Airports

Railway stations

Bus / coach stations

Sea port terminals

Places of worship

UNREFERENCED PROBLEMS WITH BUILDING WATER SUPPLIES

1 Foul taste in hotel water supply

Feather eiderdown used as insulation for roof tank. Wooden tank lid rotted, eiderdown slipped into water and rotted.

2 House – intermittent stale water

Warm stale water only in the mornings on sunny days. New service pipe laid previous autumn, new patio laid at same time. Patio faces south and receives the morning sun. cause of problem was the new service pipe laid in the sand for bedding of new patio at a depth of depth 100mm to 150mm instead of the required standard of between 750mm and 1350mm.

3 House - petrol / oil taste in water

Car oil change / petrol tank leak on driveway permeated plastic service pipe.

4 House - "swimming pool" taste and odour problem

Intermittent problem that has been occurring for some time. Cold water supply is warm but only at the kitchen tap. Cause of problem was localized heating of cold water feed to kitchen because it runs alongside hot water pipes. Therefore, poor design, lack of insulation. Remedy was to lag pipes and investigate alternative routing for hot water pipes.

5 House – phenolic taste and odour problem

Very bad in boiled water. Problem only occurs at kitchen tap. No recent plumbing changes but new washing machine fitted recently. Cause of problem was back siphonage of 'contaminated' water from flexible filling hose to washing machine. Chlorine reacts with 'contaminants' to form range of compounds described under the general term phenolic. Remedy was to fit non-return valve to washing machine hose connection.

6 Similar phenolic taste and odour problems due to:

dishwashers;
flexible hoses to drink dispensers (generally replacements and not those supplied as standard;
kettles and tea urns (particularly the rubber sealing washer for the element and in the case of tea urns and soft water, metallic taste due to internal corrosion);
tap washers; and
garden hoses where non-return valve not fitted.

7 High rise apartment block - complaint of 'strange' taste

Only a problem since local authority owner had refurbished header tank. GC - MS analysis shows the presence of bisphenol A and tert-butyl phenol. The cause was found to be a different epoxy resin lining used to that specified and although an approved material the contractor did not follow the preparation and curing instructions. Compounds leached from the un-cured coating. Remedy was to strip and re-line tank.

8 Factory (wine bottler) - vinegar odour to mains water used for washing tanks.

Only occurred after high water usage. Swabs showed the presence of *Acetobacter* in tanks after washing, not detected on swabs taken before washing. The cause was poor design leading to stagnation of surface water in storage tank. Alcohol fumes and bacteria in the air contaminate tank water. *Acetobacter* converted alcohol to acetic acid – vinegar. Remedy was to re-plumb mains feed to tank and improve ventilation.

9 Other known problems but no specific examples

(i) Taste due to microbial growth in point of entry treatment devices (softeners).
(ii) Excess sodium in softened water from point of entry devices.
(iii) Corrosion from mixed metals.
(iv) Cross contamination from private and non-potable supplies.
(v) DIY plumbing.
(vi) Storage tanks – access by birds, bats, mice, rats.

(vii) Storage tanks – vandalism.

(viii) Storage tanks – stale water due to lack of turnover.

(ix) Lack of records of water supply system in large buildings.

(x) Lack of technical knowledge in staff responsible for water supply systems in large buildings.

1.4 Types of users and vulnerabilities

1.4. Vulnerability and hazard exposition

In order to define the health risk of the people that attend or work in public buildings, it is necessary to take in account, among other factors, their degree of exposition to the existing or potentials hazards of a water system in this type of public buildings and the vulnerability of this people. Therefore, it is necessary first to define the exposed population and the relative vulnerability of the population to the identified hazards, combining then these conditions to define appropriately the risk of the vulnerable people in different exposition situations.

a) Exposed population to the water related hazards in public buildings

- People *working* in the public building. The health of these people is generally protected by the health and hygiene workers and services.

i. Administrative employees

ii. Maintenance and cleaning employees (Legionella, Pseudomonas)

iii. Etc.

- People *living* in the public building
- People *attending* the public building

i. *For short periods of time,*

1. are immune competent and will not undergo any immune depressive and/or invasive medical treatments or procedures. For example, the people that enter a public building to do some kind of paperwork in the administrative department, or enter a transport terminal to take a bus or any transportation.

2. are immune competent, and enter a health care center where they undergo any kind of invasive procedure. For example those who are going to receive an immune depressive drug or those who are undergoing a dialysis process, a tooth extraction, endoscopies, etc.

ii. *For regular periods of time*

1. At health care centers, those who are immune competent but will undergo a surgical procedure or other even more invasive procedures.

2. At health care centers, those who are immune compromised or become so at the hospitals for the environment conditions (including the stress in the ER areas).

3. In kindergartens, schools, or educational institutes.

iii. *For long periods of time*

1. Psychiatric Centers – Hospitals
2. Infectious Disease Centers – Hospitals
3. Military Barracks
4. Jails

The most important conditions of the water systems in public buildings, which might increase the hazards and people's exposition to them are among others:

- Higher Water Stagnation
  - Higher probability of lixiviation of substances in mains, deposits and reservoirs.
  - Higher probability of THM formation.
  - Higher probability of bacterial growth.
  - Higher probability of residual chlorine loss.

- Higher Complexity and Length of the systems
  - Higher probability of contaminants entering the system.
  - Higher probability of structural and operational deficiencies (breaks, crossed connections, depressurization) and higher difficulties to identify and correct them.

- Facilities that are not common in apartment buildings
  - Water Dispensers
  - Ornamental Fountains
  - Cooler Tower Pools for Central Air Conditioning Systems

- Maintenance and Cleaning of Sanitary Facilities
  - Less effective and frequent
  - Transmission of pollutants from one facility to the other (water dispensers, taps).

❑ Use of the water facilities by the employees and public, which favors the pollution possibilities because:

o The necessary hygiene practices are not applied or they are not the appropriate ones.

o There is no interest in the maintenance of these facilities.

o Pollution may vary depending on the way the facilities are used

o There might be a higher and different type of use and manipulation of these facilities

The population with a higher exposure to this pollution would be:

- o People who undergo invasive procedures in hospitals
- o People staying in psychiatric centers
- o Children in kindergartens
- o Elder People in geriatrics
- o People in Jails
- o Soldiers in military barracks

As it is deduced from the different type of expositions and the vulnerability of the exposed population, the risk arises from the different combinations that might exist, which can be analysed in the chart below:

b). Vulnerability of the population in public buildings:

The healthy person which stays for short or long periods of time in the public buildings is the one that does not have immunodeficiency or condition that might affect its health when drinking or using the water for personal hygiene, or when using it or having contact with it.

On the contrary, the non-healthy person (unwell) in these buildings, is the one that, due to its physiological, immune or pathological conditions can be more vulnerable to the hazards that the water might contain. These conditions might be:

o Immunodeficiency (natural, acquired or induced)

o Pathologies which might favor the infection or the pathologic effects due to the water pollution

o Gastritis which are medicated inhibiting the stomach's acid secretions, which causes the person to be more vulnerable to gastrointestinal infection

o Physiological conditions which favor the infections or pathological effects: For example the slow methylators in the case of the Arsenic, or the people with specific blood type which are more susceptible to the Vibrio cholera infection.

Even if these conditions increase people's vulnerability to the infections, intoxications or cancer, they are not exclusive of the people who live , work or enter a public building, with the exception of the hospitals, geriatrics or kindergartens, where a higher amount of vulnerable people is concentrated, or where people gets immunodepressed due to medication and invasive procedures they undergo.

In the case of the people that go to a hospital, the vulnerability can determine the risk better than the exposition, while in the administrative public buildings, the characteristic that matters the most in the risk configuration is the exposition

At the hospitals the situation is even more delicate as it is an environment where the water is not only used for drinking or for personal hygiene, but also to prepare solutions for medical use, to disinfect wounds and burns, to wash or rinse medical equipment, etc.

In the kindergarten the children exposition to the contaminated water could be by ingestion of drinking water but it is common the infection by ingestion or contact with water of undisinfected swimming pools contaminated with their own excreta. This transmission pathway has been demonstrated in several outbreaks involving Shigella and Cryptosporidium among other pathogens. For that reasons the children in kindergarten are more exposed and vulnerable to water related hazards.

There is no doubt that the health care centres are the public buildings that concentrate the most exposed and most vulnerable people . In other words agglutinate the people with the more important waterborne disease risks.

Therefore the more vulnerable people in public buildings are , in increasing vulnerability order the following :

- Naturally imunocompromised people
- Immunocompromised people by other diseases
- Immunocompromised people by drugs
- Immunocompromised people by their age (children and elderly people)
- Immonocompromised people by stress
- undernourished people

Even if this type of buildings (health care centres) lodge more vulnerable people that the apartment buildings , it is evident that each time more vulnerable people could be found in the last ones by their convalescent status after clinical diseases or surgical procedures or people that are permanent immunodepressed by chronic diseases and don't need hospitalization. It is less probable that these people go to public buildings that a normal ones . It could signify that in some public buildings (administrative or commercial) it would be less possible found vulnerable people than in the private buildings. In the private buildings there are some particular specific exposition pathways like shower or immersion baths, that are infrequently found in public buildings.

Resuming, in the administrative, commercial, educational, transport terminal and other public buildings, the hazard presence and augmentation and the exposition to these hazards are their more important characteristic related the people health risks . Anyway there are some types of factors that affect these people vulnerability .For instance the stress (military barracks) the different chemical water (for instance sulfates, and other salts) composition of the drinking water with respect to their homes drinking water (similar to traveller diarrhoea)

One of the characteristics of the public buildings water systems that it is necessary to take in account is the quantity of people that could be affected by one water contamination episode that could be larger that the effect in apartment buildings.

According with the previous comments I insist that taking in account the state of the art, the public buildings WSP application would be justified essentially for health care centres where there would be a growing risk defining conditions due to the more concentrated hazards, exposition and vulnerability conditions that are rarely recognized or detected in other type of buildings.

It would be possible to think that the more important differences between the risks of the people that attend to public buildings with respect to the people that live in apartment buildings are more quantitative than qualitative. That it to say that the number of exposed people in the same time period is larger in the public buildings because the people quantity and turnover are larger than in private buildings.

What other differences would exist between public and private buildings about the WATER USE ?

WATER USE IN BUILDINGS

BUILDING TYPE

WATER USES
PUBLIC BUILDING
PRIVATE BUILDING
Drinking
X
XX
Personal hygiene
X
XXX
Domestic hygiene
X
XX
Shower bath
X
XX
Immersion bath
-
XXX
Wound and burns cleaning
-
XX
Food preparation
X
XX

Beverages (juices) preparation

XX

XX

PEOPLE USING WATER IN PUBLIC BUILDINGS

WATER USES IN PUBLIC BUILDINGS

EMPLOYEE

PUBLIC

INHABITANT

Drinking

XX

X

XX

Personal hygiene

XX

X

XXX

Domestic hygiene

X/-

-

XX

Shower bath

X

-

XX

Immersion bath

-

-

XXX

Wound and burns cleaning

X/-

-

XX

Food preparation

X

X/-

XX

Beverages (juices) preparation

XX

X

XX

The people that enter a public building to do some paperwork, are possibly less exposed than the employees that work in this same building, simply because they stay less time in the building, and are consequently less exposed to the water which might be polluted.

However, there would be other risks to which this people might be exposed, even in a higher level than the building employees, such as the contamination of public-use facilities:

- Water dispensers
- Public use taps
- Public use bathrooms

These facilities are generally very poorly maintained, when they are maintained at all, at least in Latin American countries. This constitutes a contamination and infection focus for the people that uses them.

Another reason for which it can be considered that in public buildings people is more exposed to existing water risks is because the drinking water bottles have an uncertain origin and maintenance. Most of the time, in public areas, disposable glasses are used to drink water, and these have been stored in inadequate places, in contact with dirt, insects and other vectors. In the case of water being used to prepare food, the hygienic procedures are not always applied as they should, or as they are applied in domestic situations, such as prepare the formulas for children (nursing bottles) with boiled water or boil the milk once it is prepared.

For example, we have found cockroaches in the automatic coffee dispensers.

On the other hand, in the home buildings, the water is drank from glasses and

containers properly washed. The water jars that are stored in the fridge, are used by less people than in public buildings, and consequently it is less probable that they get contaminated.

In conclusion, we could say that even if the water is provided by a public network and stored in the reservoirs, has the same quality in public or home buildings, what can make the difference is the way it is manipulated once it is transferred to the recipients which origin, cleanness and maintenance can not be ensured as adequate.

Even if the people that goes to the public buildings is less exposed to the water pollution hazards than the employees, they are still exposed to improperly maintained and operated facilities (water dispensers, public bathrooms water taps, etc.). It has been proved that in bus and train stations, the people prepare the babies´ food with water that they get from the public bathrooms´ taps, obviously of uncertain quality.

1.4.1. Introduction to concept of risk (consequences)

1.4.1 The well person

1.4.2. The unwell person in the community

1.4.3. The unwell person in care

1.5. Priorities for Action