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CONSUMER HEALTH PROTECTION

Dr. V.Madha Suresh* and V.Nagarajan**
*Lecturer, Dept. of Geography, Madras University.
** V. Nagarajan, Research Scholar,Dept. of Geography, Madras University

Abstract

The principal risks to human health are associated with the consumption of contaminated or poor quality water. Drinking water is one of the speediest vehicles for disease transmission. The consumer health under the prevailing environmental scenario encompasses the study of those things that affect the health and well being of the public at large. The consumer health aspects are of such importance and complexity, they have to be evaluated using œonstantly updated drinking water standards.

An overview of the legislation on water service protection and water disinfection treatment methods implemented/practised in Italy have been studied in this paper. The co-author has been to Italy to study these aspects among other environmental measures.

In Italy, the water service has been subjected to a wide reorganisation process for a long time so as to achieve higher service levels, in terms of efficiency and effectiveness, within a regulatory framework. The Italian Government, according to the directives of the European Union, has made mandatory and non-mandatory standards that must be met at the consumers tap. The core aims in environmental quality protection are detailed in the Italian Government decree during 1999, which is the transposition of 1991.

The Water Protection Plan (WPP) is considered an important sectorial plan, and the extract of it guarantees the aim of the Italian decree on Environmental Quality Protection (EQP). Cartographic representation is effectively applied in WPP. For surface water it covers ecological and chemical conditions. Similarly, for ground water it includes chemical and quantitative conditions. Analysis of Anthropogenic impacts and its results are given due consideration in the Water Protection Plan.

The disinfection methods practised include the latest technology of advanced oxidation process (AOP) among others. The Water Supply schemes (WSS) generally under practice are closed system for on-site reuse and closed system for urban reuse. The case study on the above said water supply scheme has been presented in the paper so as to make a self-assessment and to reach the goal of an improved consumer health protection in India.

INTRODUCTION

The International conference on primary health care in Alma-Ata, Geneva, World Health Organisation (WHO) in 1978 has identified that the provision of an adequate supply of safe water was one of the eight components of primary health care. In most countries the principal risks to human health are associated with the consumption of contaminated or poor quality water. Drinking water is the speediest vehicle for disease transmission. Drinking water supplied to the consumer should be suitable for consumption and for all usual domestic purposes. Pollution, population growth and drought place tough demands on the finite supply of safe and fresh water.

The consumer health under the prevailing environmental scenario encompasses the study of those things which affect the health and well being of the public at large. The consumer health aspects are of such importance and complexity that they have to be evaluated using constantly updated drinking water standards. Contaminants must be eliminated or reduced to a safe level to minimize menacing water borne diseases and long term health effects. When the relationship between water borne diseases and drinking water was established, the technology for treatment and disinfection developed rapidly. Standards were developed by the Health Authorities, and by the dedicated sanitary engineers and scientists .The Health Authority has a duty to the consumer community which is to promulgate , update, explain, publish, advertise and enforce drinking water standards.

An overview of the legislation on water service to protect consumer health and water disinfection treatment methods implemented/practiced in Italy, a developed country has been presented with a case study so as to make a self assessment and to reach the goal of an improved consumer health protection in India.

2. LEGISLATION ON WATER SERVICE IN ITALY

In Italy the water service have been subjected to a wide reorganization process for a long time so as to achieve higher service levels, in terms of efficiency and effectiveness, within a regulatory frame work.

The four fundamental regulation of the administration process are:

i) Consumer Health Protection.
ii) Environmental Resources Protection.
iii) Water Services Reorganisation.
iv) Water quality Protection.

2.1. DIRECTIVES OF EUROPEAN UNION (E U)

The EU set down minimum drinking water quality standards which each member state had to transpose into its own legislation by the end of year 2000, with additional or more stringent conditions if necessary. The compliance with the standards for most parameters must be achieved by 25.12.2003 according to the directives of the EU.

One fundamental feature of the EU directives is the distinction between these parameters which are considered important for human health and others which regard aesthetic quality.

2.1.1 Mandatory standards

The Mandatory standards which control human health include both micro biological and chemical parameters, according to EU directives. The parameters and parametric values are

respectively reported in part-A and part-B of Annexure-I. They represent the minimum water quality standards that must be guaranteed.

There are mandatory microbiological standards for E-coli and Enterococci at the consumers tap. The Italian government through its Health Dept. ensures that the rules must be met at the consumers tap.

2.1.2 Non mandatory Standards

According to EU directives, the non-mandatory standards are included for monitoring purposes only. It is sufficient to take action only if there is a threat to human health.

The non mandatory indicator parame ters include turbidity, which is a critical measure of the potential safety of water. In the case of surface water treatment the parametric value of turbidity should not exceed 1.0 NTU in the water. Another paramater is iron and manganese concentration which are important to avoid accumulations of in water distribution systems. Besides this they include aesthetic parameters such as taste, odour, colour and pH. The non mandatory indicator value are reported in part-C of Annexure –I

Compared with the back ground exposure of human beings to natural causes, it can be safely stated that radiation effects associated with water consumption are normally negligible. The Italian Govt. has specified tritium and total indicative dose as radioactivity parameters as per the EU directives.

2.1.3 Monitoring

More extensive regulatory requirements are essential to monitor treatment and sources of water supply in the interest of consumer health protection. The EU directive specifies regular monitoring that should be representative of the water supplied to the consumer throughout the year. The sampling points will be at consumer's taps. It is possible to allow sampling at treatment works for those parameters which will not change along distribution works. Monitoring must also verify the efficiency of disinfection and disinfectant by product control.

One of the important feature of the EU directive is the distinction between check and audit monitoring .The check monitoring requires relatively frequent sampling and covers microbiological, treatment, flocculant parameters and some aesthetic parameters such as turbidity, odour, color & taste. The purpose of check monitoring is to provide regular information on:

(i) Organoleptic and microbiological water quality.
(ii) Effectiveness of drinking water treatment (particularly of disinfection)
(iii) Problems of water quality due to the parameters laid down in this regulation.

The audit monitoring covers all the other parameters and is less frequent. The purpose of audit monitoring is to provide the information necessary to determine whether or not all of the law's parametric values are being complied with. All parameters must be subjected to audit monitoring unless it can be established that a parameter is not likely to be present in concentrations which could be a health risk. However, this must not be applied to radioactivity parameters.

2.1.4 Analysis and Reporting

According to the EU Directive, monitoring methods have been specified for some parameters but it is possible to use alternative methods if they produce equivalent results.

For microbiological parameters, ISO or provisional ISO method should be used while the EU Decree specifies a method for Clostridium perfrigens. The specified analysis for chemical parameters includes trueness, precision and detection limits as a percentage of the parameter value.

As per the EU directives, Italy, the member state is required to provide three year returns to the European commission on compliance with the standards.

3. ENVIRONMENTAL QUALITY PROTECTION

The Italian Government decree on environmental quality protection during 1999 is the transposition of 1991 European directive and is about protection of surface water, ground water and sea water. Its core aims are:

- prevention and reduction of pollution and water reclamation.
- improvement of water quality and adequate protection for water destined to particular uses.
- durable and lasting uses of water resources, with priority for drinking water.

3.1.0. Environmental quality Targets.

According to the requirements of said Italian decree region of country must classify water into quality classes on the basis of some chemical and biological parameter by 30.04.2003. The possible water quality classes are:

- High
- Good
- Sufficient
- Poor
- Very bad

The following must be guaranteed by the regions of Italy by 31.12.2016:

- Conservation or achievement of water quality class “good”
- Conservation of existent water quality class “high”
- Conservation or achievement for water destined to particular use.

3.2.0. Water for particular uses

The environmental quality targets for water destined to a particular use is characterized by:

i. Surface water used for drinking water production.
ii. Bathing water.
iii. Water suitable for shell fish life.
iv. Water suitable for fish life.

3. 3.0 Area Specification

The Decree on Environmental Quality Protection (EQP) defines some critical areas which require specific protection measures.

3.3.1 Sensitive areas

These areas are regards to the presence of the eutrophication phenomena. The lakes that are subjected to eutrophication, some lagoons are also included in this category.

3. 3.2 Nitrate Zone.

These are zones subjected to possible pollution due to agricultural sources. The zone that are subjected to discharge of Nitrogeneous compounds in water, i.e presence of high nitrate concentration, in water more than 50mg/ltr., are categorized as a nitrate zone

3. 3.3 Phytosanitary product and other vulnerable zone.

The area in which it is possible to impose restrictions or exclusion of phytosanitary products to protect water sources.

3. 4.0 Water Protection Plan

This is the fundamental instrument to guarantee the aims of the Italian decree on EQP. This is an extract of the watershed plan and an important sectorial plan. This is subjected to the competent watershed authority for approval.

3.4.1. General description of watershed characteristics

For surface water the watershed characteristies are described by cartographic representation of water and the indication of existing ecotypes. For ground water, the watershed characteristics are described by cartographic representation, litho stratigrafic and hydrogeological features and division into homogeneous aquifers.

3.4.2. Analysis of Anthropic impacts.

The analysis of said impact on the environmental quality of surface and ground water is:

- estimate of pollution loading from point sources.
- estimate of pollution loading from diffuse sources
- quantitative conditions of water.

3.4.3. Results of monitoring program in cartographic representation.

For surface water it includes the ecological and chemical condition. Similarly for ground water it includes the chemical and quantitative condition.

3.4.4 List of environmental quality targets for surface and ground water specified in the EQP decree.

In Italy, the Regional Agency for Environmental Conservation (ARPA) and National Agency for Environmental Conservation (ANPA) are the regulatory and competent authorities have the function of:

- Control of drinking water quality (ARPA-the regulatory authority)
- Control of treated waste water quality (ARPA- the regulatory authority)
- Data collection on environmental quality condition of water. (ARPA- the regulatory authority)

4.0 DISINFECTION METHODS UNDER PRACTICE

Disinfection of drinking water is the primary aim and the disinfectant should guarantee a residual effect, to maintain microbial quality in a water distribution system.

4.1.0 Methods of disinfection

The disinfection methods practiced in Italy are:

a) with Chlorine
b) with Chlorine dioxide (it is an unstable and explosive gas and for this reason is generated at site.)
c) with UV radiation
d) with Ozone
e) with PAA (Peracetic Acid)
f) with Hydrogen peroxide.
g) With AOP's (Advanced Oxidation Processes – such as combination of UV/ O_3 , UV/H_2O_2 and O_3 and O_3/ H_2O_2)

5.0 CASE STUDY

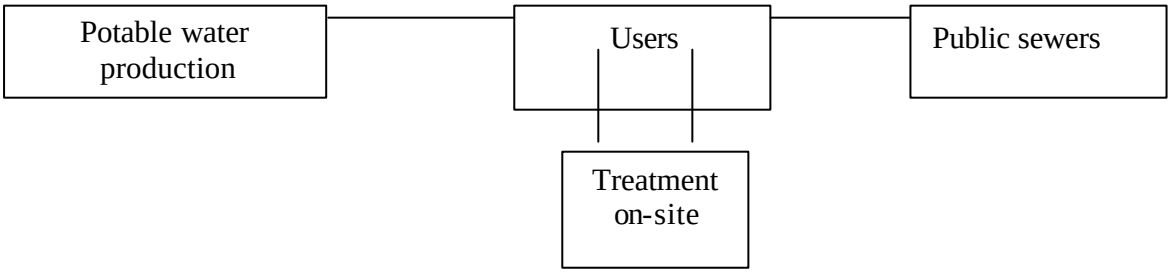
The existing WSS from Arno river, Italy and the disinfection methods, adopted for drinking water, waste water disinfection for irrigation reuse and the river's water usage practice have been studied.

5.1.0. Water supply schemes under practice.

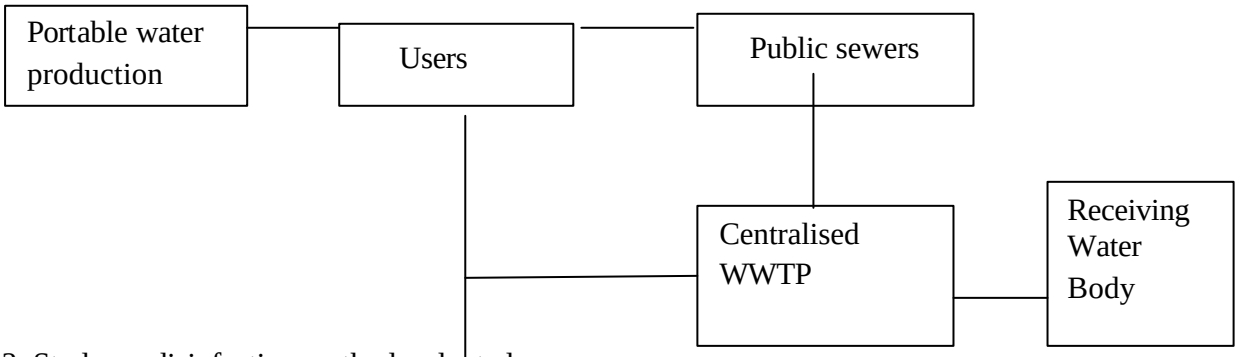
The WSS practices are of:

a) closed system for on-site reuse
b) closed system for urban reuse

5.1.1 Closed System for on - site reuse.



5.2.2 Closed system for urban reuse



5.2.3. Study on disinfection methods adopted

the study on comparison of the most used disinfection techonologies had been carried out and the study results are tabulated below.

Comparison of the most commonly used disinfection technologies :

Characteristics	Chlorine	Ozone	UV	ClO_2
Bactericidal action	++	+++	++	++
Virucidal action	+	+++	++	++
Protozoa removal	-	++	+(?)	+
Bacterial regrowth	+	+	++	+
Residual toxicity	+++	+	-	+
By-Products	+++	+	-	+
Safety problems	+++	++	+	+++
Operating costs	+	++	+	+
Investment costs	+	+++	++	+
Presence of disinfectant residual	yes	no	no	yes
Technical complexity	++	+++	++	++

((-)) none; ((+)) low; ((++))middle; ((+++)) high

((?)): some recent studies show that UV disinfection is efficient in the inactivation of *Cryptosporidium* and *Giardia* cysts.

The choice of a given disinfection process is generally driven by several criteria, such as cost-effectiveness, safety, environmental impact and public health related issues.

CONCLUSIONS:

1. The achievement and maintenance of drinking water standard levels, except for temporary derogations, have been made compulsory regardless of the division of the local authorities.

2. Minimum water supply per person of 150 lit/day in 24 hrs has been made assured under any eventuality.

3. No critical areas (zones where water services management are deficient from an infrastructural or oganisational point of view) were noticed in the study area particularly in respect of consumer health protection criticalities as stated below.

a) Protection of groundwater supply-A1

b) Presence of effective water treatment plant-A2

c) Qualitative improvement of water resource-A3

4. The choice of a given disinfection process is generally driven by several criteria, such as cost-effectiveness, safety, environmental impact and public health related issues. The process selection is important nowadays, where new indicators or pathogens other than bacteria are considered.

5. The description of watershed characteristics by cartographic representation (for both surface water and groundwater) plays an efficient tool in a water protection plan.

Annexure I

Mandatory Standards:

Part A

Microbiological parameters

Parameter	**Parametric value (number/100 ml)**	
	(a) **ITALY (**EU directive	**India**

	98/83/CE)	IS 10500-1991
Escherichia coli (E.coli)	0	Absent
Enterococci	0	Absent

Part B
Chemical parameters

Parameter	Parametric Value			
	Italy		India	
Acylamid	0.10	µg/L	-	
Antimony	5.0	µg/L	-	
Arsenic	10	µg/L	0.05	mg/L
Benzene	1.0	µg/L	-	
Benzo(a)Pyrene	0.010	µg/L	-	
Boron	1.0	mg/L	1	mg/L
Bromate	10	µg/L	-	
Cadmium	5.0	µg/L	0.01	mg/L
Chromium	50	µg/L	0.05	mg/L
Copper	1.0	mg/L	0.05	mg/L
Cyanide	50	µg/L	0.05	mg/L
1,2,-dichloroethane	3.0	µg/L	-	
Epichlorohydrin	0.10	µg/L	-	
Fluoride	1.50	mg/L	1	mg/L
Lead	10	µg/L	0.05	mg/L
Mercury	1.0	µg/L	0.001	mg/L
Nickel	20	µg/L	-	

Part B
Non Chemical parameters

Parameter	Parametric Value	
	Italy	India
Nitrate (NO_3)	50 mg/L	45 mg/L
Nitrite (NO_2)	0.50 mg/L	-
Pesticides	0.10 µg/L	absent
Pesticides-total	0.50 µg/L	-
Polycyclic aromatic hydrocarbons	0.10 µg/L	-
Selenium	10 µg/L	0.01 mg/L
Tetrchloroethene and Trichloroethene	10 µg/L	-
Trilhalomethanes-total	30 µg/L	-
Vynil chloride	0.50 µg/L	-
Chlorite	200 µg/L	-
Vanadium	50 µg/L	-

Mandatory Standards:

Part C
Indicative parameters

Parameter	Parametric Value		
		Italy	India
Aluminum	200	µg/L	-
Ammonium	0.50	mg/L	-
Chloride	250	mg/L	250 mg/L
Clostridium perfrigens (including spores)	0	No./100 ml	-
Colour	Acceptable to consumers and no abnormal change	-	5 Hazen unit
Conductivity	2500	µg/L	-
Hydrogen ion concentration	= 6.5 and =9.5	-	6.5-8.5
Iron	200	mg/L	0.3 mg/L
Manganese	50	mg/L	0.1 mg/L
Odour	Acceptable to consumers and no abnormal change	-	unobjectionable
Oxidisability	5.0	mg/L	-
Sulphate	250	mg/L	200 mg/L

Sodium	200 mg/L	-

Taste	Acceptable to consumers and no abnormal change	Agreeable
Colony count 22° C	No abnormal change	-
Coliform becteria	0	Number/100 ml
Total organic carbon (TOC)	No abnormal change	-
Turbidity	Acceptable to comsumers and no abnormal change	5 NTU
Hardness *	Value at 15-50 ‘f	300
Dry residue 180° C**	1500mg/lit	-
Residual disinfectant ***	0.2 mg/lit	0.2 mg/lit

Radioactivity(in Italy only)

Parameter	Parametric Value	Unit
Tritium	100	Becquerel/L
Total indicative does	0.10	mSv/year