)(a) "Public food service establishment" means any building, vehicle, place, or structure, or any room or division in a building, vehicle, place, or structure where food is prepared, served, or sold for immediate consumption on or in the vicinity of the premises; called for or taken out by customers; or prepared prior to being delivered to another location for consumption. The term includes a culinary education program, as defined in s. 381.0072(2), which offers, prepares, serves, or sells food to the general public, regardless of whether it is inspected by another state agency for compliance with sanitation standards.

F.S. 509.502 (3) "Campground" means any real property which is a part of a membership camping plan. This term does not include a mobile home, lodging, or recreational vehicle park or recreational camp as defined in chapter 513 so long as no membership camping plan is offered for sale, sold, or otherwise promoted with regard to such park.

<u>Question</u>

1. **Are bathroom facilities located within a private membership clubhouse considered to be open to the public? Specifically, the verbiage qualifying the applicability of section 403.1.3 applies to the facility that we have described?**

2. **For the project in question, once the minimum number of required plumbing fixture is provided in accordance with section 403.1 and section 403.1.3 of the 2014 Florida Plumbing Code based in the occupant load for the building, does the ratio established by potty parity have to be maintained for the additional fixtures provided in excess of the minimum requirements?**

P7192

Date Submitted	11/7/2018	**Section**	606.2	**Proponent**	Gary Kozan
Chapter	6	**Affects HVHZ**	No	**Attachments**	Yes

TAC Recommendation Approved as Submitted
Commission Action Pending Review

Comments

General Comments **No** **Alternate Language** **No**

Related Modifications

Summary of Modification

Clarifies that shutoff valves are not required for tub and showers when installed in residential occupancies.

Rationale

This proposal is intended to clarify that shutoff valves are not required for bathtubs or showers in any type of residential occupancy. The FBC-Residential already does not require such shutoff valves in one- and two-family dwellings. There is no reason to treat bathtubs and showers that are located in apartments or condos any differently. This inconsistency had been previously addressed by a Florida-specific provision which occurred in the first four editions of the FBC-Plumbing (see attached 2010 FBC-P text). That provision sunsetted in the 5th edition, and was never renewed. This proposal simply restores the previous exception, in the interest of promoting clarity and uniformity.

Fiscal Impact Statement

Impact to local entity relative to enforcement of code

Simplifies code enforcement because it makes the Plumbing and Residential Codes consistent like before

Impact to building and property owners relative to cost of compliance with code

Lowers the cost of code compliance. Installing tub and shower valves without stops lowers the construction cost by approx. $20-30 per valve.

Impact to industry relative to the cost of compliance with code

Simplifies code compliance because it makes the Plumbing and Residential Codes consistent like before

Impact to small business relative to the cost of compliance with code

No impact to small business.

Requirements

Has a reasonable and substantial connection with the health, safety, and welfare of the general public

Provides adequate protection to residential occupancies without the added cost of extra shutoff valves. Restores previous FBC-P requirements.

Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction

Improves the code by providing a wider range of tub and shower valve products without the need for behind-the-wall shutoff valves

Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities

Does not discriminate against any current product or construction method.

Does not degrade the effectiveness of the code

Improves the code by eliminating extra cost and making installation and enforcement more consistent

606.2 Location of shutoff valves. Shutoff valves shall be installed in the following locations:

1. On the fixture supply to each plumbing fixture other than bathtubs and showers in ~~one- and two-family~~ residential *occupancies*, and other than in individual sleeping units that are provided with unit shutoff valves in hotels, motels, boarding houses and similar *occupancies*.

2. On the water supply to each sillcock.

3. On the water supply pipe to each appliance or mechanical equipment.

8. On the water supply pipe to every water heater.

606.2 Location of shutoff valves. Shutoff valves shall be installed in the following locations:

1. On the fixture supply to each plumbing fixture other than bathtubs and showers in one- and two-family residential *occupancies*, and other than in individual sleeping units that are provided with unit shutoff valves in hotels, motels, boarding houses and similar *occupancies*.
2. On the water supply pipe to each sillcock in other than one- and two-family residential occupancies.
3. On the water supply pipe to each appliance or mechanical equipment.

Exception: Shutoff valves are not required on tubs and showers in residential occupancies.

606.3 Access to valves. *Access* shall be provided to all full-open valves and shutoff valves.

606.4 Valve identification. Service and hose bibb valves shall be identified. All other valves installed in locations that are not adjacent to the fixture or appliance shall be identified, indicating the fixture or appliance served.

606.5 Water pressure booster systems. Water pressure booster systems shall be provided as required by Sections 606.5.1 through 606.5.10.

606.5.1 Water pressure booster systems required. Where the water pressure in the public water main or individual water supply system is insufficient to supply the minimum pressures and quantities specified in this code, the supply shall be supplemented by an elevated water tank, a hydropneumatic pressure booster system or a water pressure booster pump installed in accordance with Section 606.5.5.

606.5.2 Support. All water supply tanks shall be supported in accordance with the *Florida Building Code, Building*.

606.5.3 Covers. All water supply tanks shall be covered to keep out unauthorized persons, dirt and vermin. The covers of gravity tanks shall be vented with a return bend vent pipe with an area not less than the area of the down-feed riser pipe, and the vent shall be screened with a corrosion-resistant screen of not less than 16 by 20 mesh per inch (630 by 787 mesh per m).

606.5.4 Overflows for water supply tanks. Each gravity or suction water supply tank shall be provided with an overflow with a diameter not less than that shown in Table 606.5.4. The overflow outlet shall discharge at a point not less than 6 inches (152 mm) above the roof or roof drain; floor or floor drain; or over an open water-supplied fixture. The overflow outlet shall be covered with a corrosion-resistant screen of not less than 16 by 20 mesh per inch (630 by 787 mesh per m) and by $^1/_4$-inch (6.4 mm) hardware cloth or shall terminate in a horizontal angle seat check valve. Drainage from overflow pipes shall be directed so as not to freeze on roof walks.

TABLE 606.5.4
SIZES FOR OVERFLOW PIPES FOR WATER SUPPLY TANKS

MAXIMUM CAPACITY OF WATER SUPPLY LINE TO TANK (gpm)	DIAMETER OF OVERFLOW PIPE (inches)
0 - 50	2
50 - 150	$2^1/_2$
150 - 200	3
200 - 400	4
400 - 700	5
700 - 1,000	6
Over 1,000	8

For SI: 1 inch = 25.4 mm, 1 gallon per minute = 3.785 L/m.

606.5.5 Low-pressure cutoff required on booster pumps. A low-pressure cutoff shall be installed on all booster pumps in a water pressure booster system to prevent creation of a vacuum or negative pressure on the suction side of the pump when a positive pressure of 10 psi (68.94 kPa) or less occurs on the suction side of the pump.

606.5.6 Potable water inlet control and location. Potable water inlets to gravity tanks shall be controlled by a fill valve or other automatic supply valve installed so as to prevent the tank from overflowing. The inlet shall be terminated so as to provide an *air gap* not less than 4 inches (102 mm) above the overflow.

606.5.7 Tank drain pipes. A valved pipe shall be provided at the lowest point of each tank to permit emptying of the tank. The tank drain pipe shall discharge as required for overflow pipes and shall not be smaller in size than specified in Table 606.5.7.

TABLE 606.5.7
SIZE OF DRAIN PIPES FOR WATER TANKS

TANK CAPACITY (gallons)	DRAIN PIPE (inches)
Up to 750	1
751 to 1,500	$1^1/_2$
1,501 to 3,000	2
3,001 to 5,000	$2^1/_2$
5,000 to 7,500	3
Over 7,500	4

For SI: 1 inch = 25.4 mm, 1 gallon = 3.785 L.

606.5.8 Prohibited location of potable supply tanks. Potable water gravity tanks or manholes of potable water pressure tanks shall not be located directly under any soil or waste piping or any source of contamination.

606.5.9 Pressure tanks, vacuum relief. All water pressure tanks shall be provided with a vacuum relief valve at the top

P7193

5

Date Submitted	11/7/2018	**Section**	2905.3	**Proponent**	Gary Kozan
Chapter	29	**Affects HVHZ**	No	**Attachments**	Yes

TAC Recommendation	Approved as Submitted
Commission Action	Pending Review

Comments

General Comments **No** **Alternate Language** **No**

Related Modifications

Summary of Modification

Adds a 100-ft maximum distance from hot water source to fixtures in the Residential Code

Rationale

The FBC-Residential has never contained a specific distance limitation for hot water piping. The 50-foot limit found in the FBC-Plumbing is often misinterpreted as applying to single-family homes. The confusion was finally resolved at the I-Code hearings this year with the approval of RP10-18 (see attached), which establishes a reasonable 100-foot limit in the Residential Code. This change will appear in the 2021 Edition of the International Residential Code, but that edition will not filter down to Florida until 2024. By adopting this new code language now, we can accelerate its adoption into the 2020 Florida Building Code.

Fiscal Impact Statement

Impact to local entity relative to enforcement of code

No cost impact to code enforcement

Impact to building and property owners relative to cost of compliance with code

No cost impact to building and property owners

Impact to industry relative to the cost of compliance with code

For new SFDs with any plumbing fixture farther than 100 feet from the hot water source, a circulating system would be required. The cost could range from $500-1000 per home. However, most homes of that size would likely already contain a circulating system, so few new homes would be affected.

Impact to small business relative to the cost of compliance with code

No cost impact to small business

Requirements

Has a reasonable and substantial connection with the health, safety, and welfare of the general public

Provides a reasonable 100-foot distance limitation, which could reduce the hot water wait times, and improve customer satisfaction

Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction

Updates the code to the latest changes in the International Residential Code

Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities

Does not discriminate against any products or methods.

Does not degrade the effectiveness of the code

Actually improves the effectiveness of the code by including a specific distance limitation of 100-feet

Add new section:

P2905.3 Hot water supply to fixtures. The developed length of hot water piping, from the source of hot water to the fixtures that require hot water, shall not exceed 100 feet. Water heaters and recirculating system piping shall be considered to be sources of hot water.

RP6-18

Committee Action: **Approved as Modified**

Committee Modification:

P2904.2.3 Freezing areas. Piping shall be protected from freezing as required by Section P2603.5 or by using one of the following:

1. ~~A~~a dry pipe automatic sprinkler system that is listed for residential occupancy applications.

2 . ~~Where sprinklers are required in areas that are subject to freezing, d~~Dry-side-wall or dry-pendent sprinklers extending from a nonfreezing area into a freezing area ~~shall be installed~~.

Committee Reason: For the Modification: Breaking this into a list is helpful to show that there are two alternate methods.
For the Proposal: The Committee agreed with the published reason statement. (Vote:10-0)

Assembly Motion: **NONE**

RP7-18

Committee Action: **Approved as Submitted**

Committee Reason: The Committee agreed with the published reason statement. (Vote:10-0)

Assembly Motion: **NONE**

RP8-18

Committee Action: **Approved as Modified**

Committee Modification:

P2904.4.1.3 Other Ceiling Configurations. For ceiling configurations not addressed by Sections P2904.4.1.1 or P2904.4.1.2, the flow rate shall be subject to approval by the ~~fire~~ code official.

Committee Reason: For the Modification: Smaller jurisdictions might not have a fire code official.
For the Proposal: The Committee agreed with the published reason statement. (Vote:10-0)

Assembly Motion: **NONE**

RP9-18

Committee Action: **Approved as Submitted**

Committee Reason: The Committee agreed with the published reason statement. (Vote:10-0)

Assembly Motion: **NONE**

RP10-18

Committee Action: **Approved as Modified**

Committee Modification:

P2905.3 Hot water supply to fixtures. The developed length of hot water piping, from the source of hot water to the fixtures that require hot water, shall not exceed ~~50~~ 100 feet ~~(15 240 mm)~~. Water heaters and recirculating system piping shall be considered to be sources of hot ~~or tempered~~ water.

Committee Reason: For the Modification: 100 feet is a more feasible threshold than 50 feet.
For the Proposal: Sustainability goals are important. The code needs to provide clear direction that the fixtures cannot be too far away from the hot water source. (Vote:6-4)

TAC: Plumbing

Total Mods for **Plumbing** in **No Affirmative Recommendation: 2**

Total Mods for report: 7

Sub Code: Residential

P8159

Date Submitted	12/14/2018	**Section**	2902.5.3	**Proponent**	Cheryl Harris
Chapter	29	**Affects HVHZ**	No	**Attachments**	No

TAC Recommendation No Affirmative Recommendation
Commission Action Pending Review

Comments

General Comments **No** **Alternate Language** **No**

Related Modifications

Summary of Modification

Change reference to "lawn" to "landscape" irrigation for consistency with other code sections.

Rationale

Lawn is not a consist term in other parts of the code. Landscape is the more acceptable and inclusive terminology.

Fiscal Impact Statement

Impact to local entity relative to enforcement of code

None.

Impact to building and property owners relative to cost of compliance with code

None.

Impact to industry relative to the cost of compliance with code

None.

Impact to small business relative to the cost of compliance with code

None.

Requirements

Has a reasonable and substantial connection with the health, safety, and welfare of the general public

Yes.

Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction

Yes.

Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities

No.

Does not degrade the effectiveness of the code

No.

P2902.5.3~~Lawn~~ <u>Landscape</u> irrigation systems.

The potable water supply to ~~lawn~~ <u>landscape</u> irrigation systems shall be protected against backflow by an atmospheric vacuum breaker, a pressure vacuum breaker assembly or a reduced pressure principle backflow prevention assembly. Valves shall not be installed downstream from an atmospheric vacuum breaker. Where chemicals are introduced into the system, the potable water supply shall be protected against backflow by a reduced pressure principle backflow prevention assembly.

P8163

Date Submitted	12/14/2018	**Section**	2914	**Proponent**	Cheryl Harris
Chapter	29	**Affects HVHZ**	No	**Attachments**	No

TAC Recommendation No Affirmative Recommendation
Commission Action Pending Review

Comments

General Comments **No** **Alternate Language** **No**

Related Modifications

Summary of Modification

Add Section for Irrigation Systems in Residential Code that references Chapter 14 in Plumbing Code.

Rationale

Although there is existing code for landscape irrigation systems in Chapter 14 of the Plumbing Code there is no reference to that section in the Residential Code. This modification adds that reference.

Fiscal Impact Statement

Impact to local entity relative to enforcement of code

None.

Impact to building and property owners relative to cost of compliance with code

None.

Impact to industry relative to the cost of compliance with code

None.

Impact to small business relative to the cost of compliance with code

None

Requirements

Has a reasonable and substantial connection with the health, safety, and welfare of the general public

Yes.

Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction

Yes.

Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities

No.

Does not degrade the effectiveness of the code

No.

P2914 Landscape irrigation systems.

Landscape Irrigation systems shall be designed and installed per Chapter 14 of the Florida Building Code, Plumbing.