

ASHRAE ST LOUIS JUNE 2016

Notes by Clive Broadbent.

PLENARY

Theme for 2016/17: **Shaping tomorrow's built environment today**

Plenary Guest Speaker: Jeff the Chef, a former drug dealer, prisoner, now celebrity TV chef and star who said that 65 million Americans have a criminal record; 2.3 million are in prison at any one time.

We each have a gift and a passion; Jeff's advice is to follow the gift not the passion.

Final word: we need to take young people to the next level. He called it the "Knowledge Jacker"- it's anywhere, anytime education. We do have so little time in this world and so being successful (ie in helping others) is so important. Lots of fine people helped Jeff, gave him a second chance.

TECHNICAL SESSIONS

1. Ultra low energy use commercial buildings

Jason Glazer - jglazer@gard.com

This talk was about what's technically achievable based on a Measure List of over 400 factors of which 30 selected for this study were seen as having the highest impact in a national analysis for modelling and covering all climatic zones. Concluded that 47.8% energy savings could be achieved but if PV is added then it's a net zero possibility. Measures included:

- . Daylighting and occupant control
- . Optimal choice vertical fenestration and roof insulation
- . Demand control/CO2 ventilation
- . Shift from general to task illumination and use of high performance LEDs.

2. Radiant cooling systems

Goldstein Eli of Skycool Technologies described the passive cooling of water via radiative sky cooling. The concept involves flat panels on the roof with glycol, PHE, and refrigeration condenser circuitry. Uses the principle of ice formation on car roofs and windows during evenings to reject heat during the day; the sky cooling panels are at 5C below ambient temperature. Not suited to humid climates such as Miami. Worked well at Sao Alto in San Francisco Bay Area with peak daytime temperatures around 32C.

Dr Mahabar Bhandari of Oak Ridge Labs re use in India of nighttime radiant cooling panels ICW a cooling tower and pipes embedded in the building structure – heat rejection is 50% radiation this way and energy savings 40% compared with conventional air cooled condensers. Chilled water temperatures need to be higher than usual: 12.8 to 15.6C range.

Elef Bourdakos of Denmark described nighttime radiant panel systems in several European settings producing cold water stored in tanks for daytime cooling (my comment: seemed the most sensible of the lot).

3. Seminar on insights from Legionnaires' disease outbreaks with speakers Janet Stout (microbiologist from Pittsburgh), Tim Keane (engineering consultant), Sarah Ferrari of Evapco.

In the USA incidence of LD is increasing being now 1.6 cases per 100,000 population; associated hospital costs are between \$100 and \$300 million pa.

The notorious Bronx outbreak in 2015 (139 cases of LD) was linked to a hotel cooling tower, details on the CTI website Feb 2016 called CTI TP 16-23.

Stagnation in storage tanks and mains water may represent fundamental causation at outbreaks attributed to cooling towers (but of course the aerosol comes from the tower and not the tank) – see New Jersey Dept Health Epidemiology and Infection Reports of 2014.

4. Seminar on Plumbing Systems and Legionella Growth

Gary Klein (potable water expert) discussed water use, energy use and Legionella. The interactions of components affects the system performance, eg at residences 97% of draws at faucets are of less than 3 minutes which means the water is stagnant for long periods. Water use will soon drop to 40 gal (about 160 litres) per person per day, ie only 120 gal/household/day if 3 people and there's a need to reduce conventional pipe sizes as much energy is lost in simply heating the piping before the hot water is delivered (an Australian family of 4 uses about 500 litres per day).

Jeff Ramey (materials expert) said that while the copper ions released into water from copper piping may have biocidal effects the effect is lost over time when the pipes age and develop roughened surfaces. Of all materials CPVC (chlorinated PVC) is best at minimizing biofilm. Other plastics such as polypropylene and polyethylene are poor. Chloramines indirectly influence corrosion in copper pipes due to the change in pH levels and copper pitting can occur within 18 months with chloraminated mains water. Materials that should not be used with chlorine dioxide water treatment are the polyolefins (called PP-R, PE-X, PE-RT, PE-RB). ASTM F 2023 is the standard for plastics but following its recommendations does not provide immunity from common failure but merely allows predictions on the "extrapolated time failure" time. Oxidisers alter the chemical structure of the polymer. Oxidative degradation (of plastic piping) in hot water lines is occurring in family homes. CPVC is unaffected by all forms of chlorine disinfection and is actually used in chlorine manufacture. However not one plastics manufacturer would condone use of chlorine at a level of 100 ppm as is sometimes required in decontamination events.

Tim Keane (engineering consultant) described a large LD outbreak in a Miami hotel resulting from use of carbon filters to remove the chlorine sensation to guests (city water had a chlorine level of 2 ppm) – this change caused the loss in disinfection residual. Design features that must be covered are:

- . water turnover (velocity, oversizing, equipment selections)
- . water temperature
- . water treatment proposed
- . water heater selection
- . piping materials.

Branch lines should be able to be evacuated within 30 seconds although 60 seconds in some cases may be the best that can be accommodated.

A potential problem is the introduction of devices such as UV filters, carbon filters, water softeners which all remove the chlorine so leaving no residual. POE (Point of Use) carbon filters remove chlorine too as do any of the media filters.

Commissioning is an important stage in Legionella control. Need to validate that the hot water system is balanced and need to validate that all monitoring equipment is functioning correctly. SPC 188 clause 8.4 requires flushing and disinfection of all building water systems 3 weeks prior to whole or part occupancy (Note – may have prevented the Melb. Aquarium outbreak!).

COMMITTEES

Environmental Health Committee (EHC) – I'm a newly appointed voting member.

Has as its primary responsibility to provide an environmental health perspective to the activities of ASHRAE. Environmental health is above medical issues.

In a number of recent lawsuits against ASHRAE its status with ANSI meant ASHRAE won them all.

EHC is into –

- . planning to develop a series of design guides
 - . a research project 1491-RP on ozone removal in buildings which will include a survey of commercially available products
 - . the so-called green walls trend among architects which could lead to alarming issues of mould, microbial infections, litter difficulties, fenestration deterioration, fire risk and other problems; EHC to develop a work statement on this.
 - . an **RTAR** (Research Topic Acceptance Request) being developed by Tim Keane on Legionella and true risk of scalding from higher water temperatures based on actual statistics
 - . relative humidity which plays a role in infectious disease transmission – Standard 55 states 20% is the maximum at the low end but this is now thought to be closer to 40%
 - . preparing a user manual for Std 62.1, target late 2016. Note this standard (as in AS 1668.2) is a **minimum** standard based on consensus. The guideline will be for design engineers and will cover designs other than the minimum, ie topics not applicable to a minimum eg occupancies in which there are ionisers (I took this to mean photocopiers). Although the standard will be above minimum it will still not represent **best** practice
 - . sorting out a difficulty with Std 90.1 which requires outdoor air to be no more than 135% of that described in Std 62.1 but 62.1 is happy with lots more outdoor air than this if this suits the application; discussions with the 90.1 committee under way
 - . a manual for Std 62.2 (residences, apartments) with target late 2016
 - . a new concern about the advice in standards that outdoor air can be reduced if particle filtration is installed as new evidence suggests that the outdoor air rate should be increased and not decreased, ie we can't depend on particle collection.
- At this meeting an organization called "Wellness, health and the built environment" gave a presentation on its work in providing wellness certifications for buildings.

A presentation was given by Danish investigators on indoor air CO₂, its effects on subjective and physiological responses and mental work. What is now seen as important is the pH of our blood in response to CO₂, ie CO₂ up, blood pH down perhaps from 7.35 to 7.25. At lower levels we hyperventilate to cope but the CO₂ then accumulates in bone marrow. Respiration works to maintain correct pH and to reject CO₂ which is toxic at 1% (headache, sweating). At high CO₂ levels it is easier to reject the CO₂ at sea level rather than at higher elevations. Other research showed that CO₂ of 0.1% affected mental effort and decision making. The conclusion in all this research work (much more than summarized here) is that CO₂ is an excellent proxy for the potential of negative effects on health.

SPC 188 and Guideline 12 Working Committees (I'm a voting member of both)

This standard on Legionellosis was published in June 2015 while the Guideline is still being revised. Some comments, while we worked on "continuous maintenance" issues, were:

- . The CDC website supplies much information on LD. Google "CDC Vital Signs."
- . Three minor addenda to the published standard were agreed (4.1.1 – word is review and not survey, at 7.2.7 the word designer is removed, and there's another minor change)

. Next 2-day meeting is Jan 31 and Feb 1 2017 in Las Vegas but a conference call is likely in August, mainly to finalise the words in the draft guideline document.

TC 3.6 WATER TREATMENT (I'm a voting member of this technical committee)

New ASHRAE conference program formats to be introduced at the Longbeach event (June 2017):

- . the panel session (can cover a range of topics)
- . the debate (teams compete)
- . the court trial (dry run on a hypothetical).

For Las Vegas (Jan 2017) there will be a seminar on water conservation and another on how-to-implement Std 188.

CTI has a Guideline 159 covering cooling towers, validation of the water treatment, and other matters. Relevant ASHRAE standards are Std 189.1 on green buildings and water use, energy efficiency, site sustainability, materials and resources. The health care standard 189.3 is also relevant. Note the 189.1 words on drift allow two differing rates, one for counterflow (0.002 % of flow) and one for crossflow (0.005%) towers (which I disagreed with at this meeting on consistency and public health grounds).

Re use of non-treated water (recycled, waste) the biochemical oxygen demand (BOD) needs to be less than 100 ppm (Note AS 1546,7 and NHMRC Guidelines require effluent max BOD of 20ppm as suitable for irrigating gardens and under 1 ppm for potable use. BOD is about 210 ppm in raw sewage here.

Discussion on standard 191 which is to do with the efficient use of water in buildings.

The ASHRAE Legionellosis Position Paper is under revision (I'm on that committee also) – target end 2016. There is to be an RTAR re biofilm enumeration techniques for testing and perhaps controlling depth of biofilm in cooling water systems (I'm on this working committee as well).

CDC is undertaking research, using PCR-only testing (due to the cost of cultures), into chloramination versus chlorination. I look forward to this report although the corrosion issue won't be covered.

NSF has produced a standard NSF 453 on cooling towers. NSF 444 is an all-inclusive water treatment standard and Std 188 needs to be included in this one. There seems to be a number of standards-setting organisations in the USA and NSF is one of these (CTI is another).

Accessing the ASHRAE handbook on-line is now not possible with Google due to many copyright issues. Use Explorer instead, log ASHRAE personal details, and the new tool is www.authoring.ashrae.org .

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