



December, 2013

ENVIS Newsletter



जहाँ है हरियाली ।
वहाँ है खुशहाली ॥

BIHAR ENVIS CENTRE

On State of Environment & Related Issues

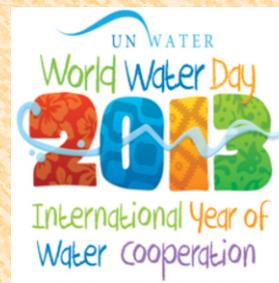
Sponsored by

The Ministry of Environment and Forests, Govt. of India.

Visit us at

www.bhenviis.nic.in, E-mail: bh@enviis.nic.in

Telefax: 0612-2284330



Bihar State Pollution Control Board

BELTRON Bhawan, 2nd Floor, Shastri Nagar, Patna (Bihar)

Ph: 0612- 2281250 / 2282265 / 2281776

Fax: 0612- 2281050/2291709

Noise Monitoring Terminals in Patna



Noise monitoring terminal at Beltron Bhawan, Patna



Noise monitoring terminal at Patliputra Industrial Area, Patna



Noise monitoring terminal at Taramandal, Patna



Noise monitoring terminal at Patna Rly Station, Patna



Noise monitoring terminal at PMCH, Patna

Cover Page-Hon'ble Chief Minister, Bihar, Sri Nitish Kumar at the foundation laying ceremony of 'Parivesh Bhawan', Head Office-cum-Laboratory and training Centre of BSPCB on 28.11.2013.

DRINKING WATER: ELIXIR OF LIFE

Water is one of the most precious natural resources of our planet. It is renewable in nature and there is no alternative of water like other natural resources-coal, petroleum etc. It is nature's vital gift to mankind as well as medium of life and life can't be imagined without water. Where there is life, there is water. The presence of water is also decisive in the emergence and survival of the climate system of Earth. The climate of Earth played a key role in the evolution of life. The constant circulation of water is the essential catalyst for constant circulation of the life.

We cannot explain how water came to be on Earth. Although more than 2/3 of the surface of our Planet is covered with water, only a tiny fraction of this water is available to us as freshwater. About 97% of the total water available on earth is found in the ocean and is too salty for drinking or irrigation. The remaining 3% is fresh water. Of this, 2.99% is locked in ice caps or glaciers. Thus, only 0.01% of the earth's total volume of water is easily available to us as soil moisture, groundwater, water vapor and the water in lakes, streams, rivers & wetlands. Living survival depends on freshwater, has to share among each other no more than 0.01% of the total water reserve of our Planet. This scarce resource however plays a crucial role in all segments of nature, society and economy. In view of the projected growth of population, demand for water and an accelerating climate change, it is expected that by 2030 some 40% of the world's population will suffer from water shortage.

Water resource knows no borders and it is not confined to political borders. For instance, 148 countries have international basins within their territory. Access to fresh water is likely to become a fundamental issue of prosperity and peace at the individual and national level alike. It would be a matter of life and death. As rapid urbanization, climate change and growing food-needs put ever-increasing pressure on freshwater resources and its availability is expected to decrease in many regions. This makes water a very precious resource and it is so delicately inter-linked with people, land, river, forests, habitat, ecology and environment that any imbalance in equilibrium bring catastrophe to this earth. Therefore, it is needed to have a pollution prevention and conjunctive usage of all available water resources.

Human body needs three requisites for its smooth functioning – oxygen, water and food in that order. Our first requirement to live is oxygen, since we cannot survive more than a few minutes without taking oxygen. Water has been ranked as second essential requisite for life, because we can stay for a few days without drinking water. Then comes the food.

Human body is made up of two-thirds of water and one-third of solid matter. The average adult body is 55 to 75% of water. A human embryo is more than 80% water. A newborn baby is 74% water. Human survival is dependent on water and there are lots of properties of water which make it essential for life as well as for our good health. Water quality is more influential for our physical health also. People drink up to one ton of water in a year and this is a tremendous amount. It is a known fact that safe drinking water is essential for healthy living. There is enough scientific data to prove that most of the serious diseases and deaths particularly in rural area, are caused due to the unsafe drinking water. With a growing population and rising needs of a fast developing nation as well as the given indicators of the impact of climate change, per capita availability of water is likely to go down from 1545 cubic metre/yr, in 2011 to 1341 cubic metre/yr, in 2025. One out of every three persons in the country is facing water problem. The increasing demand of water for various purposes will further strain with the possibility of deepening water conflicts among different user groups as drinking water need is going to rise by 44 percent, irrigation need by 10 percent, industry need by 81 percent respectively by 2025. Water is essential to sustain life, and a satisfactory (adequate, safe and accessible) supply must be available to all. This can be done by water conservation, minimizing wastage, creating mass awareness and ensuring more equitable distribution of water resources. In view of above, the UN General Assembly declared the period from 2005 to 2015 as the International Decade for Action, "Water for Life." Indian Govt. declared the year 2013 as 'Water Conservation Year'.

Bihar with having high groundwater potential is facing a serious water quality problem due to deterioration of ground water quality in recent years because of various human activities. Around 95% of the population draws water from underground, whose level is constantly falling. Depletion of water table, presence of chemical impurities like Arsenic, Fluoride and Iron in water in many areas is making it more unsafe, since it is only source of drinking water in the state. We are going to be dependent on packed drinking water day by day. Therefore, in Bihar (and possibly in whole country), water is being sold every where in plastic containers and bottles as packed drinking water and common people are buying them and drinking water. Number of new unit to manufacture packed drinking water in the State is increasing exponentially. So, there is need to know about the quality of these packed water and regulations related to it. We should be aware of how safe is the water we are drinking. We have tried to disseminate ground reality of drinking water management and related issues through this newsletter.

Related Terminology

- **Drinking Water:** Drinking water is water intended for human consumption for drinking and cooking purposes from any source. It includes water (treated or untreated) supplied by pipes or any other means for human consumption by any supplier.
- **Pure Water:** Pure water is that water which contains only two parts of hydrogen and one part of oxygen. It is water from a source that has removed all impurities. Distilled water is the common form of pure water. Pure water can be used for cooking, drinking, scientific studies and laboratories.
- **Distilled Water:** Distilled pure water is the water that is produced by distillation, this water is boiled and the steam is then condensed into a container to get distilled water.
- **De-ionized Water:** It is cheaper imitation of distilled water. This type of pure water is obtained by removing all minerals, ions such as calcium, copper and iron. The deionization process is a physical process that use ion-exchange resins that removes the mineral salt from water.
- **Wholesome Water:** Water which is fit to use for drinking, cooking, food preparation, or washing without any potential damage to human health. In other words, wholesome water is that pure water which is not chemically pure but does not contain anything which can be harmful to human health.
- **Palatable Water:** The water which is tasteful for drinking and aesthetically pure, is known as Palatable Water.
- **Potable Water:** The water which is fit for consumption by humans and other animals. It is also called drinking water, in a reference to its intended use. Water may be naturally potable, as is the case with pristine springs, or it may need to be treated in order to be safe. Potable water should not be harmful in any way. In fact, the water which has both the characteristics i.e. of 'wholesome water' and 'palatable water' is known as potable water. **Potability of water** refers to fitness of the water for drinking;
- **Packaged Drinking Water:** "Packaged drinking water" means water derived from any surface water or underground water or sea water which is subjected to hereinunder specified treatments, namely, decantation, filtration, combination of filtration, aerations, filtration with membrane filter, cartridge filter, activated carbon filtration, demineralisation, remineralisation, reverse osmosis and packed after disinfecting the water to a level that shall not lead to any harmful contamination in the drinking water by means of chemical agents or physical methods to reduce the number of micro-organisms to a level beyond scientifically accepted level for food safety or its suitability. Provided that sea water, before being subjected to the above treatments, shall be subjected to desalination and related processes.

- **Natural Mineral Water and Packed Natural Mineral Water:** Water clearly distinguishable from ordinary drinking water because it is obtained directly from underground water-bearing strata for which all possible precautions should be taken within the protected perimeters to avoid any pollution of, or external influence on, the chemical and physical qualities; characterized by its contents of certain mineral salts and their relative proportions and the presence of trace elements or of other constituents; of the constancy of its composition and the stability of its discharge and its temperature and it is collected under conditions which guarantee the original microbiological purity and chemical composition of essential components. Packed natural mineral water is natural mineral water filled into hermetically sealed containers of various compositions, forms and capacities that is, suitable for direct consumption without further treatment.
- **Carbonated Water:** Carbonated water, also known as sparkling water or seltzer water, is plain water into which carbon dioxide gas under pressure has been dissolved. This process, known as carbonation, is a process that causes the water to become effervescent. It results in the formation of carbonic acid (which has the chemical formula H_2CO_3). Soda water is an example of carbonated water which is easily available in the open market.
- **Polluted Water:** The water which consists of undesirable substances which make it unfit for drinking and domestic use, is known as polluted water.
- **Contaminated water:** The water containing pathogenic organisms is called as “Contaminated Water”. The contaminated water is also polluted but the polluted water may not be contaminated.
- **Water Pollution:** Water pollution can be defined as alteration of physical, chemical or biological characteristics of water through natural or human activities and making it unsuitable for its designated use.
- **Surface Water:** The water that is found in streams, rivers, lakes, wetlands and artificial reservoirs is called surface water.
- **Ground Water:** Water that percolates into the ground and fills the pores in soil and rock is called ground water.
- **Effluent:** Effluent is an outflow of water from a natural body of water or from human made structure. Commonly defined as waste water treated or untreated- that flows out of a treatment plant, sewer or industrial outfall; and is generally refers to wastes discharged into surface water.
- **Water Quality:** Water quality is the physical, chemical and biological characteristics of water. It is a measure of condition of water relative to the requirements of any human need or purpose.

What is Drinking Water

Fresh water present on the earth is put to many uses. It is used for drinking, domestic and municipal uses, agriculture, irrigation, industries, navigation, recreation...etc. The term 'drinking water' is synonymously used with 'potable water', 'wholesome water', 'safe drinking water', or 'clean drinking water'. Fresh, pure and clean water is tasteless, odorless clear liquid. Pure and healthy drinking water reduces a wide range of contaminants of health concern.

It has not been defined legally. The Supreme Court of India upholds as right to clean drinking water is a fundamental right. It has been linked with Article 21 of the Indian Constitution by the court. In our country, drinking water norms are still remain voluntary in nature. Potable water/drinking water is still not included under the PFA Act, 1954 as “Food”. Groundwater also still remains unlegislated in the country except some states like Goa and other. The Centre, therefore, only 'recommend'. It is the state, and its (state-level) agencies, that have to ensure quality drinking water.

Sources and Pollution of Drinking Water

Surface and groundwater both are sources of drinking water after required treatment. Most of water pollution is man-made. It may also occur naturally by addition of soil particles through erosion, animal wastes and leaching of minerals from rocks.

Sources of surface water pollution can be classified as

- ◆ Municipal Waste Water;
- ◆ Industrial Waste;
- ◆ Inorganic Pollutants;
- ◆ Organic Pollutants;
- ◆ Agriculture Wastes; and
- ◆ Thermal Pollution.

Sources of Underground/Ground Water Pollution

Underground water was considered fairly safe source of drinking water but it is threatened with contamination due to seepage from industrial waste & effluent, municipal waste & sewage and agricultural runoff. The ground water also gets polluted by leaching of salts and minerals due to overuse of ground water sources.

Saltwater encroachment associated with over drafting of aquifers or natural leaching from naturally occurring deposits are natural sources of ground water pollution. Most concern over ground water contamination has centered on pollution associated with human activities.

Over Use of Water

Water is used by every living organism on the earth. The requirement of everybody varies, people should utilize it economically, but population growth has created much demand of water. In some areas the demand for water already exceeds nature's supplies. Due to rapid urbanization more people move toward urban areas which lead to overuse of water in urban areas. Over exploitation in term is often used when the rate of extraction exceeds the safe yield of any water resources. The most evident problem is a lowering of the water table beyond the reach of existing wells. Well must consequently be deepened to reach the ground water, in some places the water table has dropped hundreds of feet because of extensive well pumping. A lower water table may, in turn, cause other problems such as groundwater-related subsidence and salt water intrusion.

As per United Nation

- In developing countries, 70 percent of industrial wastes are dumped untreated into waters where they pollute the usable water supply;
- Globally, diarrhoea is the leading cause of illness and death, and 88 per cent of diarrhoeal deaths are due to a lack of access to sanitation facilities and unsafe drinking water;
- The provision of improved sanitation and safe drinking water could reduce diarrhoeal diseases by nearly 90 percent; and
- 11 % of the global population, or 783 million people, are still without access to water.

Demand of Water

As we know there are various uses of water in houses such as for drinking, bathing, cooking, washing etc. It mainly depends upon the habit, social status, climatic conditions and customs of the people. Under normal conditions, the minimum domestic consumption of water in India is about 135 liter/day/capita. The details of domestic consumption are

a) Drinking -	5 liter
b) Cooking-	5 liter
c) Bathing-	55 liter
d) Clothes Washing-	30 liter
e) Utensil Washing-	20 liter
f) <u>House Washing-</u>	<u>20 liter</u>
Total-	135 liter/day/capita

Per Capita Demand of Water: If 'Q' is the total quantity of water required for various purposes by a town per year and 'P' is population of town, then per capita demand will be = $\frac{Q}{P \times 365}$ liter/day.

For an average Indian Town, the requirement of water in various uses is as under:

a) Domestic Purpose-	135 liter/capita/day
b) Industrial use-	40 liter/capita/day
c) Public use-	25 liter/capita/day
d) Fire demand-	15 liter/capita/day
e) Losses, Wastage and Theft-	<u>55 liter/capita/day</u>
Total-	270 liter/capita/day

As per United Nation

- Each person needs 20-50 litres of water a day to ensure their basic needs for drinking, cooking and cleaning; and
- The daily drinking water requirement per person is 2-4 litres, but it takes 2000 to 5000 litres of water to produce one person's daily food.

Role of Various Govt. Organizations Involved in Water Management

The drinking water supply is a State subject and, therefore, it is primarily the responsibility of the respective State Governments to provide safe drinking water to the people. Various govt. organizations are involved in drinking water management but the Central Government acts only as a facilitator in this regard. In our country the following agencies are directly or indirectly connected with regulating, monitoring and laying down standards of water:

- Ministry of Health & Family Welfare;
- Bureau of Indian Standards under the Ministry of Consumer Affairs, Food and Public Distribution;
- Ministry of Rural Development;
- Ministry of Urban Development;
- Ministry of Environment and Forests;
- Ministry of Water Resources; and
- Local Bodies

Central Government

◆ **The Ministry of Health and Family Welfare:** The Ministry administers the Prevention of Food Adulteration Act, 1954, along with the Prevention of Food Adulteration Rules, 1955. Earlier, drinking water was not included in the purview of this act. Only packaged water ("bottled drinking water" or "packed drinking water") has been included under the definition of food vide notification GSR 202(E), dated 21st March, 2001. Thereafter, it had been brought under the compulsory certification scheme of the BIS. Potable water/drinking water is still not included under the PFA as "Food".

The PFA Act covers food standards, general procedures for sampling, analysis of food, powers of authorized officers, nature of penalties and other parameters related to food. Then, this act was repealed by The Food Safety and Standards Act, 2006 which is related to:-

- Procedure for Licensing and Registration of Food Business Operators;
- Operationalization of Food Safety and Standards Act by the State Government; and
- To deal with the other business of food safety etc.

Food Safety and Standards Authority of India (FSSAI)

It has been established under Food Safety and Standards Act, 2006 (FSS Act) which consolidates various central acts & orders [like Prevention of Food Adulteration Act, 1954, Fruit Products Order, 1955, Meat Food Products Order, 1973, Vegetable Oil Products (Control) Order, 1947, Edible Oils Packaging (Regulation) Order, 1988, Solvent Extracted Oil, De-Oiled Meal and Edible Flour (Control) Order, 1967, Milk and Milk Products Order, 1992 etc] that have hitherto handle food related issues in various Ministries and Departments. FSSAI has been created for laying down science based standards for articles of food and to regulate their manufacture, storage, distribution, sale and import to ensure availability of safe and wholesome food for human consumption.

The FSS Act also aims to establish a single reference point for all matters relating to food safety and standards, by moving from multi-level, multi-departmental control to a single line of command. To this effect, the Act establishes an independent statutory Authority – the **Food Safety and Standards Authority of India** with head office at Delhi. Food Safety and Standards Authority of India (FSSAI) and the State Food Safety Authorities enforce various provisions of the Act. Ministry of Health & Family Welfare, Government of India is the Administrative Ministry for the implementation of FSSAI.

- ◆ **The Bureau of Indian Standards:** The Bureau of Indian Standards (BIS) an autonomous national standards body of the country under the administrative control of the Department of Consumer Affairs is mandated to prepare and implement standards. BIS bottle water norms have been notified under the Prevention of Food Adulteration Act, 1954, whereas the drinking water/potable water norms still remain voluntary in nature. BIS ensures the quality of Packaged Drinking Water manufactured by its licensees through a well-defined certification scheme wherein regular surveillance is done of the licensees by factory inspections and drawing of samples from factory & market and their independent testing to check the conformity of the product to relevant Indian Standards. If such licensees are found not meeting the norms prescribed in the relevant Indian Standards, actions like warning, stop marking, deferment of renewal of licence and cancellation of licence are taken.
- ◆ **The Ministry of Rural Development and The Ministry of Urban Development:** They are concerned with the supply of drinking water in the country. It is the Department of Drinking Water Supply under the Ministry of Rural Development in regard to rural areas and Central Public Health and Environmental Engineering Organization (CPHEEO) under the Ministry of Urban Development for urban areas. Though the norms for quality of drinking water have been laid down by both these agencies, these are only recommendatory in nature. The implementation part vests with the State Governments.
- ◆ **The Ministry of Environment and Forests:** Ministry is concerned with implementation of policies and programmes related to conservation of the country's natural resources including lakes and rivers and the prevention and abatement of pollution. There are many Acts/ Legislation available in the country for control/abatement of water pollution like:- The Water (Prevention and Control of Pollution) Act,1974, The Water Cess (Prevention and Control of Pollution) Act, 1977 and The Environment (Protection) Act,1986, which monitors surface water quality, chiefly rivers. The Central Pollution Control Board and State Pollution Control Board under the Ministry of Environment and Forests implement these legislations.
- ◆ **The Ministry of Water Resources:** The Ministry is responsible for laying down policy guidelines and programmes for the development and regulation of country's water resources.
 - **Central Ground Water Authority:** It has been constituted under Section 3 (3) of the Environment (Protection) Act, 1986 to regulate and control the development and management of ground water resources in the country and function under the administrative control of the Ministry of Water Resources.
 - **Central Ground Water Board:** Central Ground Water Board (CGWB), a subordinate office of the Ministry of Water Resources, Government of India, is the National Apex Agency entrusted with the responsibilities of providing scientific inputs for management, exploration, monitoring, assessment, augmentation and regulation of ground water resources of the country. Central Ground Water Board was established in 1970 by renaming the Exploratory Tube wells Organization under the Ministry of Agriculture, Government of India. It was merged with the Ground Water Wing of the Geological Survey of India during 1972.
 - **Central Water Commission:** Central Water Commission is a premier Technical Organization of India in the field of Water Resources and is presently functioning as an attached office of the **Ministry of Water Resources, Government of India**. The Commission is entrusted with the general responsibilities of initiating, coordinating and furthering in consultation of the State Governments concerned, schemes for control, conservation and utilization of water resources throughout the country, for purpose of Flood Control, Irrigation, Navigation, Drinking Water Supply and Water Power Development. It also undertakes the investigations, construction and execution of any such schemes as required.
 - **The Water Quality Assessment Authority:** There are several agencies, which are operating water quality network in the country. These include the Central Ground Water Board/Authority, Central Water Commission, Water Supply Authorities, Industries and Educational Research Institutes. All these agencies are working more or less independent of each other and there is hardly any co-ordination among these. The result was that, total confusion as one agency did not know what the other was doing and very often there was a great deal of overlapping. In order to address this problem of multiplicity and with a view to bringing the various agencies on a single interactive platform, the Central Government, Ministry of Environment and Forests constituted **The Water Quality Assessment Authority** in May, 2001 which function under the administrative control of the Ministry of water Resources, Govt. of India.
Functions of Water Quality Assessment Authority at Central level- To exercise powers under Section 5 of Environment (Protection) Act 1986 for issuing direction and for taking measures for investigations and research; establishment or recognition of environmental laboratories and institutes; collection and dissemination of information and preparation of manuals, codes or guides relating to the prevention, control and abatement of water pollution.
- ◆ **National Water Development Agency:** National Water Development Agency(NWDA) was set up in July, 1982 as Autonomous Society under the Societies Registration Act, 1860, to carry out the water balance and other studies on a scientific and realistic basis for optimum utilisation of Water Resources of the Peninsular rivers system for preparation of feasibility reports and thus to give concrete shape to Peninsular Rivers Development Component of National Perspective. In 1990, NWDA was also entrusted with the task of Himalayan Rivers Development Component of National Perspectives. Recently, the functions of NWDA have been further modified and the work of preparation of detailed Project Reports (DPR) of various link proposals and Pre-feasibility Reports and feasibility reports of intra-State links as proposed by the States have been included in the functions of NWDA.
- ◆ **National Ganga River Basin Authority:** To take measures for abatement of pollution and conservation of the river Ganga to maintain its ecology, water quality with other measures.

State Government

Drinking water is a state subject and role of the Union Ministry is merely recommendatory in nature. It is the state government that must adopt standards and enforce them. CPHEEO has recommended drinking water quality standards in its *Manual on Water Supply and Treatment*, but the standards are not legally binding on local governments. BIS has also developed drinking water quality standards but they are not mandatory. Local bodies such as Municipal Corporation/Nagar Parishad/Nagar Panchayat and Public Health Engineering Department in urban areas are expected to follow these guidelines.

Functions of various state level agencies

- ◆ **Line Department of State Government:** Implementation of provisions of PFA Rules and water quality management programmes and schemes;
- ◆ **Water Quality Review Committee at state level under the Water Quality Assessment Authority at Central level:** Generation of reliable water quality data; facilitation of activities for prevention and control of pollution of water bodies and improve co-ordination between central and state agencies;
- ◆ **Bihar State Ganga River Conservation Authority:** To take measures for abatement of pollution and conservation of the river Ganga in the State to maintain its ecology, water quality with other measures;
- ◆ **State Pollution Control Board:** Enforcement of provisions of various acts and rules for prevention and control of water pollution; and
- ◆ **Rural and Urban Local Bodies:** Implementation of water supply & quality management programmes formulated by the Govt. in the field of Drinking Water.

Water Quality Standards

Water quality depends on the intended use of water which may be either human consumption or it may be for industries, irrigation, recreation etc. Depending upon the proposed use of water, certain water quality criteria are established and based on these criteria water quality standards are specified by health department and other regulation agencies. Different types of uses require different level of water purity. Drinking water requires highest standards of purity.

In our country, there are following specifications of water based on physical, chemical and microbiological analysis:

- Potable Water/Drinking Water;
- Packaged Drinking Water
- Packaged Natural Mineral Water;
- The Water for Food Industry;
- Reagent Grade Water;
- Water for Swimming Pools;
- Water for different designated best use-notified under The E(P) Rules,1986;Schedule I, Sl. No.-86
- Water for Pharmaceutical industry;
- Water for Irrigation; and
- Water for Construction Etc

Drinking water standards

Drinking water/Potable water in urban and rural areas is generally supplied only by the State Govt. undertakings or the local bodies and water is treated and purified by them before it is supplied to the public. Water treated and supplied by local authorities is not within the definition of “food” under PFA Act, 1954. Drinking water remains unlegislated in India. PFA Act prescribes the standards for bottle water only which is implemented by the prescribed authority.

Following standards for drinking water quality are in practice:-

❖ **Standards on Packed Drinking Water notified under The PFA Act, 1954:**

- For Packaged drinking water; and
- For Natural Mineral Water.

❖ **Bureau of Indian Standards (BIS) has formulated following Indian Standards:**

- Drinking Water Specification: **IS 10500: 2012**
- Packaged drinking water (other than natural mineral water) specification **IS: 14543:** Indian Standard
- Natural Mineral Water. specification **IS: 13428:** Indian Standard

For Packing Materials:

- Bottles, cups, glasses and Jars as per **IS:15410;** and
- Pouches and Films as per **IS:15609.**

❖ **Drinking water quality standards recommended by CPHEEO.**

❖ **Drinking water quality standards recommended by World Health Organization (WHO).**

Characteristic/Parameters	Drinking Water/Potable Water Specifications (As per IS 10500:2012)		Standards of Packaged Drinking Water		CPHEEO recommended standards for Potable Water		WHO Guidelines Values
	Requirement (Acceptable Limit)	Permissible Limit in absence of alternate source,	Under PFA Rules. 1955	As per IS 14543:2004	Acceptable mg/l	Cause for rejection	
Organoleptic and Physical Parameters							
Colour (Hz units),max.	5	15	Not more than 2 Hz Units/True Colour Units	2	5	25	Not mentioned
Odour	Agreeable	Agreeable	Agreeable	Agreeable	Unobjectionable	Unobjectionable	No guideline
pH	6.5 to 8.5	No relaxation	6.5-8.5	6.5 to 8.5	7.0 to 8.5	<6.5 or >9.2	No guideline
Taste	Agreeable	Agreeable	Agreeable	do	Unobjectionable	Unobjectionable	
Turbidity, NTU, max.	1	5	Not more than 2 nephelometric turbidity unit (NTU)	2	2.5	10	Not mentioned
TDS, max.	500	2000	Not more than 500 mg/litre	500	500	1500	No guideline
General Parameters Concerning Substances Undesirable in Excessive Amounts							
Aluminium (as Al), mg/l, Max	0.03	0.2	Not more than 0.03 mg/litre	0.03	0.03	0.2	0.2 mg/l
Ammonia (as total ammonia-N), mg/l,Max	0.5	No relaxation					No guideline
Anionic detergents (as MBAS)mg/l, Max	0.2	1.0	Not more than 0.2 mg/litre	0.2	0.2	1.0	
Barium (as Ba), mg/l, .Max	0.7	No relaxation	Not more than 1.0 mg/litre	1.0	--	--	0.7
Boron (as B), mg/l, Max	0.5	1.0	Not more than 5 mg/litre	5	--	--	2.4
Calcium (as Ca), mg/l, Max	75	200	Not more than 75 mg/litre	75	75	200	
Chloramines (as Cl ₂), mg/l, Max	4.0	No relaxation					
Chloride (as Cl), mg/l, Max	250	1000	Not more than 200 mg/litre	200	200	1000	
Copper (as Cu), mg/l, Max	0.05	1.5	Not more than 0.05 mg/litre	0.05	0.05	0.5	2
Fluoride (as F) mg/l, Max	1.0	1.5	Not more than 1.0 mg/litre	1.0	1.0	1.5	1.5
Free residual chlorine, mg/l, Min	0.2	1	Not more than 0.2 mg/litre	0.2	0.2	>1.0	5 (C)
Iron (as Fe), mg/l, Max	0.3	No relaxation	Not more than 0.1 mg/litre	0.1	0.1	1.0	No guideline
Magnesium (as Mg). mg/l, Max	30	100	Not more than 30 mg/litre	30	30#	150	
Manganese (as Mn). mg/l, Max	0.1	0.3	Not more than 0.1 mg/litre	0.1	0.05	0.5	0.5 mg/l
Mineral oil, mg/l, Max	0.5	No relaxation	Not more than 0.01 mg/litre	A bsent	0.01	0.3	
Nitrate (as NO ₃), mg/l, Max	45	No relaxation	Not more than 45 mg/litre	45	45	45	50
Phenolic compounds (as C ₆ H ₅ OH), mg/l, Max	0.001	0.002	Not more than 0.001 mg/litre	A bsent	0.001	0.002	
Selenium (as Se), mg/l, Max	0.01	No relaxation	Not more than 0.01 mg/litre	0.01	0.01	0.01	0.04 (P)
Silver (as Ag), mg/l, Max	0.1	No relaxation	Not more than 0.01 mg/litre	0.01	--	--	
Sulphate (as SO ₄) mg/l, Max	200	400	Not more than 200 mg/litre	200	200	400	
Sulphide (as H ₂ S), mg/l, Max	0.05	No relaxation	Not more than 0.05 mg/litre	0.05	--	--	
Total alkalinity as calcium carbonate, mg/l, Max	200	600	Not more than 200 mg/litre	200	200	600	
Total hardness (as CaCO ₃), mg/l, Max	200	600			200	600	No guideline
Zinc (as Zn), mg/l, Max	5	15	Not more than 5 mg/litre	5	5.0	15.0	3 mg/l
Nitrite (as NO ₂), mg/l, Max			Not more than 0.02 mg/litre	0.02	--	--	3
Sodium (as Na), mg/l, Max			Not more than 200 mg/litre	200	--	--	40
Antimony (as Sb), mg/l, Max			Not more than 0.005 mg/litre	0.005	--	--	0.005 mg/l
Parameters Concerning Toxic Substances							
Cadmium (as Cd), mg/l, Max	0.003	No relaxation	Not more than 0.01 mg/litre	0.01	0.01	0.01	0.003
Cyanide (as CN) mg/l, Max	0.05	No relaxation	Not more than 0.05 mg/litre	A bsent	0.05	0.05	
Lead (as Pb), mg/l, Max	0.01	No relaxation	Not more than 0.01 mg/litre	0.01	0.10	0.10	0.01 (A,T)
Mercury (as Hg) mg/l, Max	0.001	No relaxation	Not more than 0.001 mg/litre	0.001	0.001	0.001	0.006
Molybdenum (as Mo), mg/l, Max	0.07	No relaxation					
Nickel (as Ni), mg/l, Max	0.02	No relaxation	Not more than 0.02 mg/litre	0.02	--	--	0.07

Pesticides, µg/l. Max		No relaxation	Below detectable limits				
Polychlorinated biphenyls, mg/l, Max	0.0005	No relaxation	Not detectable	Not detectable	--	--	
Poly nuclear aromatic hydrocarbons (as PAH), mg/l, Max	0.0001	No relaxation	Not detectable	Not detectable	0.2	0.2	
Total arsenic (as As), mg/l, Max	0.01	0.05		0.05	0.05	0.05	0.01(A,T)
Total chromium (as Cr), mg/l, Max	0.05	No relaxation	Not more than 0.05 mg/litre	0.05	0.05	0.05	0.05 (P)
Trihalomethanes :							
a) Bromoform, mg/l, Max	0.1	No relaxation					100
b) Dibromochloromethane, mg/l, Max	0.1	No relaxation					100
c) Bromodichloromethane, mg/l, Max	0.06	No relaxation					60
d) Chloroform, mg/l, Max	0.2	No relaxation					300
Parameters Concerning Radioactive Substances							
Radioactive Materials:							
a) Alpha emitters Bq/l. max	0.1	No relaxation	Not more than 0.1 Becquerel/litre (Bq)	0.1			
b) Beta emitters Bq/l.max	1.0	No relaxation	Not more than 1 Pico curie/litre (pCi)	1			
Pesticide Residues Limits							
Pesticide	Limit in µg/l						
Alachlor	20						20 µg/l
Atrazine	2						2 µg/l
Aldrin/ Dieldrin	0.03						0.03 µg/l
Alpha HCH	0.01						
Beta HCH	0.04						
Butachlor	125						
Chlorpyrifos	30						
Delta HCH	0.04						
2,4-Dichlorophenoxy acetic acid	30						30
DDT (o,p and p, p-Isomers of DDT, DDE and DDD)	1						2 µg/l
Endosulfan (alpha, beta, and sulphate)	0.4						
Ethion	3						
Gamma -HCH (Lindane)	2						
Isoproturon	9						9
Malathion	190						
Methyl parathion	0.3						
Monocrotophos	1						
Phorate	2						
i) Pesticide residues considered individually	-		-	Not more than 0.000 1 mg/l			
ii) Total pesticide residue	-		-	Not more than 0.000 5 mg/l			
Bacteriological Quality of Drinking Water							
Organisms	Requirements						
i) All water intended for drinking							
a) E. coli or thermo tolerant coli form bacteria	Shall not be detectable in any 100 ml sample						
ii) Treated water entering the distribution system:							
a) E. coli or thermo tolerant coli form bacteria	Shall not be detectable in any 100 ml sample						
b) Total Coli form bacteria	Shall not be detectable in any 100 ml sample						
iii) Treated water in the distribution system							
a) E. coli or thermo tolerant coli form bacteria	Shall not be detectable in any 100 ml sample						
b) Total Coli form bacteria	Shall not be detectable in any 100 ml sample						

Note: According to WHO 2011- The WHO recommends a set of guideline values representing the concentration of constituents in drinking water that will not result any significant health risk to a consumer weighing 60 kg over a lifetime consumption of 2 litres per day for 70 years.

P- Provisional guideline value, the available information on health effects is limited.

T- Provisional guideline value as calculated guideline value is below the level that can be achieved through practical treatment

methods, source protection, etc.

A- Provisional guideline value as calculated guideline value is below the achievable quantification level.

D- Provisional guideline value as disinfection may result in the guideline value being exceeded.

C- Concentrations of the substance at or below the health-based guideline value may affect the appearance, taste or odour of the water, leading to consumer complaints.

An Overview State's Drinking Water Resources and their Status

Bihar: A brief profile

Bihar is the third largest state of Republic India having population over 103.80 million. 89% of its population resides in rural area. The brief profile of Bihar state is given in Table.

Latitude	24°20'10"~ 27°31'15"N
Longitude	83°19'50"~ 88°17'40"E
Total area	94,163.00 sq. kms
Height above sealevel	173 feet
Avg. number of rainy days	52.5 days in a year
Districts	38
CD blocks	534
Panchayats	8463
Towns/ Cities	124 (According to Urban Development & Houshing Department)
Population(2011)	103804637
Population density(persons per Sq Km)	1102
Literacy Rate	63.82
Decadal Growth Rate (2001 to 2011)	25.07

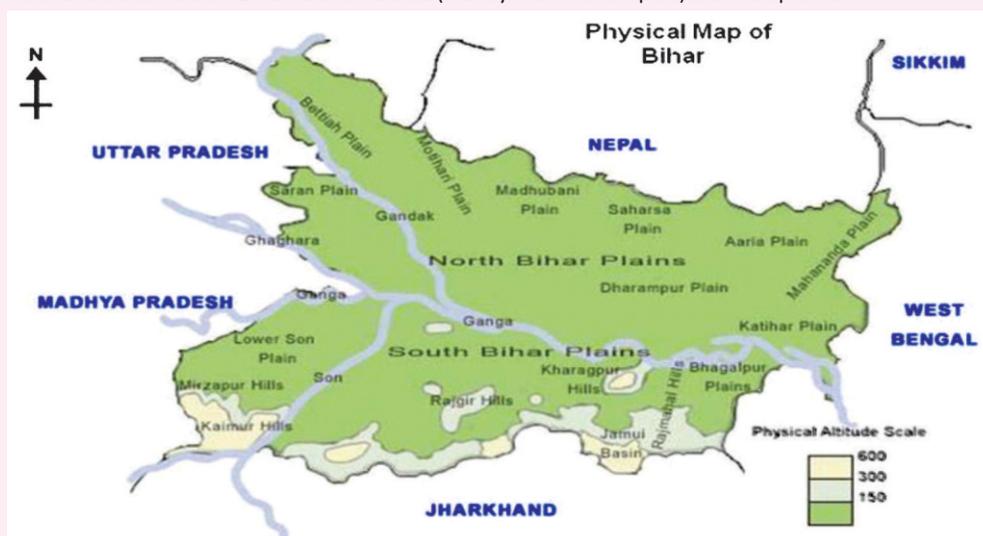
(Sources: Directorate of Economics and Statistics, GoB)

➤ The annual average rainfall in the state during last ten years is as under:

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Rainfall in mm	1095.0	1024.7	863.6	1031.8	1477.7	1196.0	871.3	682.7	1125.6	704.10

➤ There is uncertainty in availability of water. Rainfall in larger parts of the State is usually inadequate and varies from year to year and place to place. Therefore, ground water resources are depleting with deterioration of water quality also.

➤ River Ganga is the main course of drainage dividing the state in two main regions, viz. North Bihar and South Bihar. The origin of the all rivers of North Bihar (Ghaghra, Gandak, Bagmati, Adhwara, Kamla-Balan, Kosi and Mahananda) is Nepal. Major rivers of South Bihar are Karamnasha, Saryu, Kiul etc and mostly having origins and linkages in Jharkhand, MP and UP. The water balance available in the state is approx. 17% of the total national average of surface water. About 71% area of the states (mainly the northern part) are flood prone.



➤ Water flows in the river Ganga now is water from nalas and streams that carry with them sewage and industrial effluents. The residual freshwater of river is unable to dilute the pollutants and rivers turn into stinking sewers. In Patna the course of river Ganga is shifting away from its original due to the waste of man-made activities;

➤ Exploitation of groundwater for agriculture, industrial and purposes other than drinking is not managed so as not to exceed the average recharge potential.

➤ More than 80% of drinking water sources in the State are based on ground water. Hand pumps and Tube wells are major drinking water sources across Bihar. Emphasis has been concentrated on physical coverage of habitation with water supply with little emphasis on quality of the supply water. This has resulted in widespread use of ground water laden with fluoride, arsenic and iron. It is evident that ground water sources are subject to chemical contamination in the form of excess fluoride, arsenic, nitrate, iron or salinity.

Role of Line Departments for Drinking Water Supply

The following state agencies are responsible for designing and implementation of drinking water supply infrastructure/schemes, operation and maintenance of the systems:

- Public Health Engineering Department (PHED);
- Bihar Rajya Jal Parishad;
- Municipal Corporation/Nagar Parishad/Nagar Panchayat; and
- The Bihar State Sanitation and Water Mission (constituted under the provision of Society Registration Act, 1860).

The standard followed by the rural water supply is **BIS standard IS-10500** while in town, equivalent norms framed by the **CPHEEO** under the Ministry of Urban Development, are followed.

Function of PHED:

- Ensuring access to safe water;
- Supply of drinking water to rural areas and development of facilities;
- Constant monitoring of quality of drinking water supply;
- Ensuring participation of communities in schemes involving drinking water supply; and
- Reforming water supply sector.

Various State/Centrally sponsored programmes for ensuring delivery of drinking water to Rural areas:

- Deployment/ Installation with operation & maintenance of hand-pumps;
- Running of water harvesting schemes for better usage of rain water;
- State Plans.
- National Rural Drinking Water Programme.
- Plans for Water Quality affected Areas.
- Centrally Sponsored Urban Water Supply Plans.
- Drinking Water Sanitation Schemes for Government Buildings.
- Total Sanitation Campaign.
- Lohiya Swachhata Yojana.
- Swajaldhara Yojana

Groundwater Scenario of Bihar (Source-Central ground Water Board)

Area (Sq.km)	94,163
Rainfall (mm)	1205 mm
Total Districts / Blocks	38 Districts

Hydrogeology

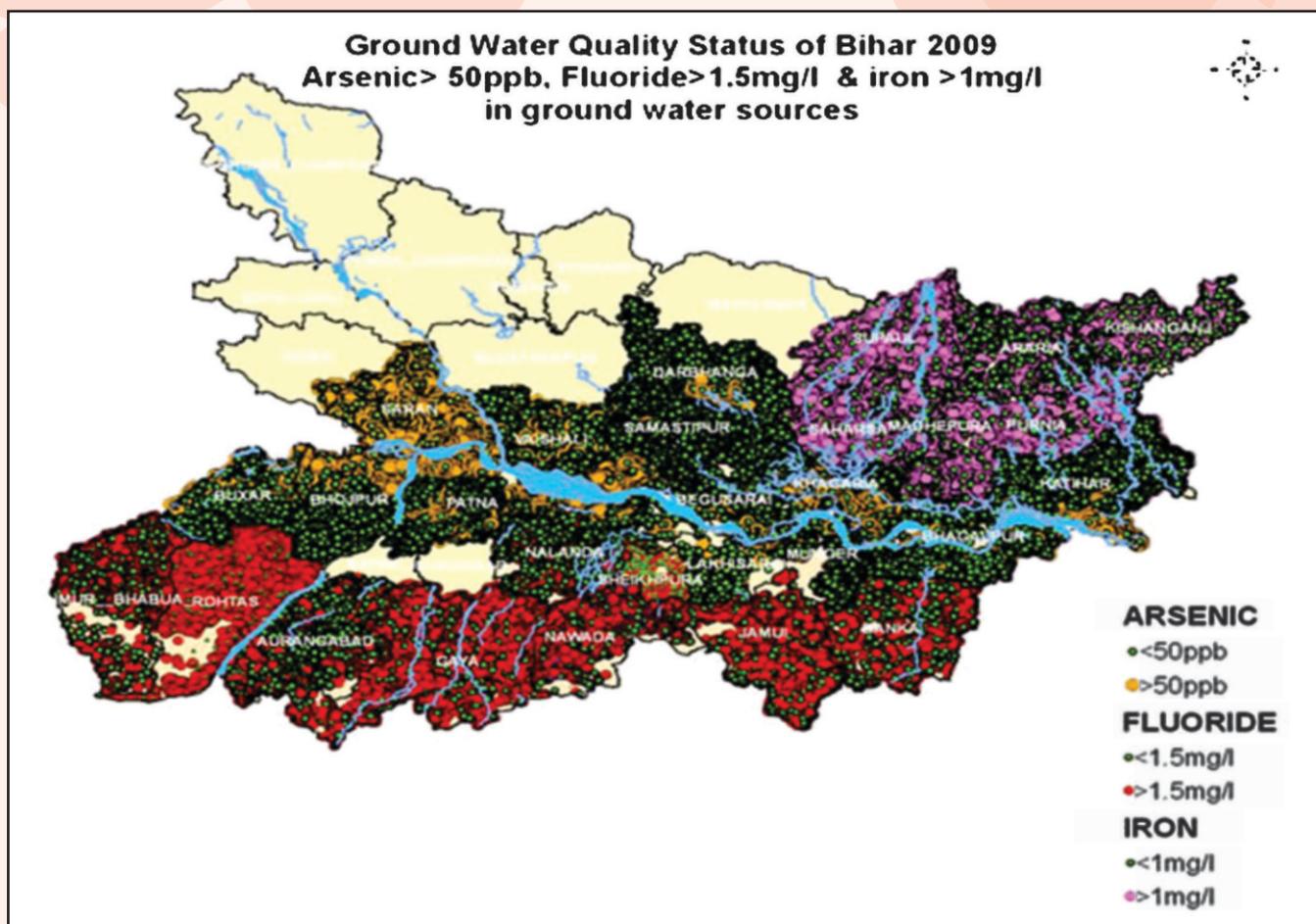
Hydrogeologically, the various litho-units of the State can be grouped as unconsolidated / Alluvial formation, semi-consolidated formations and consolidated/fissured formations. The main alluvial tract covers entire north Bihar and a sizeable area south of the Ganga River. These alluvial formations constitute prolific aquifers where the tubewell can yield between 120-247 m³/hr. The potentiality of these aquifer decreases due south in the marginal tract. Auto flow conditions occur in the sub-Tarai region of Madhubani, Sitamarhi and West Champaran Districts. In the hard rock areas of South Bihar, borewells located near lineaments/fractures can yield between 10-50 m³/hr.

Dynamic Ground Water Resources (2009)	
Annual Replenishable Ground water Resource	28.63 BCM
Net Annual Ground Water Availability	26.21 BCM
Annual Ground Water Draft	11.36 BCM
Stage of Ground Water Development	43 %
Ground Water Development & Management	
Over Exploited	NIL
Critical	NIL
Semi - critical	NIL
Artificial Recharge to Ground Water (AR)	Area identified for AR: 760.3 sq. km. Volume of water to be harnessed: 83.14 MCM Volume of water to be harnessed through RTRWH:23.13 Feasible AR structures: 277 Percolation tanks; 1663 Nala Bund & Check Dams, 118 Recharge shaft; 95000 RTRWH (H); 5000 RTRWH (G & I)
Ground Water Quality Problems	
Contaminants	Districts affected (in part)
Fluoride (>1.5 mg/l)	Aurangabad, Banka, Bhagalpur, Buxar, Gaya, Jamui, Kaimur(Bhabua), Munger, Nawada, Rohtas, Supaul
Iron (>1.0 mg/l)	Aurangabad, Begusarai, Bhojpur, Buxar, East Champaran, Gopalganj, Katihar, Khagaria, Kishanganj, Lakhisarai, Madhepura, Muzaffarpur, Nawada, Rohtas, Saharsa, Samastipur, Siwan, Supaul, West Champaran
Nitrate (>45 mg/l)	Aurangabad, Banka, Bhagalpur, Bhojpur, Darbhanga, Kaimur(Bhabua), Patna, Rohtas, Saran, Siwan
Arsenic (>0.05 mg/l)	Begusarai, Bhagalpur, Bhojpur, Buxar, Darbhanga, Katihar, Khagaria, Kishanganj, Lakhisarai, Munger, Patna, Purnea, Samastipur, Saran, Vaishali

Central Ground Water Authority

Areas Notified for Regulation of ground water development	NIL
---	-----

Groundwater Quality Problems in Bihar (Source- PHED):



Water Quality Affected Districts											
13 Arsenic Prevalence Districts				11 Fluoride Prevalence Districts				9 Iron Prevalence Districts			
District Name	Total Blocks	Total Affected Blocks	Total Affected Habitations	District Name	Total Blocks	Total Affected Blocks	Total Affected Habitations	District Name	Total Blocks	Total Affected Blocks	Total Affected Habitations
Begusarai	18	4	84	Nalanda	20	20	213	Khagaria	7	3	417
Bhagalpur	16	4	159	Aurangabad	11	8	37	Purnea	14	14	3,505
Bhojpur	14	4	31	Bhagalpur	16	1	224	Katihar	16	16	766
Buxar	11	4	385	Nawada	14	5	108	Araria	9	9	2,069
Darbhangha	18	1	5	Rohtas	19	6	106	Supaul	11	11	3,397
Katihar	16	5	26	Kaimur	11	11	81	Kishanganj	7	7	1,593
Khagaria	7	4	246	Gaya	24	24	129	Begusarai	18	18	2,206
Lakhisarai	7	3	204	Munger	9	9	101	Madhepura	13	13	2,445
Munger	9	4	118	Banka	11	6	1,812	Saharsa	10	10	2,275
Patna	23	4	65	Jamui	10	10	1,153	Khagaria	7	3	417
Samastipur	20	4	154	Sheikhpura	6	6	193	Purnea	14	14	3,505
Saran	20	4	37								
Vaishali	16	5	76								
Total	195	50	1,590	Total	151	98	4,157	Total	105	101	18,673

Health Implications due to Contaminated Drinking Water

- According to the Bureau of Indian Standards (BIS), presence of 0.05 milligram of arsenic in one-litre water is not harmful, but the arsenic levels crossing this permissible limit in water affect cardio vascular system in children apart from causing skin irritation and posing the risk of lung cancer.

<ul style="list-style-type: none"> • <u>Excess of arsenic (50 ppb) in drinking water in 13 districts</u> • <u>Prevalence of arsenicosis symptoms among the villagers</u> 	<ul style="list-style-type: none"> • <u>Excess of fluoride (>1.5mg/l) in drinking water in 11 districts of Bihar</u> • <u>Prevalence of Fluorosis symptoms among the villagers.</u> 												
<table border="0"> <tr> <td data-bbox="284 551 525 728"></td> <td data-bbox="531 551 789 728"></td> </tr> <tr> <td data-bbox="284 737 525 793"><u>Melanosis</u></td> <td data-bbox="531 737 789 793"><u>Hardening of palms (moderate keratosis)</u></td> </tr> <tr> <td data-bbox="284 802 525 978"></td> <td data-bbox="531 802 789 978"></td> </tr> <tr> <td data-bbox="284 987 525 1043"><u>Hardening of sole with nodules</u></td> <td data-bbox="531 987 789 1043"><u>Spotty pigmentation of skin & keratosis</u></td> </tr> </table>			<u>Melanosis</u>	<u>Hardening of palms (moderate keratosis)</u>			<u>Hardening of sole with nodules</u>	<u>Spotty pigmentation of skin & keratosis</u>	<table border="0"> <tr> <td data-bbox="852 551 1163 728"></td> <td data-bbox="1169 551 1341 944"></td> </tr> <tr> <td data-bbox="852 737 1163 944"><u>Dental fluorosis</u></td> <td data-bbox="1169 737 1341 944"><u>Skeletal fluorosis</u></td> </tr> </table>			<u>Dental fluorosis</u>	<u>Skeletal fluorosis</u>
													
<u>Melanosis</u>	<u>Hardening of palms (moderate keratosis)</u>												
													
<u>Hardening of sole with nodules</u>	<u>Spotty pigmentation of skin & keratosis</u>												
													
<u>Dental fluorosis</u>	<u>Skeletal fluorosis</u>												

Steps and Intervention taken up by the Line Department:

- Infected hand-pumps have been identified and put into hold for further usages.
- Task force at state level constituted.
- State and Districts laboratories are functional for testing and mapping of water sources.
- Holistic approach has been adopted for mitigation activities in water quality affected areas.
- Traditional water sources like dug wells are being converted into sanitary wells.
- Rain water harvesting system and aquifer recharging systems are being constructed in quality problems areas.
- Surface water based scheme planned.
- Safest aquifers explored for Piped water supply.

Mitigation Measures in Arsenic/Fluoride/Iron Affected Districts:

Several activities are being enforced by the line departments like awareness campaign, multi village piped water supply scheme by using conventional treatment plant for arsenic & fluoride affected area, piped water supply scheme from safest aquifer, solar based mini piped water supply scheme with treatment unit, handpump attachment treatment unit, sanitary dug well with IM3 handpump and with solar based pump and rainwater harvesting systems.



Solar based mini piped water supply scheme with Arsenic & Iron treatment unit



Premises of mini piped Water Supply Scheme



Treatment Plant

Sahlampur, Block: Mohanpur, District: Samastipur.

Handpump with Fluoride attachment Treatment Unit



Supply of Fluoride Free Water after Proper Treatment.

Related Issues

- ◆ Presence of arsenical skin lesions, consistent peripheral motor and sensory neuropathy as well as other neurological abnormalities in the arsenicosis patients of Bihar;
- ◆ Although iron is not toxic but it creates unpalatable taste to drinking water, creates enormous laundry problems due to discoloration. There are reported cases of indigestion and gastro-intestinal cases among population consuming iron laden water containing high levels of arsenic also contains considerable levels of iron in drinking water.
- ◆ It has been reported that pharmaceuticals have been detected and confirmed in water cycle.
- ◆ In vast tracts of Bihar, the prevalence of physical deformity is a chilling evidence of excessive fluoride like dental fluorosis etc.
- ◆ There are critical gaps in drinking water quality management in Bihar.
- ◆ Improving access to safe drinking-water can result in tangible benefits to health.
- ◆ Local authorities play an important role in managing water resources and drinking-water supplies. They are responsible for quality assurance and quality control.
- ◆ In many cases, the water supplier is not responsible for the management of the catchment feeding sources of its supplies.
- ◆ As per The Food Safety and Standards (Prohibition and Restrictions on Sales) Regulations, 2011:
 - No person shall manufacture, sell or exhibit for sale packed drinking water and mineral water except under the Bureau of Indian Standards Certification Mark.
- ◆ As per The Food Safety and Standards (Packaging and labelling) Regulations, 2011:
 - Packing requirements for Drinking Water (Both Packaged and Mineral Water): it shall be packed in clean, hygienic, colourless, transparent and tamperproof bottles/containers made of polyethylene (PE) (conforming to IS: 10146 or polyvinyl chloride (PVC) conforming to IS: 10151 or polyalkylene terephthalate (PET and PBT) conforming to IS: 12252 or polypropylene conforming to IS: 10910 or foodgrade polycarbonated or sterile glass bottles suitable for preventing possible adulteration or contamination of water. All packaging materials of plastic origin shall pass the prescribed overall migration and colour migration limits.

Water Supply Requirements

Water Supply for Residences

A minimum of 70 to 100 litres per head per day may be considered adequate for domestic needs of urban communities, apart from non domestic needs as flushing requirements. As a general rule the following rates per capita per day may be considered minimum for domestic

1)	For communities with population up to 20000 and without flushing system a) Water supply through stand post b) Water supply through house service connection	40 lphd (Min) 70 to 100 lphd
2)	For communities with population 20 000 to 100,000 together with full flushing system	100 to 150 lphd
3)	For communities with population above 100 000 together with full flushing system	150 to 200 lphd

Note:- The value of water supply given as 150 to 200 liters per head per day may be reduced to 135 liters per head per day for house for Lower Income Groups (LIG) and Economically Weaker Section of Society (EWS), depending upon prevailing conditions. Out of the 150 to 200 litres per head per day, 45 liters per head per day may be taken for flushing requirements and the remaining quantity for other domestic purposes.

Water Supply for Buildings other than Residences

Sl No	Type of Building	Consumption per day, litres
i)	Factories where bath rooms are required to be provided	45 per head
ii)	Factories where no bath rooms are required to be provided	30 per head
iii)	Hospital (including laundry): a) Number of beds not exceeding 100 b) Number of beds exceeding 100	340 per head 450 per head
iv)	Nurses homes and medical quarters	135 per head
v)	Hostels	135 per head
vi)	Hotel	180 per head
vii)	Offices	45 per head
viii)	Restaurants	70 per head
ix)	Cinemas, concert halls and theatres	15 per head
x)	Schools: a) Day schools b) Boarding schools	45 per head 135 per head

(Source: IS 1172:1993 Reaffirmed 2013)





Parivesh Bhawan: Proposed Building of BSPC Board, Patna.



Please refer to the original documents for correctness

Prepared & Edited By
Sri Anil Kumar, Sr Programme Officer,
Bihar State Pollution Control Board on behalf of Bihar ENVIS Centre

DEAR READERS

**If you have writeups, suggestions and views about the newsletter,
please send us on address below**

Published by
ENVIS Centre
Bihar State Pollution Control Board, 2nd Floor, BELTRON Bhawan
Shastri Nagar, Patna-800 023

Disclaimer : The information published in the newsletter are based on the secondary data collected by the Centre from various govt. departments, institutions etc or sourced from publicly available information. All efforts have been made to make this information as accurate as possible and the Centre of Bihar State Pollution Control Board will not be responsible for any loss to any person caused by inaccuracy in the information available in the newsletter.