DPHE-ITN

Water Safety Plan

For
Handtubewell in
Rural Water Supply System

April, 2006

Introduction

The first edition of the model water safety plan for Tubewells was prepared in December, 2004 for use in Bangladesh. The model WSP was then tested by several organizations in their respective pilot projects to observe its appropriateness for application under local context. The pilots were implemented over a period from February to November 2005 with slight difference in their durations. The experience of the pilots has been captured and documented in March, 2006. Based on the experience and lessons gained from the pilots projects the first edition has been revised.

Below is the process through which WSP for PSF was developed and revised:

- A workshop was organized by APSU in November, 2004 with the sector professional from government organization, NGOs and Development partners.
- During the workshop one group was assigned to prepare the outline of a model WSP for Shallow Tubewell through systematic analysis and consultative process.
- During November and December, 2004 a complete WSP document for Shallow Tubewell was prepared as a first edition.
- During a period from February 2005 to November 2005 WSP for Shallow tubewell was tested in the field in pilot projects
- During March, 2006 APSU organized a workshop to review the first edition in the light of the experience gained from the pilots.
- Based on the review results and recommendations of the March, 06 workshop ITN-BUET and DPHE has revised the first edition to form the second edition of the model WSP for Shallow tubewell as of April 2006.

Now, it is expected that the government and non-government organizations can apply this version of Water Safety Plan (WSP) directly. However, if they feel that there is need to make further changes based on their own water supply system the concerned organization can do that keeping a record of the changes made. A separate sheet is added in the following page to keep record of the changes already made or to be made in future.

Document Change Record Sheet

Location	Changes made	Remarks
General Page-3	Insert *Document change record sheet*	To be filled in by individual organization making changes in the document
Page-4	Insert *Document development history and approval table***:**	To be updated by individual organization implementing the WSP
Table 2	Rewrite description of process steps: i) 'water source', ii) 'distribution of water'	
Table 3	Shift 'iron' from safety parameters to aesthetic parameters	
Table 6	Add a column for additional control measures Delete last 2 columns: 'Basis' and 'action required'	
	- Rewrite existing control measures - Rewrite additional control measure column	
Table 6 (TW0)	Delete item 2 of TW0	
Table 7	Change in the order of the Tables. Table-8 was brought to front as Table 7 and renamed as *Operational Monitoring schedule*	
	Table 7 was brought down as Table-10 and renamed as **Improvement Action Plan.**	
	Specify the support programmes and link them to Table 10:Improvement Action plan	
Table-10	Delete column 'signed off by' Rewrite responsibility column	Based on real situation
Table10	Add this table to delineate various support programmes for smooth implementation of WSP	

Proformas

1. The WSP Team

The first step of implementing the WSP is to form a team of people from implementing organization/s and DPHE working on water safety plans for Tubewells. It is preferred that the team will include people from different disciplines and those having commitment and technical ability to develop and implement WSP.

Table 1: **The WSP Team**

Name	Organization	Title	Role in WSP team	Contact Information	
				Address	Telephone, E-mail

The WSP documents are dynamic documents. As new information and experience becomes available about the water supply technology system and as the system improves the WSPs can be improved and modified to reflect these changes. Therefore, the implementing organizations should assign a person who will be responsible for updating the WSP and disseminate it to WSP team members through a set process of the organization.

Document development history:

Version	***Date***
1st version	*November 2004 by Guy A. Howard, APSU*
2nd version	*April 2006 by SG Mahmud , ITN*
3rd version	*……..*

Document Approved by: *Name: ……*

Date: ……..

Table 2. Water Supply Process Description.

Step	Description
Water source	Abstraction from groundwater via a Hand pump fitted tubewell.
Water treatment	Water is not treated at the source as a consequence, no other chemicals are currently added to the water in terms of treatment and need not be considered further. Where there is excessive iron, an iron removal plant may be attached to the tubewell and control of safety through such plants should be considered
Distribution of water	Water is carried to the home by households, generally using clay or metal pitchers
Storage after treatment	Although water is not treated, after distribution, water is transferred into a kulshi for storage in the kitchen area. Storage kulshis are generally kept above the floor but are not covered.
Any special controls required?	Arsenic contamination is of particular concern. Being shallow in depth leaching from waste dump in close proximity to the well is of particular concern Contamination of stored water must be controlled.
Water quality requirements?	Water quality is compared against the Bangladesh Standards for drinking water (GoB, 1997) and will be informed by the results of the QHRA.

Table 3. Intended uses of water and nature of consumers, information capture form.

Intended Use	Intended Consumer
❑ Water is obtained from shallow and deep tubewells and is intended for use in the home for drinking and cooking. ❑ A caretaker looks after the well. ❑ Water should meet safety and quality (aesthetic) standards i.e. the Bangladesh Drinking Water Standards (GoB, 1997): ❑ Safety (subset of parameters): o *E. coli* o Turbidity o Arsenic o Nitrate o Manganese o Chloride o Total hardness ❑ Aesthetic requirements (includes sanitation and clothes washing issues): o Taste not unpleasant o Colour o Turbidity o Iron	❑ The users of the water are people residing in villages and include the healthy, young, old, pregnant, disabled and immunocompromised. ❑ Misuse of the water has been observed through priming of the pump with water of potentially a lower quality than sourced from the shallow and deep tubewells. A number of users transport water in vessels that are not kept solely for drinking water use and store water in unsanitary conditions, which can lead to contamination. Controlling these risks requires hygiene education about the safe water chain by hygiene education staff working at the Union and Upazila level. ❑ Shallow and deep tubewells are tested for arsenic on commissioning and community was informed of the results. At present no system is in place for community to access water quality testing, but this is being established in the DPHE Upazila office.

Table 4. Technology description (should be supported by community water and sanitation maps prepared for individual communities and sanitary surveys)

To be completed by each organisation applying WSP for Shallow Tubewell

Issue	Information	Attached documents
Standard design		
Usual setting		
Materials specification		
Source protection measures required		
People served by an individual facility		
How technology is managed		
Training requirements		
Requirements for tests prior to commissioning		
Data on facilities constructed		

Date Prepared: .....

Date Revised: .....

Date Approved: .....

Table 5. Process Flow Diagram.

Code	Step	Description	Responsibility
TW1		Source (catchment)	Agencies, community
TW2		Source (groundwater)	Agencies, community
TW3		Shallow tubewell	Caretaker
TW4		Handpump	Caretaker
TW5		Water collected in vessel	Villagers
TW6		Water transported in vessel	Villagers
TW7		Storage at point of use	Villagers
TW8		Use	Villagers

Symbols:

Key:	
	Operation
	Transport
	Storage
	Inspection
	Delay

Table 6. Hazard Analysis

Process Step	Hazardous Event	Hazard Type	Existing Control Measures	Risk	Additional control measures
TW0 Social exclusion	Poor members of community excluded from use of source because of income, gender to other social barriers	Social	Ensure that all members of the community involved in water supply development from start	U	Design of programmes and involvement of communities in water source development
TW1 Catchment around source	Leaching from over-application of fertilisers or organic waste dumps	Nitrate and nitrite	Fertilisers not used within at least 10m of the well Waste dumps located at least 10m from the well	U (STW) I (DTW)	Community discussion to agree minimum distance for fertiliser use and waste dumps
	Faecal contamination through sub-surface leaching from human or animal waste	Microbial (B,V) Nitrate	Prevent open defecation by community Ensure pit latrines located acceptable distance (if no specific guidance then use 10m from well as a default) Prevent animal yard/pen within 10m of well Provide fence around tubewell	S (STW) U (DTW)	Promote sanitation within the community. Establish minimum safe distance for latrines and animals pens (check with DPHE or NGO) and agree with community to keep faecal material away from the well. Ensure fence does not prevent access for some members of community.
TW2 Groundwater used for tubewell	Presence of natural chemicals in tubewell	Arsenic Manganese Boron Iron Others	Use a test borehole to expected depth before digging well ; consult geological data Ensure all water sources tested prior to commissioning	S	Ensure Water Quality tests performed before commissioning
TW3 Tubewell	Ingress of contaminated water through cracks and mouse burrows undercutting the platform	Microbial (B,V,P)	Platform is of sufficient size and properly maintained to prevent flow-paths developing; fence surrounds tubewell	S	Ensure correct mortar mix used and make repairs when required
	Ingress of contaminated water through poorly sealed rising main	Microbial (B,V,P)	Ensure top 5m of annulus properly sealed	S	Monitor construction quality and materials specification
	Entry of contaminated stagnant water due to poor drainage	Microbial (B,V)	Spilt water is properly drained away from the tubewell platform	S	Ensure apron properly constructed and repair cracks. Dig drains around well and keep clean. Motivation for sanitation improvement in community.
	Ingress of contaminated surface water during flooding	Microbial (B,V,P)	Ensure the tubewell is raised above the flood level	S	Emergency response programme during disaster. Provide drainage around tubewells
TW4 Handpump	Contamination introduced through use of contaminated priming water for handpump	Microbial (B,V,P)	Ensure pump foot valve in good condition Ensure only clean water is used to prime handpump	S	Install new seat valves
	Contamination of handpump spout	Microbial (B,V,P)	Good hygiene during water collection	U	Hygiene education

TW5 Collection of water	Collected water becomes contaminated due to dirty container	Microbial (B,V,P)	Vessel should be cleaned regularly with clean water and if possible soap	S	Hygiene education in community
	Water becomes contaminated from unclean hands used to direct water into vessel	Microbial (B,V,P)	Ensure that vessel is put close to spout to allow direct entry of water	S	Hygiene education in community
TW6 Transport of water	Water becomes contaminated during transport in an uncovered container	Microbial (B,V,P)	Ensure vessel has a cover	U	Hygiene education in community
TW7 Water stored at home	Water becomes contaminated from animals in home	Microbial (B,V,P)	Ensure vessel is covered at all times when water not being used Water stored at elevated levels	S	Hygiene education in community
	Water becomes contaminated because dirty utensils used to collect water	Microbial (B,V,P)	Use clean dipper or cup to withdraw water Tip water from container into drinking vessel	S	Hygiene education in community
TW7 Water stored at home	Water becomes contaminated because users dip unclean fingers into the pot	Microbial (B,V,P)	Use clean dipper or cup to withdraw water Tip water from container into drinking vessel	S	Hygiene education in community
TW8 Use	Water contaminated before consumption because dirty drinking utensil used	Microbial (B,V,P)	Use clean cup for drinking	S	Hygiene education in community

NB: B = bacteria; V = viruses; P = protozoa

S = significant; U = uncertain; I = insignificant

Table 7. Operational monitoring Schedule.

Process Step	Performance Indicator	Monitoring		Critical Limit	Corrective Action		Supporting Programs
Catchment around source	Land use close to tubewell	What:	Land-use around tubewell	No latrines, animal pens, waste dumps or fertiliser use within 10m of the tubewell	What:	Re-siting of latrines, animal pens, waste dumps Stop fertiliser use	Training of committee and caretaker Education and motivation of communities to change defecation practice
		How:	Catchment inspection		How:	Use of local bye-laws and community dialogue	
		When:	Monthly		When:	As soon as identified	
		Where	In catchment area (10m radius from well)		Who:	Community committee	
		Who:	Caretaker and committee				
Groundwater	Quality of groundwater used for dug well	What:	Tests for arsenic, manganese and other key chemicals	All chemical parameters within GOB standards	What:	Paint As contaminated tubewells red and provide alternative source	Develop local testing capacity Arsenic awareness-raising campaigns Ongoing screening programmes
		How:	Field test kits		How:	Through ongoing testing programme	
		When:	Before commissioning water supply Periodic tests		When:	On detection of arsenic above GOB standard	
		Where	At source		Who:	Community supply: NGO, LGI or DPHE Household supply: LGI and household	
		Who:	Community supply: NGO or DPHE Private supply: LGI and/or household arranges for test				
Tubewell	Sanitary maintenance of tubewell	What:	Condition of platform to check for cracks, burrows and undercutting	No cracks or undercutting of platform; fence surrounds tubewell	What:	Repairs to platform Repairs to fence	Caretaker training and community motivation
		How:	Sanitary inspection		How:	Repair of concrete works Repair of fence	
		When:	Monthly		When:	Protection works: within 7 days Fence: within 1 month	
		Where	At the tubewell		Who:	Caretaker	
		Who:	Caretaker				
Tubewell	Protection of rising main	What:	Whether annulus seal in place	Annulus sealed for top 5m	What:	Ensure design norms followed	Sponsoring agency identify appropriate contractors and train committee
		How:	Sanitary inspection		How:	Monitor and sign off of construction	
		When:	On installation		When:	Within 7 days of completion	

		Where	At the tubewell		Who:	Caretaker and committee	
		Who:	Caretaker and committee				
Tubewell	Proper drainage	What:	Drainage of water away from tubewell	Drain in good condition and clear of debris	What:	Clear debris and make minor repairs	Caretaker training
		How:	Sanitary inspection		How:	Follow O&M guidance	
		When:	Monthly		When:	Before monsoon and weekly during monsoon	
		Where	At tubewell		Who:	Caretaker	
		Who:	Caretaker				
	Flood protection	What:	Level of tubewell	Tubewell raised above flood level	What:	Raise tubewell	Check flood levels with community during design
		How:	Inspection		How:	Increase height of handpump and provide concrete protection to rising main	
		When:	As flood waters rise		When:	On commissioning	
		Where	At tubewell		Who:	NGO/DPHE	
		Who:	Caretaker				
	Post flood chlorination	What:	Presence of chlorine	Smell and taste of chlorine present If use comparator at least 0.1mg/l free chlorine		Add chlorine following guidelines	Caretaker training Chlorination schedule Sanitary maintenance of dug well
		How:	Taste and smell, use of comparator where available			Use recommended practice	
		When:	After chlorination, daily basis			Twice per year and in response to community complaints	
		Where	At tubewell			Caretaker	
		Who:	Caretaker				
Handpump	Priming water use	What:	Quality of priming water	Clean or no priming water used	What:	Replace foot valve and control priming water source	Caretaker training
		How:	Caretaker inspection		How:	Pump maintenance	
		When:	Daily		When:	Within 7 days	
		Where	Where priming water stored		Who:	Caretaker	
		Who:	Caretaker				
	Sanitary maintenance of pump platform	What:	Inspection of water hygiene practice	Spout is clean	What:	Hygiene education of users	Community and hygiene promoter training
		How:	User inspection		How:	Participatory approaches	
		When:	Daily		When:	Within 7 days	
		Where	At pump platform		Who:	Community hygiene educators	
		Who:	Caretaker				

Post source	Hygienic water use	What:	Hygiene practice during collection, transport and storage	Water collection, transport and storage is hygienic	What:	Key hygiene messages	Development of hygiene education materials and training of community hygiene promoters
		How:	Hygiene inspection		How:	Hygiene education	
		When:	Regularly within community		When:	Ongoing	
		Where	With households and in community		Who:	Community hygiene promoter	
		Who:	Community hygiene promoter				

Date: ..... **Prepared By:** ..... **Page:** ..... **of** .....

Table 8. Validation schedule

Process Step	Hazardous Event	Validation
All processes	Introduction of pathogens and presence of arsenic	Use of verification data in quantitative health risk assessment model to assess changes in potential disease burden
Social inclusion	Members of community have no/restricted access to water source	Community meetings demonstrate that access is assured to all
Catchment	Introduction of pathogens and nitrate via hazardous events identified in form 6	Combined analysis of water quality and sanitary inspection data from verification to assess whether protection measures have been effective
Tubewell	Introduction of pathogens into well via hazardous events identified in form 6	Combined analysis of water quality and sanitary inspection data from verification to assess whether protection measures have been effective
	Presence of arsenic and other chemicals in tubewell	Drill test borehole and test water for presence of arsenic and other major chemicals prior to construction. Use of verification of data to demonstrate performance in relation to arsenic
Handpump	Introduction of pathogens at pump via hazardous events identified in form 6	Combined analysis of water quality and sanitary inspection data from verification to assess whether protection measures have been effective
Post source	Introduction of pathogens at via hazardous events identified in form 6	Analysis of water quality and sanitary inspection data from verification to assess whether hygiene education has been effective

Table 9. Verification schedule

Activity	Description	Frequency	Responsible Party	Records
Effectiveness of water safety management	Regular meetings with community and/or water and sanitation committee	Regular sample of communities visited each year Household: random sampling		
Reduction of social exclusion to source	Regular meetings with community and/or water and sanitation committee	Regular sample of communities visited each year		
Sanitary inspection	Inspection form to include all major hazard events that may occur due to poor infrastructure condition, poor operation and poor catchment protection	Source: sample of tubewells every year (minimum); twice per year (dry season and monsoon) if possible Household: random sample	NGO or DPHE	Data stored at local levels and transferred to national water supply information centre (in the interim, all data should be sent to NAMIC)
Testing of microbial quality	Thermotolerant coliform analysis using either field kit (DelAgua, Potatest etc) or laboratory Confirmatory testing for *E.coli* on 10% of positive samples	Source: sample of tubewells every year (minimum); twice per year (dry season and monsoon) if possible Household: random sample		
Testing of chemical quality	Arsenic Nitrate	On installation and regular sampling of tubewells		
	Manganese Iron	On installation In response to complaints		
Testing of physical quality	Smell Turbidity Colour Taste	Twice per year (dry season and monsoon) to coincide with sanitary inspection		

Table 10. Improvement Action plan.

Issue Identified		Action Required	Procedures or Records?	Responsibility	Time Frame	Status
No.	**Issue**					
1	Sanitary protection in catchment	Establish minimum safe distances for latrines, animal pens and waste dumps	Follow guidelines from DPHE, or 10m as a default	DPHE/option provider and NGOs responsible for commissioning or undertaking construction	Short	
2	Sanitary protection measures at tubewell	All tubewells should have a platform to protect the rising main; there should be proper drainage around well.	Follow approved standard designs	DPHE/option provider and NGOs	Short	
3	Maintenance of well	Training of caretakers and provision of notes and tools for basic sanitary maintenance	Follow standard training and develop minimum community maintenance pack	DPHE/option provider and NGOs	Short	
4	Confirmation of arsenic status	All dug wells must be tested for arsenic before they are handed over to community	Use field tests kits with cross-checking of 20% in laboratory	DPHE/option provider and NGOs	Short	
5	Handpump design and maintenance	Pump must be firmly attached to platform and platform should be at 1m in diameter. There should be proper drainage around pump	Follow approved standard designs	DPHE/option provider and NGOs	Short	
		New well should have direct action pump and pumps requiring priming on existing wells should be replaced.	Install approved standard direct action pumps	DPHE/option provider and NGOs	Medium	
6	Ensuring safe water handling post source	Provide hygiene education programmes to community to ensure safe water handling during collection, transport and storage	Follow guidelines on hygiene education	VBO members and NGOs responsible for undertaking hygiene education programme	Medium	