installed.

Prepared 12 May 1999

2．WHO調査

本研究は、WHOの水安全計画に基づいて貯水槽水道の管理レベルを向上させようとするものであり、平成20年2月スイス（ジュネーブ）のWHO本部において、担当者と調整を行った。その概要を以下に述べる。

日程；2008.2.14-15
場所；スイス、ジュネーブ　WHO本部
相手方；WHO本部環境保健部　Yves Chartier, Bonifacio B. Magtibay etc.
内容；WHOにおける貯水槽水道調査の進捗状況、調査概要、本研究との調整など

現在WHOでは、建築物内の水の安全に関するガイドラインを策定中であり、最新のドラフトを入手し、その内容について議論した。
WHOガイドライン策定についての今後の予定は以下の通りである。
今春（2008年春）各チャプターのリーダー会議を開催し、2008年9月に最終案をまとめ各国の専門家に配布し、意見聴取のうえ最終確定する予定。　その際に最終案を早川研究班にも示し意見聴取したい。
この研究は2008年末には終了する予定であったが、やや（数ヶ月）遅れる見込みである。
またこのドラフトには、世界各地での問題事例の報告が添付されており、建築物内飲料水供給システム（貯水槽水道など）が原因の疾病の事例を知ることができる。
これらの情報をわれわれの研究と供給することにより、日本における貯水槽水道の管理レベル向上につなげていきたい。
なおWHOのこのガイドラインは、先進国だけではなく、途上国を対象にしているので、貯水槽水道による病気発生に重点がおかれていることが特徴であり、さらにレベルの高い管理を求めるわれわれの研究内容とは重点の位置がやや異なっている。

入手資料

1　第７次　ドラフト

WATER SAFETY in BUILDINGS

Version 7 - April 2007

WATER SAFETY in PUBLIC BUILDINGS

Section 0

Note: this section aimed at introducing and providing an overview of the document:

- *Scope*
- *Global document definition*
- *Definition per section,*
- *Targeted readers*
- *In context of guidelines*
- *Principles such as cost benefits*

Introduction

Extensive experience has shown that inadequate management of water systems in buildings of all types is associated with outbreaks of disease. The building types, water uses, disease outcomes, and individuals affected are each very diverse. The associated health risks can be readily controlled [and at low cost]. However available evidence - both from outbreak detection and from understanding of underlying driving forces - suggests that the overall trend is increasing. The rising trend, preventability and cost-effectiveness of interventions suggest the issue should be considered a [public health] priority.

Building types from which water-derived disease outbreaks have been detected include abc - xyz as well as domestic buildings. With increasing global urbanization the overall exposure of the human population to such buildings is increasing rapidly and in consequence the potential risk is increasing.

Outbreaks and cases of [insert short list e.g. typhoid, cryptosporidiosis, lead poisoning, ...] have been associated with water mismanagement in buildings.

'Drinking water' is a long-recognized cause of water borne disease caused by both pathogens and toxic chemicals arising from ingestion of the infectious (e.g. ...) or toxic agents (e.g. lead, copper, nickel, vinyl chloride, all of which are prone to increase in water between its arrival and use due to the means of its storage and use). There are uses of water in buildings other then ingestion that are associated with disease. Legionellosis arises following inhalation of 'aerosols' and this route of infection has been associated with health care settings and garden centers ... Other health outcomes that may be prevented by achievable improvements in water management in buildings include drowning, scalding...

A significant proportion of such water-borne disease is associated with contamination within buildings. This arises from direct contamination (e.g. pigeon shit into tanks); indirect (e.g. cross connections between potable water and contaminated water and growth of indigenous microbes (e.g. ???).

The impacts on health of inadequate management of water in buildings is considerable and has in turn significant economic impacts [? expand with some example of economic impacts - costs to people getting ill, costs to health care system, lost opportunity arising from illness (productive and school time lost). In health care settings [add a statistic or link to one of the case studies that 'sells' the scale of impact

and cost savings attainable]. Add a sentence on Legionella and impact on tourism.

Different population groups may be especially susceptible to certain water-related hazards and certain building types are therefore of special concern. Important examples include health care environments where growth of Ps aeruginosa is a significant health concern and leads to substantive avoidable costs; care homes for the elderly (scalding; ?, then one more example)

The third edition of WHO's Guidelines for Drinking-water Quality introduced the concept of 'water safety plans' and a 'Framework for Drinking-water Safety' (see box x and insert the simple version as a box - from available materials). The Framework focuses attention on effective preventive management and thereby disease prevention. The Guidelines Chapter 6 deals with the application of the Guidelines in a series of settings with specific reference to 'Large Buildings' such as health care facilities and schools and day care. The Guidelines recommend that 'large buildings' such as these have their own 'water safety plans to ensure the maintenance of water safety within such premises, with the intention that such 'building water safety plans' complement the water safety plans of water suppliers.

In most cultures for buildings (other than private domestic premises ie other than 'owner occupiers') there is a person or institution that bears some responsibility for the safety of water installations. This text, which is a supportive text to the Guidelines for Drinking-water Quality - is intended to support the improvement of such management. Its target audience includes the full range of 'actors' that influence the overall safe management of building water. In addition to 'building managers' this includes [insert list based on chapter titles of section 3].

At the meeting of government-nominated experts that finalized the third edition of the Guidelines the issue of water safety in buildings was identified as a priority and this lead to a plan of work that lead to the development of this document. It also draws on two other processes and publications: the WHO Guidelines for Safe Recreational Water Environments Volume 2: swimming pools and similar environments; and Legionella in the prevention of Legionellosis.

This document therefore deals with the control of water safety in buildings through the development and implementation of 'building water safety plans' as recommended in the Guidelines for Drinking-water Quality. It addresses all building types [insert

essentially the agreed definition of scope]. The list of building types addressed is very extensive [cross reference box in later section with David's long list].

This document does not deal with:
* good practice in plumbing, which is dealt with in a separate supporting document to the GDWQ: 'Health Aspects of Plumbing'
* recycling of water which is the focus of a separate initiative under the 'rolling revision' of the GDWQ
* direct management of water sources (such as wells) by building managers which is addressed directly in the GDWQ

This book is therefore structured in three sections as outlined in figure x

[insert figure showing sections and chapters in a neat flow chart]

Health impacts and other consequences are highlighted through a series of case studies in boxes in chapters

Section 1 .....concerns ..... and is organized in by chapters addressing ....., ..., and .....

Section 2 concerns ..... and is organized in by chapters addressing ....., ..., and .....

Section 3 concerns ..... and is organized in by chapters addressing ....., ..., and .....

Section 4 concerns ..... and is organized in by chapters addressing ....., ..., and .....

Section 1 - What is the problem
Leader: Jeni COLBOURNE

Note: see notes below. This section should be made of short introductions with principles....

Chapter 1 - Hazards

Note: this would include:

- identifying hazards

- identifying consequences

- likelihood exposure

- risk prioritization including a simplified matrix and the matrix table 4.2 in the GDWQ. It also includes the table - criteria for confirmation of biological... involved in waterborne outbreaks...

Introduction and Overview of Hazards

Approach to this chapter: we believe there should be a general but short introduction that puts the document into context specifically how it fits into the Water Safety Plan Approach as advocated by WHO in the Drinking Water Guidelines 2004. This is something that it is consistent with all other WSP guidance documents. However, we would suggest that this needs to explain why drinking water quality in buildings has to be handled differently from water supply quality i.e. water suppliers, be they public or private, are organisations who can be held accountable for water safety, sufficiency and quality in the public interest, this is not the case for water within buildings, where the accountability falls to the owner and it is for the building being safe (water being but one of many factors (and not something that the owner can be expected to have a deep knowledge of).

Note: we envisage most sub sections will be a short paragraph, nothing longer.

1.2.1.Introduction to the concept of a hazard

1.2.2. Microbiological Hazards - Sewage/excrement

Domestic single premises and multi-occupancy (as agreed not aimed specifically at individual householders who would not be expected to have a WSP but to building managers / landlords of either individual or multi-occupancy buildings).

1.2.2.1.Types of system and uses (piped systems; mains and borehole / well for drinking and food preparation, for cleaning; personal hygiene; washing; etc, also hot tubs; swimming pools).

1.2.2.2. Risks associated with domestic drinking water systems (eg untreated water from borehole supplies;; system design; long runs in reticulated systems; poor temp; scalding control; hot tubs and swimming pools

1.2.2.3. Risks associated with domestic hot tubs; pools etc

1.2.3 Microbiological Hazards – growth of environmental organisms

Public buildings (not healthcare) includes schools; offices; hotels; leisure complexes; spa resorts etc

1.2.3.1. Systems and uses piped systems; mains and borehole uses to include large scale catering food preparation; irrigation (in addition to above cooling systems; pools; water features ;grey water ;fire sprinklers; hot tubs / spa pools swimming pools etc)

1.2.3.2.Risks to include intermittent usage; maintenance; management at risk users etc

1.2.4. Chemical Hazards – accidental contamination

Industrial premises

1.2.4.1(Additional systems and uses; including both open and closed cooling systems including continuous use; food manufacture (cross ref to codex)

1.2.4.2 Additional risks e.g; industrial processes with high nutrients / special waste considerations eg plastics factories ;wastewater and reclamation; long systems runs etc

1.2.5. Problems caused by materials in contact with drinking-water

Healthcare premises

1.2.5.1.Systems and uses (in addition to above; dental chairs; hydrotherapy pools; endoscope washers; sonicating baths etc

1.2.5.2.Additional risks; large systems; intermittent usage; at risk populations etc

1.2.6. Chemical Hazards – inadequate maintenance

Buildings for special purposes (e.g. fire stations; pumping stations; laundries) (to discuss)

1.2.6.1.Systems and Uses

1.2.6.2 Risks

1.2.7. Design hazards – Temperature

1.2.8. Design Hazards – exposure

1.2.9. Design hazards – reliability

1.2.10 User hazards

1.2.11 Natural Hazards and disasters

Chapter 2: People (target groups and actors)

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.

Introduction to concept of risk (consequences)
The well person
The unwell person in the community
The unwell person in care

Chapter 3: Building types

Note: what are specific risks associated to specific buildings

Definition of building
Definition of Building (in the context of water safety). We will use the definitions contained in a DWI research report authored by WRc for public buildings expanded to include the domestic and developing country context (buildings with no piped supply but standpipes or tanks/containers)

Types of buildings and associated water systems, uses and associated risks

Introduction to concept of risk (likelihood)
Overview of piped water systems and design issues; availability of water; effect of water quality e.g. of sources mains v borehole; Systems design and materials; water storage; waste water etc

Types of buildings

Set out below, in no particular order, are the kind of buildings, from a UK perspective, we would consider should be included in considering water safety plans for buildings. The main criteria for inclusion is buildings where people are likely to drink water, consume food prepared using water or be exposed to water for washing, showering etc. It is not proposed that this is an exhaustive list of buildings.

School / College
University
Further Education
Nursery school

Hospital
Clinic
Doctor surgery
Dentist surgery
Residential care / retirement home
Health centre
Nursing home
Childrens' home
Vet surgery
Ambulance station / fire station

Restaurant
Fast food outlets
Hotel / Inn
Hostel
Guest House (bed & breakfast)
Public House / Bar
Café
Campsite

Museum
Art gallery
Exhibition centre
Conference centre

Sports ground
Stadium
Leisure centre
Swimming pool
Health clubs / fitness centres
Dance halls/ nightclubs
Theatre / concert hall
Ice rink
Cinema
Historic building / stately home
Shops
Garden centres

Hairdresser beauty salon
Prison / detention centre
Community centre
Police station
Barracks

Houses
Offices (low rise and high rise)
Factories
Production centres
Workshops
Apartment blocks (low rise and high rise)

Public toilets
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.