

**Draft Standard Operation Procedure
(SOP)
on
New Planning Formulation of Water
Distribution Facilities**

Planning of water distribution facilities

1. Service area
2. Target Year
3. Location of facilities
 - 3.1 Location of facilities
4. Estimation of Water Demand
5. Planning of Distribution Networks
 - 5.1 Pipe Size
 - 5.2 Pressure Head
 - 5.3 Pipe Materials
 - 5.4 Welding Joints of HDPE
 - 5.5 Gate and Butterfly valves
 - 5.6 Roles and Location of Valves
 - 5.7 Locating valves at Branches
 - 5.8 Air Valves and Washouts
 - 5.9 Washout Drains
 - 5.10 Fire Hydrants

1. Service area

- Identification of Service Area
- Municipality border/Regional border
- Any existing water facility
- Whether for expansion of facilities or new planning
- Population
 - high density- cost will be minimize and effect will be higher
 - Scatter- cost will be higher and effect will be less.
- Facilities available.(Industries, schools, hospitals and government offices)

2. Target Year

- Generally for 15 years.
- Considering developments activities, available funds and population growth, it can be changed.

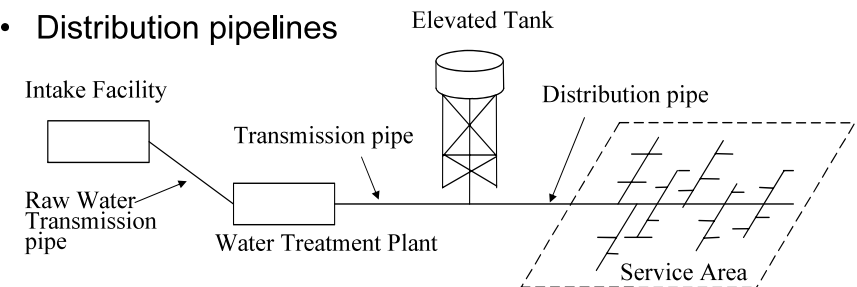
3.Location of Facilities

- Facilities are provided near the service areas.
If not appropriate location, then suitable location at higher elevation are chosen to provide effective supply.
- Geographic features are taken into account on choosing location of Facilities.

3.1 Water Distribution Facilities

Regular check of water distribution facilities

- Intake facility
- Raw water transmission pipelines
- Water Treatment Plant
- Transmission pipelines
- Elevated tank or Service reservoir
- Distribution pipelines



A) Intake

- Generally intake lies at outside of city area, only in case of deep boring where other alternative are not available, they are constructed in appropriate locations.
- Availability of water throughout the year.
- Accessibility to site.
- Selection of water source (Surface water or Groundwater)

B) Water treatment plant

- Meets WHO or Nepal standards of quality water.
- To remove contamination of constituent agents.
- To provide quality water to consumer.

C) Service Reservoir

- Purpose to collect water from intake.
- Capable to collect design capacity.
- Accessibility.
- Future expansion provision.
- Away to avoid trespassing.

D) Elevated Tank

- Provided for provision of gravity flow type.
Reduction on electricity consumption.
- Provided near service area using advantage of geographical condition.

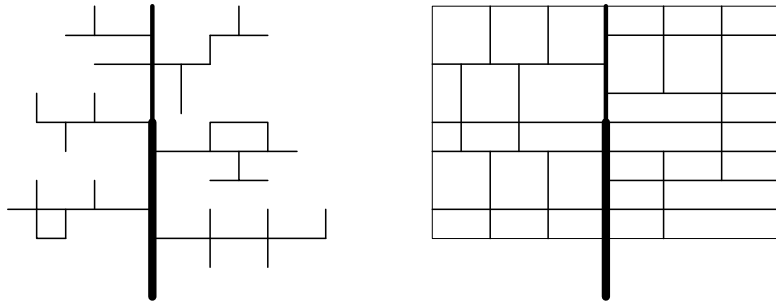
E) Pipe Route

- Identification of shortest pipe route with more number of service connection points.
- Identifying pipeline network.(Grid or tree type etc.)

F) Distribution Pipelines

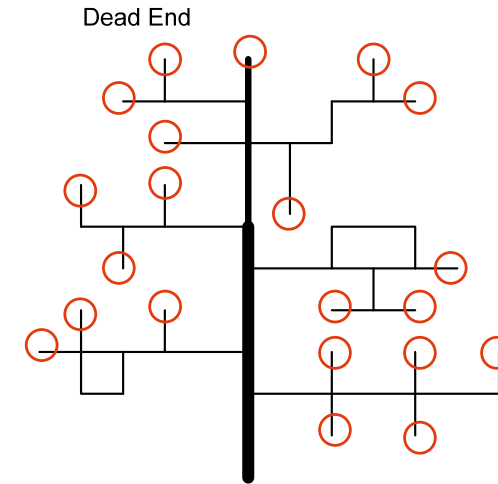
- Pipe size arrangements.
- Location of various apparatus.(Air valves, Valves, Fire hydrants, and washouts)
- Pipe materials.(HDPE, Cast iron, Galvanized iron)

G) Distribution Network Systems



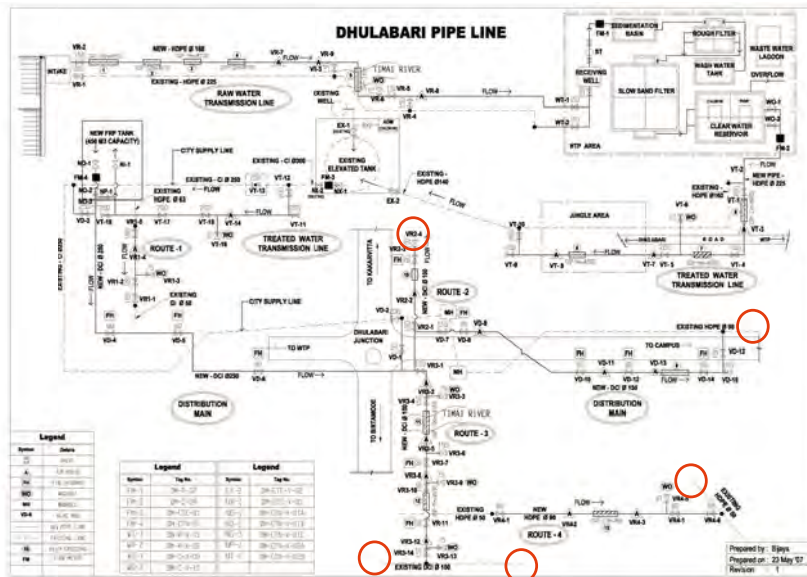
Tree Type Distribution System Grid Type Distribution System

H) Tree Type Distribution System



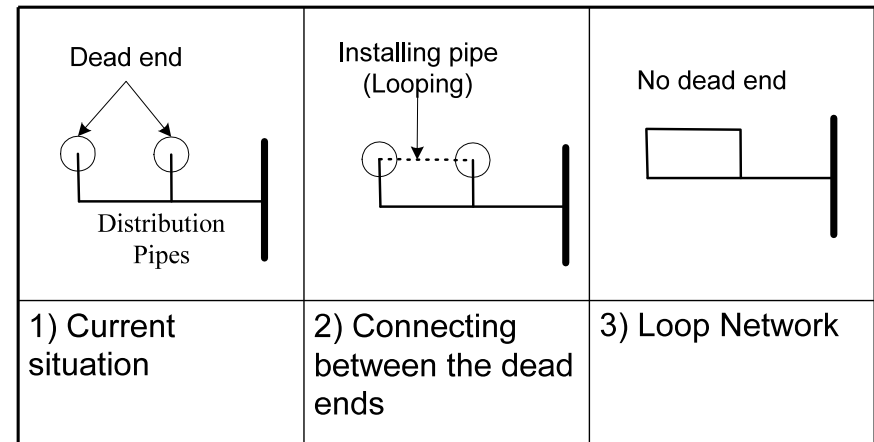
Tree type system has dead ends which are the potential for stagnation and deterioration of water quality

I) Flow Diagram of Pipelines in Dhulabari



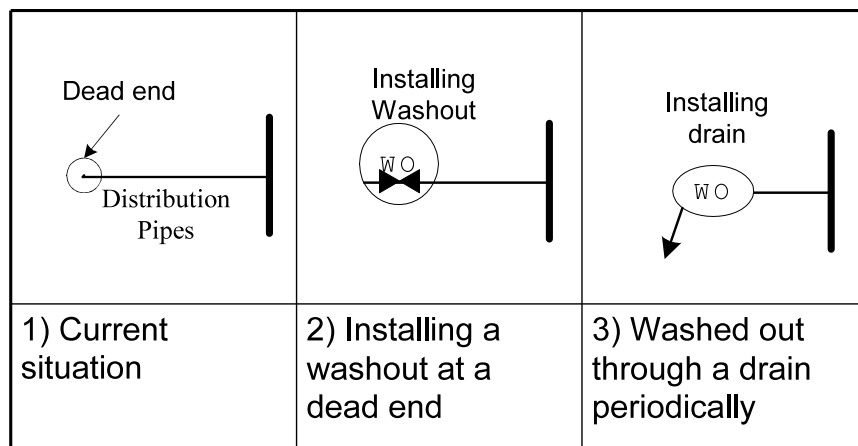
J) Elimination of dead end

To loop a pipe network



K) Avoiding of generation of rust-colored water at a dead end

To install a washout drain at a dead end



4. Estimation of Water Demand

1. Estimate the Design Population
2. Estimation of Water volume required in service area
3. Maximum daily design water flow, Hourly maximum design water flow
4. Pipe Size
5. Pressure Head

4.1 Estimate the Design Population

- To calculate Design population, survey is carried out.
- Increase rate is determined.
- Arithmetic, Geometric and Incremental Increase Rate, mostly Geometric is used.

4.2 Estimation of Water volume required in service area

A) Average daily design water flow:

Annual water flow divided by 365 days

. Estimation of service charge and O&M costs

2) Maximum daily design water flow:

Water flow on the day of maximum water generation in a year

. Design of WTP, Transmission Pipe and Transmission Pump

3) Hourly maximum design water flow:

24 hours conversion of numerical value (m^3/day) of a peak water flow per hour on the day of maximum water generation

. Design of distribution pipe and distribution pump

4.3 Maximum daily design water flow, Hourly maximum design water flow

1) Water demand

Domestic water demand (daily average):
100 L/capita/day

2) Leakage Rate

10 % of average daily water flow . 10 L/capita/d

3) Variation Coefficient

Daily maximum/Daily average = 1.2
. (100 + 10 L/capita/d) x 1.2 = 132 L/capita/d

4) Hourly peak factor

Hourly maximum/ Daily maximum = 3.0
. 132 x 3.0 = 396 L/capita/d

5. Planning of Distribution Network

1. Pipe Diameter:

Investigation of main pipe and branch pipe diameters.

2. Pipe Routes:

Confirmation of pipe route and pipe position with map of the existing pipe network.

3. The distribution network layout:

Network will be formed by loops of pipelines to the extent practicable, thereby minimizing dead ends and providing flexibility in operation.

4. Pipe Connecting Node:

Confirmation of position of pipe connecting node with map of the existing pipe network.

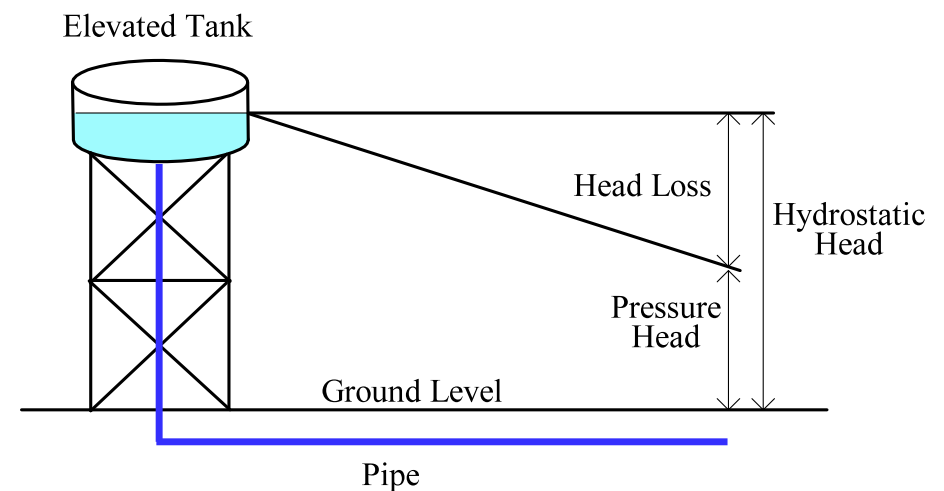
5. Determination of siphon culvert location:

Method of installation of pipe at diversion points is decided after confirming other existing buried objects. Clearance between pipe and buried object should be more than 0.3 m.

5.1 Pipe Size

- In design of water distribution system, pipe size must be balanced against the maximum velocity and total head loss across the distribution network.
- Pipe size too small . Head loss will be greater.
. Pressures will be reduced.
- Pipe size too big . Head loss will be reduced.
- Appropriate velocities are 0.5 – 1.5 m/sec in a pipeline.
. Economical construction.
 $Q \text{ (m}^3\text{/sec)} = A \text{ (m}^2\text{)} \times V \text{ (m/sec)}$
Q: Flow, A: Sectional area of a pipe, V: Velocity

5.2 Pressure Head (1)



5.2 Pressure Head (2)

- **Pressure head.** Internal energy of a fluid as a column of water.

$$\text{Pressure Head (m)} = \text{Hydrostatic Head (m)} - \text{Head Loss (m)}$$

- **Head loss:** Loss of energy due to friction.
- Major losses- length of pipe,
- and minor losses- bends, fittings and valves.

$$\begin{aligned} \text{Head Loss (m)} &= \text{Hydraulic gradient (\%)} \times \text{Pipe Length (m)} \\ &= I \times L \\ &= 10.666 C^{-1.85} D^{-4.87} Q^{1.85} \times L \end{aligned}$$

- **Hydrostatic head :** the pressure rise caused by gravity acting on a column of rest water or fluid.

5.2.1 Hydraulic Design Criteria

- Pipe materials: HDPE
- Pressure rating: PN 2.5, 4, 6, 10 type pipes
Maximum residual pressure: approx. 50 m
- Minimum service pressure: 0.5 - 0.7 bars throughout the distribution network except that service pressure will be relaxed in case of fire flow (using a fire hydrant).
- Hazen-Williams Coefficient: C= 110 - 150 (HDPE)
Included in pipe bends: C = 120
Straight pipeline : C = 130
- Minimum flow velocity: 0.3 m/sec.
- Maximum flow velocity: 3 m/sec.
- Typical range of hydraulic gradient: 0.1 - 0.5 %

5.2.2 Selection of Pipe Specification

Water Temperature °C	20	25	30	35	40
Pressure Reduction Factor	1.00	0.93	0.87	0.80	0.74
Maximum Allowable Pressure MPa (kgf/cm ²)	1.00 (10.2)	0.93 (9.5)	0.87 (8.9)	0.80 (8.2)	0.74 (7.5)
Working Pressure MPa (kgf/cm ²)	0.75 (7.6)	0.68 (6.9)	0.62 (6.3)	0.55 (5.6)	0.49 (5.0)

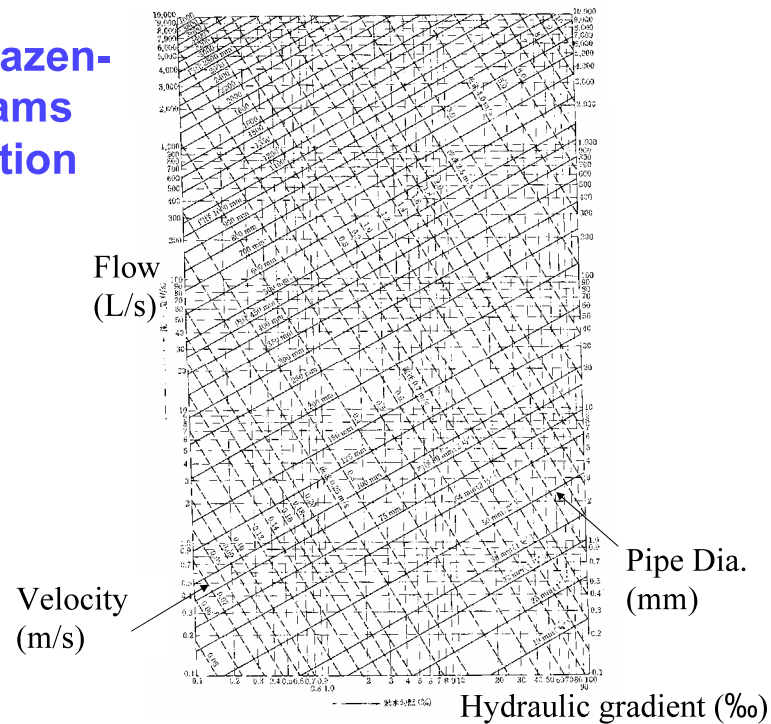
5.2.3 HDPE Diameter

HDPE Pipes Dimension (IS 4984-1987 / NS 40-2042)

de mm	Pressure Class							
	PN 2.5		PN 4		PN 6		PN 10	
	e mm	di mm	e mm	di mm	e mm	di mm	e mm	di mm
16							2.2	11.9
20							2.6	15.2
25							3.1	19.2
32					2.6	26.9	4.0	24.4
40			2.2	35.6	3.2	33.7	4.9	30.7
50			2.7	44.7	3.9	42.2	6.0	38.5
63	2.2	58.6	3.3	56.5	4.9	53.3	7.6	48.4
75	2.6	69.9	4.0	67.1	5.7	63.6	9.0	57.8
90	3.1	83.9	4.8	80.5	6.9	76.3	10.8	69.3
110	3.7	102.6	5.7	98.7	8.3	93.4	13.4	84.3
125	4.2	116.6	6.4	112.2	9.5	106.1	15.0	96.3
140	4.7	130.7	7.3	125.5	10.5	119.0	16.7	107.9
160	5.3	149.5	8.3	143.4	12.0	136.0	19.0	123.5
180	6.0	168.0	9.3	161.5	13.6	152.9	21.5	138.8
200	6.7	186.7	10.3	179.4	15.1	169.9	23.8	154.3
225	7.4	210.3	11.6	201.9	16.8	191.4	26.8	173.4
250	8.3	233.5	12.9	224.3	18.7	212.6	29.8	192.8
280	9.2	261.7	14.3	251.4	20.9	238.2	33.2	216.2
315	10.3	294.5	16.1	282.8	23.6	267.9	37.3	243.3
355	11.6	331.9	18.1	318.8	26.5	302.0	42.0	274.2
400	13.1	373.9	20.4	359.2	29.9	340.3	47.4	308.9
450	14.6	420.8	22.9	404.2	33.5	383.0	53.2	347.8
500	16.4	467.3	25.5	449.1	37.2	425.6	59.3	386.0

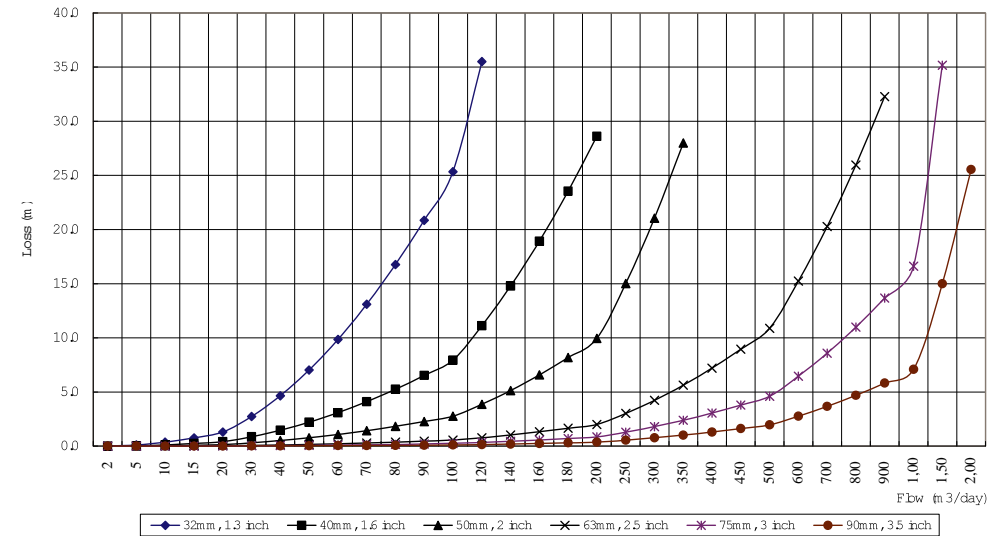
de = outside diameter of the pipe
di = inside diameter of the pipe
e = wall thickness
PN = nominal pressure rating (bar)

5.2.4 Hazen-Williams Equation



5.2.5 Friction Loss of Water

Friction Loss of water in meter per 100m length of pipe, based on Hazen & Williams formula using $C = 130$



5.3 Pipe Materials

High Density Polyethylene (HDPE) pipe is adopted in most projects.

- Light weight for ease of installation
- Flexible pipe
- Special corrosion protection is not required
- Available in welding joints
- Special joint restrains may not be required at changes in direction
- (HDPE pipe for a sewer is not affected by hydrogen sulphide.)

5.4 Welding Joints of HDPE (1)

- Welded joints are restrained and can not be pulled apart under pressure and is appropriate for manual jointing. However, in case of incorrect joint such as insufficient and gappy at joint point, joints may pull apart and/or leakage of water may occur.



a) Soldering iron

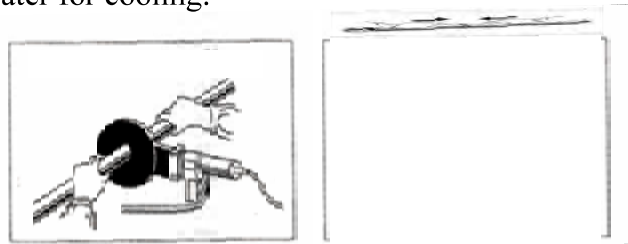
b) Heating soldering iron over a gas burner

c) Manual welding joint.

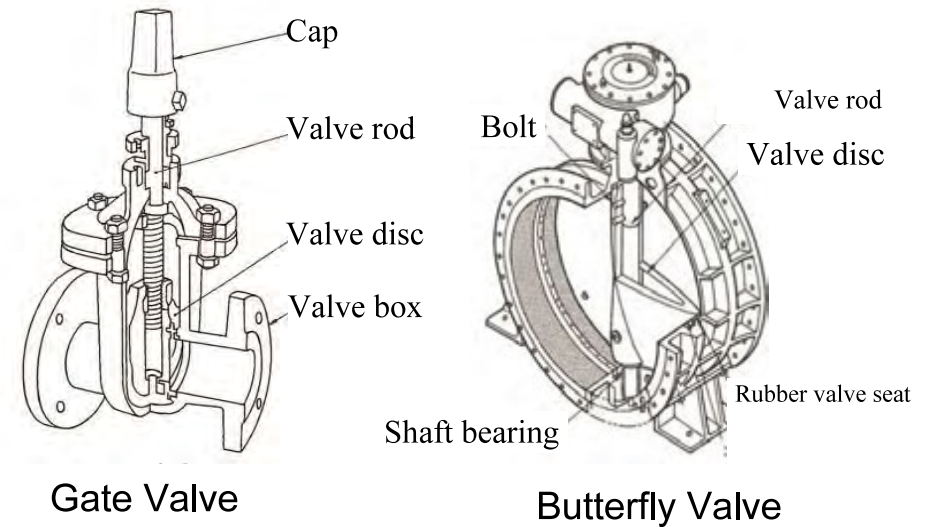
d) Handmade socket type conjugation tube

5.4 Welding Joints of HDPE (2)

- For correct butt welding:
 - Parts to be welded must be cut square
 - The welding plate and the parts to be welded must be clean.
 - The welding plate must be at the correct temperature.
- Butt welding for using a welding plate:
 - Press clean and cut-square ends against the weld plate.
 - Do not accelerate the cooling process. For instance, usage of water for cooling.



5.5 Gate and Butterfly Valve (1)



5.5 Valve (2)

Gate Valve:

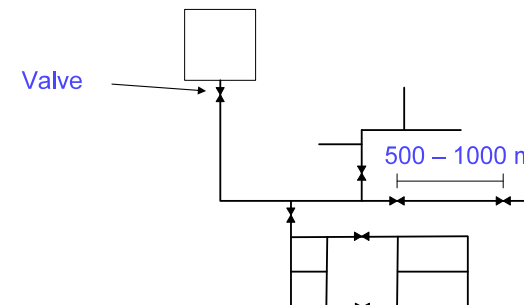
- ✓ Gate valve is mainly used by on-off control.
- ✓ In case of opening only some position of valve disc, use of the gate valve is not advised.
- ✓ Valve disc in valve box moves up and down, and opens and shuts.

Butterfly Valve:

- ✓ Valve disc in the valve box moves a valve rod in an axis, turns and opens and shuts.

5.6 Roles of Valves and Locations

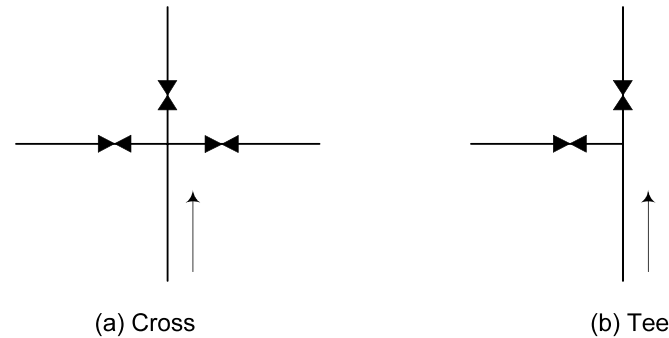
- To control flows and maintain pipelines
- Leakage Repair and Pipe Replacement
- Gate Valve for 300 mm diameters below
- Butterfly Valve for 300 mm above
- To be installed at intervals of approx. 500 m – 1000 m



5.7 Location of Valves at Branches

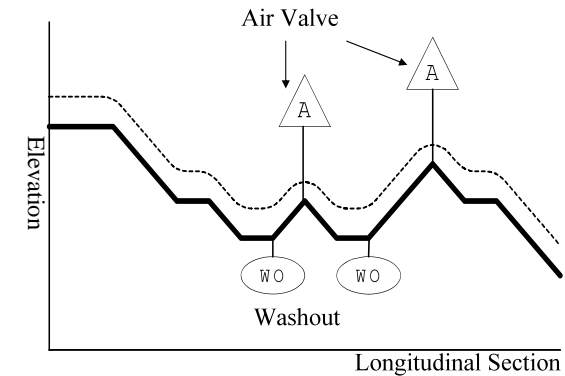
(a) Maximum 3 valves will be provided at crosses

(b) Maximum 2 valves will be provided at tees



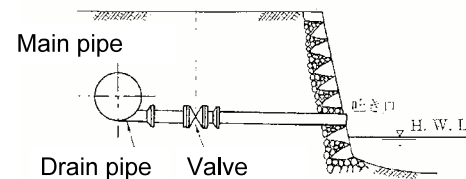
5.8 Air Valve and Washout

- Air valves are located on all high points in the transmission and distribution pipelines to allow trapped air to be released from pipelines without loss of water.



5.9 Washout Drain

- Washouts are located at dead ends and low spots in the distribution pipelines to allow accumulated sediment to be cleaned by flushing.
1. Location of washout drain: washout drain should be installed nearby drainage canal or river.
 2. Drain pipe diameter is normally 1/2 – 1/4 size of main pipe diameter.
 3. Washout drain should be built strongly at the spillway so as not to erode or to be destroyed by draining.



5.10 Fire Hydrant

- Fire hydrant will be located in the distribution network on all pipelines of at least 150 mm nominal diameter.
- Otherwise, negative pressure may occur in small diameter such as less than 100 mm.
- Spacing will be at about 200 m.



खानेपानीको नयां संरचना निर्माण गर्ने प्रक्रिया

June, 2011

1.1 पानी वितरण गर्ने पाइपको योजना

योजना बनाउने प्रक्रिया

- क. उपभोक्ताको पानीको माग थाहा पाउने
- ख. उक्त माग अनुसरको उत्पादन र वेशरको निकष्य गर्ने,
- ग. वितरण प्रणाली, पाइपको स्टड तथा पाइपको साइज कोरे थाहा पाउने

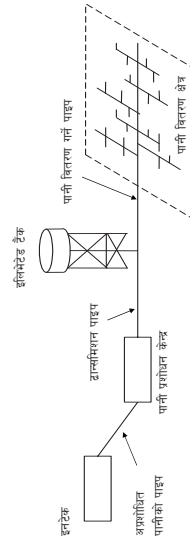
योजना बनाउदा

- १. संरचना क्षेत्र, पानीको माग, र वितरण गर्नुपर्ने पानीको :
- क. पानीको मागको परिमाण
- ख. वितरण गर्नुपर्ने क्षेत्र र वितरण गरिने प्नेटको तिष्ठित गर्ने,
- ग. पानी वितरण गर्ने स्थानमा आवश्यक पर्ने प्रेशर छ छैन भनी तिष्ठित गर्ने

1. खानेपानी वितरण प्रणालीको संरचना

खानेपानी वितरण प्रणालीको निम्न संरचनाको नियमित परीक्षण गर्ने

- १. इन्टेक
- २. अप्रभोधिण पानीको पाइप
- ३. टान्समिशन पाइप
- ४. डिस्मिटेड टैंक
- ५. पानी वितरण गर्ने पाइप



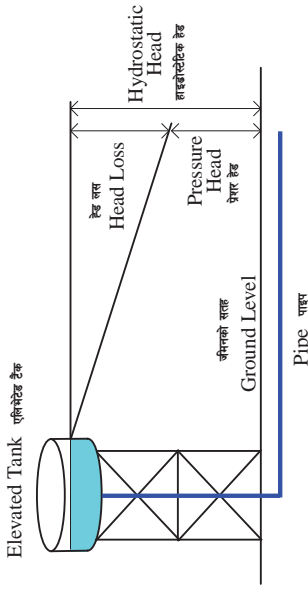
2. पानीको आवश्यक मात्रा थाहा पाउन

- १. औसत दैनिक पानीको बहाव निकाल्न
 - वार्षिक पानीको बहावलाई ३६५ ले भाग गर्ने
 - यसपछि लेवा शुल्क र मरम्मत तथा साञ्चालनको खर्च अनुमान गर्ने
- २. अधिकतम दैनिक पानीको बहाव निकाल्न
 - एक बर्षमा अधिकतम पानी उत्पादन भएको दिनको पानीको बहाव निकाल्ने
 - पानी प्रशोधन केन्द्र, टान्समिशन पाइप र पम्पको अनुमान गर्ने
- ३. अधिकतम प्रति घण्टा पानीको बहाव निकाल्न
 - अधिकतम दैनिक पानी उत्पादनलाई २४ ले भाग
 - अधिकतम पाइप र पम्पको अनुमान गर्ने

2.1 अधिकतम दैनिक पानीको वहाव र अधिकतम प्रतिघण्टाको पानीको बहाव

१. पानीको माग
घरायसी पानीको माग (दैनिक औसत) : १०० लिटर प्रति व्यक्ति प्रतिदिन
२. दैनिक अधिकतम मागलाई दैनिक औसत मागलाई १.२ गुण्य ।
३. निरंकुश दर
दैनिक औसत पानी बहावको १० प्रतिशत
४. उच्चतम प्रतिघण्टा
अधिकतम प्रतिघण्टा लाई अधिकतम दैनिक वे माग गर्दा ३.० हुन्छ ।

2.3 प्रेशर हेड



2.2 पाइपको साइज

१. पानी निरन्तरको गोलामा बग्दाको दिक्कत प्रणालीका अतिरिक्त पानीको निरन्तरमा बग्दाको गति र हेड नक्को अन्ततःको नमन हिनाक गर्नुपर्छ ।
उरे सानो पाइप होन हेडकस उरे हुन्छ र पानीको चाप बढ्छ ।
उरे ठूलो पाइप हेड हेडकस कम हुन्छ र पानीको चाप बढ्छ ।
पाइपलाइनमा उपयुक्त गति ०.४ देखि १.४ मि. प्रतिसेकण्ड हुन्छ ।
क्रियायती निर्माण

2.3 Pressure Head (2)

- Pressure head is a term that represents the internal energy of a fluid as a column of water.
Pressure Head (m) = Hydrostatic Head (m) – Head Loss (m)
- Head loss: In any real moving fluid, energy is dissipated due to friction.
- Major losses associated with energy loss per length of pipe, and minor losses associated with bends, fittings and valves.
Head Loss (m) = Hydraulic gradient (%) x Pipe Length (m)
= I x L
= 10.666 C^{-1.85} D^{-4.87} Q^{1.85} x L
- Hydrostatic head is the pressure rise caused by gravity acting on a column of water or fluid that is not in motion.

2.4 Hydraulic Design Criteria

- Pipe materials: HDPE
- Pressure rating: PN 6.3 - 25 type pipes
Maximum residual pressure: approx. 50 m
- Minimum service pressure: 1.0 bars throughout the distribution network except that service pressure will be relaxed in case of fire flow (using a fire hydrant).
- H-W Coefficient: C= 110 - 150 (HDPE)
Included in pipe bends: C = 120
Straight pipeline : C = 130
- Minimum flow velocity: 0.5 m/sec.
- Maximum flow velocity: 3 m/sec.
- Typical range of hydraulic gradient: 0.1 - 0.5 %

2.6 HDPE Diameter

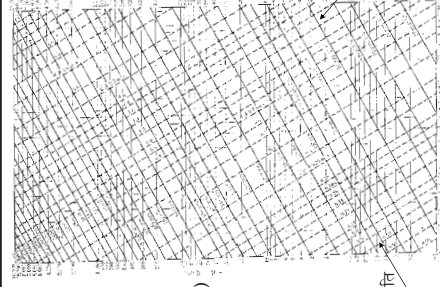
DN	Standard Dimension Ratio											
	S-12.5		S-10		S-8		S-6.3		S-5		S-4	
	di	e	di	e	di	e	di	e	di	e	di	e
20	20	2.0	20	2.0	20	2.0	20	2.0	20	2.0	20	2.0
25	25	2.5	25	2.5	25	2.5	25	2.5	25	2.5	25	2.5
32	32	3.2	32	3.2	32	3.2	32	3.2	32	3.2	32	3.2
40	40	4.0	40	4.0	40	4.0	40	4.0	40	4.0	40	4.0
50	50	5.0	50	5.0	50	5.0	50	5.0	50	5.0	50	5.0
63	63	6.3	63	6.3	63	6.3	63	6.3	63	6.3	63	6.3
75	75	7.5	75	7.5	75	7.5	75	7.5	75	7.5	75	7.5
90	90	9.0	90	9.0	90	9.0	90	9.0	90	9.0	90	9.0
100	100	10.0	100	10.0	100	10.0	100	10.0	100	10.0	100	10.0
125	125	12.5	125	12.5	125	12.5	125	12.5	125	12.5	125	12.5
140	140	14.0	140	14.0	140	14.0	140	14.0	140	14.0	140	14.0
160	160	16.0	160	16.0	160	16.0	160	16.0	160	16.0	160	16.0
180	180	18.0	180	18.0	180	18.0	180	18.0	180	18.0	180	18.0
200	200	20.0	200	20.0	200	20.0	200	20.0	200	20.0	200	20.0
225	225	22.5	225	22.5	225	22.5	225	22.5	225	22.5	225	22.5
250	250	25.0	250	25.0	250	25.0	250	25.0	250	25.0	250	25.0
280	280	28.0	280	28.0	280	28.0	280	28.0	280	28.0	280	28.0
315	315	31.5	315	31.5	315	31.5	315	31.5	315	31.5	315	31.5
355	355	35.5	355	35.5	355	35.5	355	35.5	355	35.5	355	35.5
400	400	40.0	400	40.0	400	40.0	400	40.0	400	40.0	400	40.0
450	450	45.0	450	45.0	450	45.0	450	45.0	450	45.0	450	45.0
500	500	50.0	500	50.0	500	50.0	500	50.0	500	50.0	500	50.0
560	560	56.0	560	56.0	560	56.0	560	56.0	560	56.0	560	56.0
600	600	60.0	600	60.0	600	60.0	600	60.0	600	60.0	600	60.0
630	630	63.0	630	63.0	630	63.0	630	63.0	630	63.0	630	63.0
700	700	70.0	700	70.0	700	70.0	700	70.0	700	70.0	700	70.0
800	800	80.0	800	80.0	800	80.0	800	80.0	800	80.0	800	80.0
900	900	90.0	900	90.0	900	90.0	900	90.0	900	90.0	900	90.0
1000	1000	100.0	1000	100.0	1000	100.0	1000	100.0	1000	100.0	1000	100.0
1200	1200	120.0	1200	120.0	1200	120.0	1200	120.0	1200	120.0	1200	120.0
1400	1400	140.0	1400	140.0	1400	140.0	1400	140.0	1400	140.0	1400	140.0
1600	1600	160.0	1600	160.0	1600	160.0	1600	160.0	1600	160.0	1600	160.0

2.5 उचित पाइपको छनौट

पानीको तापक्रम °C	20	25	30	35	40
पानीको ग्रेड घट्ने क्रम	1.00	0.93	0.87	0.80	0.74
पानीको अधिकतम ग्रेड घट्ने क्षमता Mpa (kgf/cm ²)	1.00 (10.2)	0.93 (9.5)	0.87 (8.9)	0.80 (8.2)	0.74 (7.5)
पानीको काम गर्ने अधिकतम ग्रेड क्षमता Mpa (kgf/cm ²)	0.75 (7.6)	0.68 (6.9)	0.62 (6.3)	0.55 (5.6)	0.49 (5.0)

2.7 Hazen-Williams Equation

पानीको
वहाव (L/s)



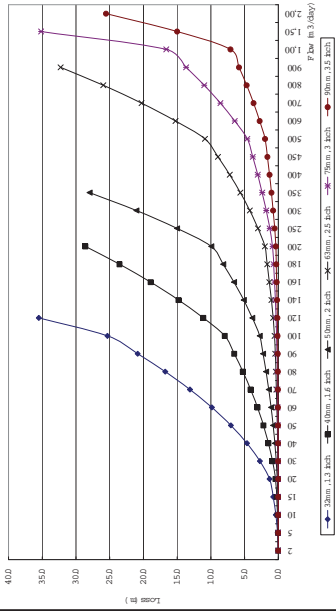
पाइपको
व्यास (mm)

पानीको
ग्रेड क्षमता (m/s)

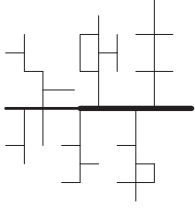
हाइड्रोलिक ग्रेडिएन्ट (%)

2.8 पानीको घर्षणको गिरावट

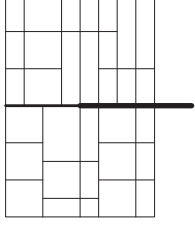
Friction Loss of Water in Pipes: 10m length of pipe, based on Hazen & Williams formula, $C = 130$



3.1 वितरण सञ्जालको प्रक्रिया



रुख प्रकारको (हांगा भएको)

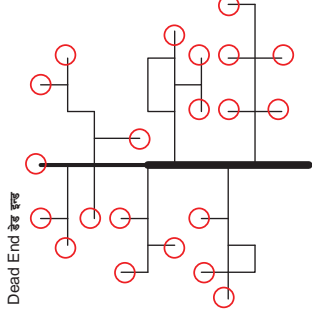


बक्स प्रकारको (सीड भएको)

3. नयाँ पाइप वितरण सञ्जालको योजना गर्दा

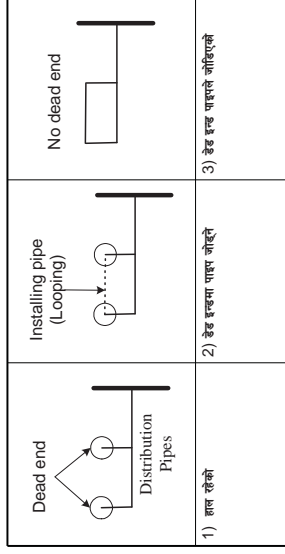
1. पाइपको डायामिटर: मुख्य तथा सहायक पाइपको डायामिटर बाह्रा पाउने
2. पाइपको स्टे: नक्सा हेरेर विद्यमान पाइपका स्टे तथा अवस्था बाह्रा पाउने
3. नेटवर्कको विस्तार: नेटवर्कको विस्तार हेरेर सर्वेसमा डेडएण्ड नरहने गरी पाइपको अन्त्यमा जोड्दै जादा काम गर्न सजिलो र बासआउटको सम्पत्त जोड्ने।
4. पाइप जोड्ने नाइ: विद्यमान नेटवर्कको तन्माका आधारमा नया पाइपहरूको जोड्ने स्थान निर्धारण गर्ने।
5. पाइपस्ट डेडएण्ड: नया पाइपहरू गर्ने क्रममा पाइपको स्टेमा अन्य बस्तुहरू गाडिएको पाउने सम्भावना अपना त्यसलाई लकोर लाग्ने हुन्छ, यस अवस्थामा उक्त बस्तुको र जोड्ने पाइपको दूरी कमिमा पनि 0.3 मिटर हुनु जरुरी छ।

3.2 रुख प्रकारको (हांगा भएको) वितरण प्रणाली



3.3 डेड इन्डहरू हटाउने तरिका

क. पाइपहरू गाँसेर डेड इन्डहरू हटाउने तरिका



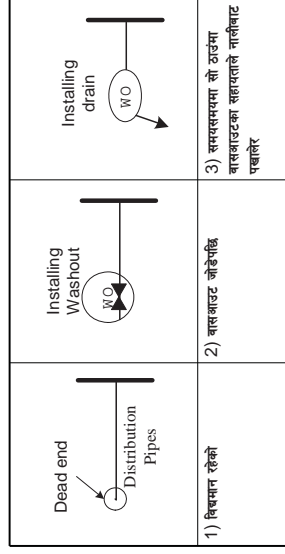
3.5 पाइपको प्रकार निर्धारण

सबैले HDPE एच डि.पि.इ. पाइप प्रयोग गरेको पाइन्छ किनकि यो :

- जीवन हुलाक हुन्छ ,
- संयोजन गर्नजस्तो हुन्छ तर यसलाई विद्युतजन विरोध किस्मको व्यवस्था हुनुपर्छ ,
- बासी विद्युतवाट जोगाइलनु पर्दैन,
- जोडिन्छरु सरी पाइन्छ ,
- रट बचाउन बासी मुक्ति गर्न सकिन्छ ,
- हाइड्रोलिक सल्लाहले HDPE पाइपलाई राम्रो पाईन

3.4 डेड इन्डको पहिलो रडको पानी हटाउने उपाय

डेड इन्डहरूमा वासभाउट र नाली जोडेर



3.6 तताएर वेल्डिङ गरी बनाइएका जोइन्टहरू

1. तताएर वेल्डिङ गरी हालैले बनाइएका जोइन्टहरू अतिथक र हलाल छुट्याउन पनि सकिने (तर राम्रोरी नतीतिथक जोइन्टहरू बुझ्न सक्ने र टाइट गरी नतीतिथकका टाइटबाट निस्कन हुने सम्भावना थपि रहन्छ ।



तताउने जोइन्ट	आइउन तताउने व्यास चुली	तताएर वेल्डिङ गरिएको	जोइन्टका जोडि तयाएर बनाइएका जकट
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3.6 वेल्ड गरी बताइएका HDPE जोइन्टहरू (2)

ह तलमाथि चित्र हेर्नुहोस्:

- वेल्ड गरी गर्ने काटिका टुक्रा मिलाएर काटनुपर्छ,
- वेल्डिङ प्लेट र काटिका टुक्रा सार्नुपर्छ,
- वेल्डिङ प्लेट आवश्यक मात्रामा मात्र तताउनुपर्छ।

- ह वेल्डिङ प्लेटको प्रयोग गर्न सक्नुपर्छ
- काटिका टुक्राको छेउलाई वेल्डिङ प्लेटमा बिचि,
- काटिका टुक्रा लाई बिसाई सेलाउन दिने।



3.7 भल्भ

गेटभल्भ :

- ✓ गेटभल्भ पानी अत र अक गर्न प्रयोग गरिन्छ ।
- ✓ तर अधिक पानी बोल्नका लागि भने गेटभल्भको प्रयोग गरिदैन ।
- ✓ गेटभल्भ घुमाउदार त्यसको डिस्क तलमाथि सरेर पानी अत र अक गरिन्छ ।

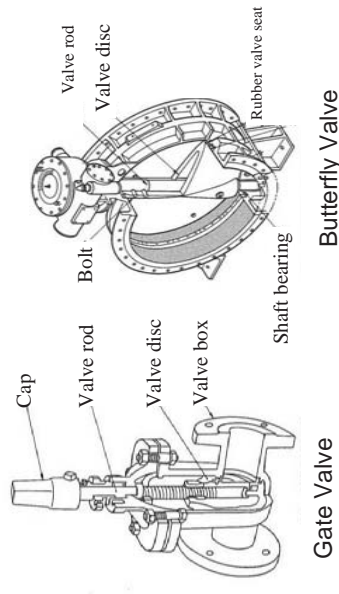
बटरफ्लाई भल्भ

बटरफ्लाई भल्भ अत र अक गर्न नै प्रयोग गरिन्छ तर अल्प डिस्क घुमेर पानी अत र बोल्न काम गरिन्छ ।

धुलावारीको पाइपलाइनको फलो चित्र



3.8 Gate and Butterfly Valve



3.9 भल्भहरू, ती राखिने स्थान र तिनको भूमिका

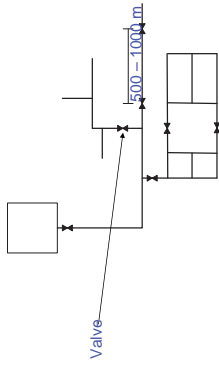
भल्भको मुख्य कार्य भनेको पाइपको पानीको बहावलाई नियन्त्रण र पाइपलाइनको सञ्चालन गर्नु हो ।

. भल्भबाट लिक्ने भएमा भन्दा गर्नु ल्या गर्ने

३०० एम.एम. भन्दा कम डायामिटरको पाइपका लागि सेट भन्दा प्रयोग गर्ने

३०० एम.एम. भन्दा बढी डायामिटरको पाइपका लागि बटरफ्लाई भन्दा प्रयोग गर्ने

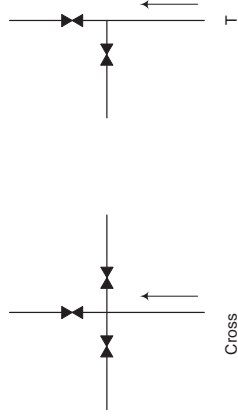
सँगै ४०० देखि १००० मीटरको अन्तरमा भल्भ जोडाइ गर्ने



3.10 सहायक पाइपमा भल्भ राख्दा

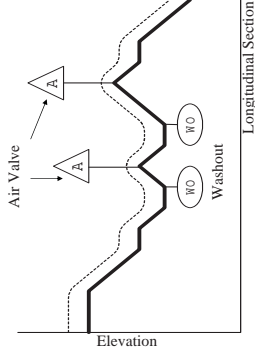
१. बल्भहरूमा बढीमा ३ वटा भन्दा भन्दा राखिन्छ ।

२. आर्को पाइपमा T भाँट जोडिने पाइपमा बढीमा २ वटा भन्दा राख्न सकिन्छ ।



3.11 एयर भल्भ

एयर भल्भ पाइपलाइन जम्मा भएको ठाउँमा निक्कलका लागि पाइपलाइनहरू विच्छाड्नको उपयुक्त अर्थात् स्थानहरूमा जोडिन्छ ।



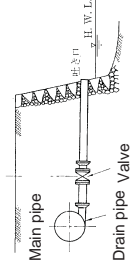
3.12 वासआउट नाला

पाइपमा जम्मा भएको फोहोरलाई पखालेर सफा गर्न ड्रेड इन्च या पाइपलाइनको अन्त्यमा वासआउटको प्रयोग गरिन्छ ।

१. वासआउट ड्रेड इन्च वा पाइपलाइनको अन्त्यमा खोला या खोल्सा अतिको नजिकै जोडिन्छ ।

२. यो नालाको डायामिटर सामान्यतया मुख्य पाइपको आधा वा एक चौथाइ साइजको हुनुपर्छ ।

३. यो नाला बलियो तथा ओटलो चिपको पाँटेर बनाइएको हुनुपर्छ ताकि फिटि विचार नलाभोस ।



3.13 अतिससन भल्म

अतिससन भल्म १५० एएएफ. ड्रायभिएटको पाइपको साइजमा प्राय सबैदिवस गरिएको पाइपलाइनमा अडिएको हुन्छ ।

४ अतिससन भल्म सँगै भन्दा सार्थो साइजमा माए यसले तिस्रोतिम प्रार त्योउन सक्छ ।

४ अतिससन भल्म कमसेकम २०० शीटको दुईमा राखिनुपर्छ ।



(1) Discussion about user complaint management
 - Discuss about implementation and update of user complaint manual

- Are there any request/suggest for change the contents?
 - Are there any request/suggest for change the format and style introduce in the manual?

- How and where your WUSC plan to implementing?
 - When your WUSC plan to start to implementing?

- When and how I can get your feedback?

Feedback sheet of user complaints management manual

Name of WUSC:

(1) Are you already implement user complaints management manual?

yes no

(a) Do you have intension to implementing? (further question for answer "no" to previous question)

yes no

(b) Reasons of no intension? (in case of no intension)

Reasons:

(c) Do you have idea/plan to implementing? (in case you have intension)

yes no

(d) Reasons of no plan (in case of no plan)

Reasons:

(e) Your plan for implementing user complaints management manual (in case if you have plan/idea)

Plan/idea:

(2) Your implementation is whole or partially? (in case of your answer is "yes" to question (1))

whole partially

(a) Why the reason of partially implementing? (in case your answer is "partially" to question (2))

Reasons:

(b) Do you have intension to implementing other part?

yes no

(c) Reasons of no, if in case you do not have intension to implementing other part?

Reasons:

(d) Your plan for implementing other part of user complaints management manual (in case if you have plan/idea)

Plan/idea:

(3) Are there any difficulty when in your implementation? (in case of implemented)

yes no

(a) Difficulties and reasons, in case you have experience of difficulty

(b) Your request/suggestion/comment of improving user complaints management manual from your experiences

(4) Requirement/suggestion/comment for improving user complaints management manual (structure, item and contents, style)

(5) Requirement/suggestion/comment for improving format (card, slip, form and log) for complaints management in the manual

(6) Your free comments

Date: / /

Name of Manager with signature

Procedure for Hand Made Sockets and its Installation

1. Fire and Marking on Pipes



Mark the required Length on the Pipe with desired Diameter pipe for Socket .

Put on the fire first.
Either on the stove or other means of heating.



2. Cutting and Heating of pipes



Cut the marked Length of pipe for Socket .

Put over the fire to get the pipe Expand in Diameter.



3. Heating and Expanding of Pipes



Check the pipe if it is loosen or not.

Roll a pipe of smaller diameter to get the heated part to expand up to outer diameter of connecting pipe.



4. Filing and inserting the pipes



Insert Standard size filed pipe of same size to minimum 150 mm length.



File the end surface of same size pipe with sand paper or with round or flat file.

5. Pressing and heating again



Put the surface over the fire and rotate the pipe for penetration for length more than 150 mm .



Hit it on the firm ground or wooden plank for more penetration inside.

6. Heating and Pressing another end



Put the standard size pipe of same diameter and let for some time to cool down

Now put the another side of pipe over the fire for expansion.



7. Completion of Socket



Put the socket at leakage point to prevent leakage or on expansion purposes.

Hand made socket is ready to use



8. Installing inspection



Mark the length on the pipe approximately to cut.



Check the socket to fit the length to be cut.

9. Cutting of pipes



Pull the pipe above the ground to insert inside the socket.



Check if length cut is ok or not.

The penetration must be at least 150 mm inside.

10. Installing Pipes



Insert the pipe in the socket.

For proper fixing, hit the socket with another pipe.



11. Inserting and placing of pipes



Slowly press it down on the ground for proper installation.

Pull another pipe at required height to let it insert inside the socket.



12. Completion of Connections



Installation of socket completed.

Thanks for your Presence and
attaining this workshop.

NJS Consultant
And
Morang, WSSDO

Industrial Wastewater Management in Japan-2

Certified Environmental Analyst System



Catalog of Chemical Analysis Consultam Ltd.

1st October 2008, IZAWA Tetsuo

1

Topics of This Seminar

- Background of the certified qualification
- Required knowledge to become a certified environmental analyst
- Measurement law system in Japan
- Problems of the current Japanese measurement law system
- How to cope with the problems
- What are necessary to keep accuracy management in analysis of industrial wastewater quality
- Recommendations
- Others



Pre-treatment apparatus
(TOYOTA Chemical Engineering)

2

Background of Certified Environmental Analyst System

- To secure reliability and accuracy in environmental analysis
- An indispensable registration criteria as personnel asset (full-time employee) to open measurement certification business of concentration of substances in soot, water, soil or noise level,
- At least one certified environmental analyst in a laboratory
- Measurement certification report is legally required the signature of the certificated environmental analyst.



Required Knowledge and Responsibilities of Certified Environmental Analyst

- High degree of measurement knowledge and techniques
- Comprehensive measurement management from plan and design of measurement to implementation of measurement and evaluation of analysis results, such as;
 - How to take a sample,
 - Selection and decision of analysis or measurement,
 - Evaluation of the analysis results,
 - Maintenance and inspection of analyzers,
 - Preparation of analysis report,
 - Improvement of measurement methods,
 - Education of the measurers,
- Others necessary to secure accurate measurement and analysis



3

4

How to become the Certified Environmental Analyst

- To pass Certified Measurer National Examination (once a year) + Practical experience, etc.
- Registration, Passing rate of the examination is around 10 %.
- Training course given by National Institute of Advanced Industrial Science and Technology + Practical experience + Certification by Measurement Administration Council (twice annually) .Registration



Required Knowledge for the Examination

No.	Certified Environmental Analyst concerning concentration	Certified Environmental Analyst concerning noise and vibration
1A	<p>Basic knowledge of environmental measurement</p> <p>Basic knowledge of environment relating laws and chemistry</p> <p>1) Environment relating laws: The Basic Environment Law, Air Pollution Control Law, Water Pollution Control Law, Offense Color Control Law</p> <p>2) Chemistry</p> <ul style="list-style-type: none"> • Basic knowledge of physical chemistry: Law of Avogadro, Chemical Thermodynamics, etc. • Phase equilibrium: Thermodynamics of mixed gases, nature of solutions, law of distribution, etc. • Chemical equilibrium and reaction velocity • Structures and natures of substances: Kinds of atomic bonds, kinds of oxidation and reduction agents, chelating agents, surfactants, etc. • Structures and natures of organic compounds: Substitution reaction, addition reaction, elimination reaction, etc. • Qualitative analysis of organic compounds: Chemical actions of reaction agents • Others: Atomic nucleus disintegration, etc. <p>Outline of chemical analysis and measurement of concentration</p> <p>1) General application of chemical analysis</p> <p>2) Knowledge of basic principals of analyzers, handling, maintenance and others concerning general knowledge of measurement and analysis</p> <ul style="list-style-type: none"> • Foundation of chemical analysis: Classification of analysis methods, performances of analyzer • Reliability of analysis results • Management of measurement instruments: Calibration of measurement instruments, maintenance items • Preparation of calibration curve: Absolute calibration, internal standard, standard addition method and remarks 	<p>Basic knowledge of environmental measurement</p> <p>Basic knowledge of environment relating laws and physics</p> <p>1) Environment relating laws: The Basic Environment Law, Noise Regulation Law, Vibration Regulation Law</p> <p>2) Physics</p> <ul style="list-style-type: none"> • Unit • Classical dynamics: Kinetic equation, gravity law, simple oscillation, circular movement with uniform velocity, Elasticity and wave motion, etc. • Physical optics: Reflection of substances, optic interference, refraction and dispersion, etc. • Electromagnetism: Static electricity, stable electric current, electromagnetic field, electromagnetic induction, etc. • Others: Thermo-dynamics, etc. <p>Outline of noise and vibration and measurement of sound pressure level and oscillating acceleration level</p> <p>1) Knowledge of natures of sound and vibration</p> <p>(General knowledge of measurement of sound pressure level and oscillating acceleration level)</p> <ul style="list-style-type: none"> • Basic knowledge of noise and vibration: Basic knowledge of sound, vibration and wave motion, unit of sound, Indication of vibration level, sound wave generation and nature of sound source, transmission of sound wave, transmission of wave motion, calculation of dB, etc • Influence of noise • Noise meter: Calibration of noise meter, noise recorder, Frequency analysis • Noise measurement: Measurement of noise level, measurement of power level, measurement of sound reduction materials, frequency analysis
2B	<p>Outline of chemical analysis and measurement of concentration</p> <p>1) General application of chemical analysis</p> <p>2) Knowledge of basic principals of analyzers, handling, maintenance and others concerning general knowledge of measurement and analysis</p> <ul style="list-style-type: none"> • Foundation of chemical analysis: Classification of analysis methods, performances of analyzer • Reliability of analysis results • Management of measurement instruments: Calibration of measurement instruments, maintenance items • Preparation of calibration curve: Absolute calibration, internal standard, standard addition method and remarks 	<p>Outline of noise and vibration and measurement of sound pressure level and oscillating acceleration level</p> <p>1) Objective and definition of measurement law</p> <p>2) Measurement unit, etc.</p> <p>3) Regulation of measurement instruments, etc.</p> <p>4) Implementation of accurate measurement</p> <p>5) Measurement certification business</p> <p>6) Appropriate measurement management: Measurers, appropriate measurement management office system, etc.</p> <p>7) Calibration of measurement instruments, etc. Traceability system,</p> <p>8) Other regulations and punishment</p> <p>4</p> <p>Outline of measurement management</p> <p>1) Measurement plan: Objectives of measurement, methods and selection of measurement instruments, data transmission, calibration and SN ratio, Accuracy management of measurement instruments, standardization of measurement works</p> <p>2) Measurement system design: Outline of automatic measurement</p> <p>3) Quality control: Errors and accuracy in measurement</p> <p>4) Sampling and random sampling inspection method</p> <p>5) Data management: Statistical treatment of the measured figures</p> <p>6) Other general knowledge concerning measurement: definitions of measurement methods, Dynamic characteristics of measurement instruments: Deflection and zero method, maintenance and reliability of measurement instruments, control chart method and design of experiment</p>

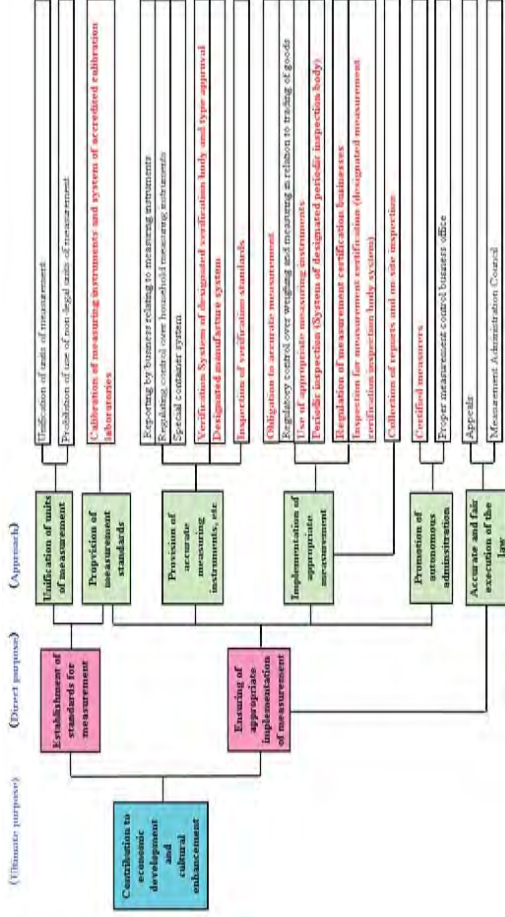
Required Knowledge for the Examination

No.	Certified Environmental Analyst concerning concentration	Certified Environmental Analyst concerning noise and vibration
2B	<p>Outline of chemical analysis and measurement of concentration</p> <p>2) Knowledge of basic principals of analyzers, handling, maintenance and others concerning general knowledge of measurement and analysis</p> <ul style="list-style-type: none"> • Chromatography: Gas-Chromatography, High Performance Liquid Chromatography, Ion-Chromatography, etc. • Spectrum-photometry: X-ray Fluorescence Analysis, absorptionometry, Fluorescence Spectrophotometer, Infrared Spectrophotometry, Atomic absorption method, Chemiluminescence, Nuclear Magnetic Resonance, Mass analysis, Activation Analysis, Inductively Coupled Plasma (ICP) atomic emission spectrometry, etc • Electric-Chemical method: Conductimetry, coulometry, ion-selective electrode method, etc • Analysis of inorganic compounds: Pre-treatment, cation-ion separation, titration, weight analysis, etc. • Soot analysis: Sampling, pre-treatment, SOx, NOx, O₂ oxidant, CO, HC, dust, SP, Cl, HCl, F, NH₃, H₂S, etc. • Water analysis: Sampling, pre-treatment of sample, SS, pH, DO, BOD₅, COD, TOC, TOD, n-hexane extract, phenol, TDS, Anion-surfactant, F, CN, NH₄-N, NO₂-N, NO₃-N, Org-N, T-N, P, coliforms, Cl₂, Ca, Pb, Cr, Hg, As, V, Mn, etc. • Soil, industrial waste, food analysis 	<p>Outline of noise and vibration and measurement of sound pressure level and oscillating acceleration level</p> <p>2) General knowledge of measurement of sound pressure level and oscillating acceleration level</p> <ul style="list-style-type: none"> • Noise control: How to control noise, countermeasures of noise source, prevention of sound transmission, noise transmission in building and prevention, sound absorption materials, sound-cut materials • Vibration pollution: Influence of vibration, evaluation of ISO vibration exposure • Vibration meter: Principal and structure, etc., maintenance management, standard of vibration level meter, calibration of vibration meter, vibration measurement • Measurement of oscillating acceleration level: Plan of measurement of vibration • Measurement of oscillating acceleration level • Prevention of vibration: Vibration generation and prevention of vibration, elasticity support, elasticity support materials, vibration prevention countermeasures

Required Knowledge for the Examination

No.	Certified Environmental Analyst concerning concentration	Certified Environmental Analyst concerning noise and vibration
3	<p>Laws concerning measurement</p> <p>1) Objective and definition of measurement law</p> <p>2) Measurement unit, etc.</p> <p>3) Regulation of measurement instruments, etc.</p> <p>4) Implementation of accurate measurement</p> <p>5) Measurement certification business</p> <p>6) Appropriate measurement management: Measurers, appropriate measurement management office system, etc.</p> <p>7) Calibration of measurement instruments, etc. Traceability system,</p> <p>8) Other regulations and punishment</p> <p>4</p> <p>Outline of measurement management</p> <p>1) Measurement plan: Objectives of measurement, methods and selection of measurement instruments, data transmission, calibration and SN ratio, Accuracy management of measurement instruments, standardization of measurement works</p> <p>2) Measurement system design: Outline of automatic measurement</p> <p>3) Quality control: Errors and accuracy in measurement</p> <p>4) Sampling and random sampling inspection method</p> <p>5) Data management: Statistical treatment of the measured figures</p> <p>6) Other general knowledge concerning measurement: definitions of measurement methods, Dynamic characteristics of measurement instruments: Deflection and zero method, maintenance and reliability of measurement instruments, control chart method and design of experiment</p>	<p>1) Objective and definition of measurement law</p> <p>2) Measurement unit, etc.</p> <p>3) Regulation of measurement instruments, etc.</p> <p>4) Implementation of accurate measurement</p> <p>5) Measurement certification business</p> <p>6) Appropriate measurement management: Measurers, appropriate measurement management office system, etc.</p> <p>7) Calibration of measurement instruments, etc. Traceability system,</p> <p>8) Other regulations and punishment</p> <p>4</p> <p>Outline of measurement management</p> <p>1) Measurement plan: Objectives of measurement, methods and selection of measurement instruments, data transmission, calibration and SN ratio, Accuracy management of measurement instruments, standardization of measurement works</p> <p>2) Measurement system design: Outline of automatic measurement</p> <p>3) Quality control: Errors and accuracy in measurement</p> <p>4) Sampling and random sampling inspection method</p> <p>5) Data management: Statistical treatment of the measured figures</p> <p>6) Other general knowledge concerning measurement: definitions of measurement methods, Dynamic characteristics of measurement instruments: Deflection and zero method, maintenance and reliability of measurement instruments, control chart method and design of experiment</p>

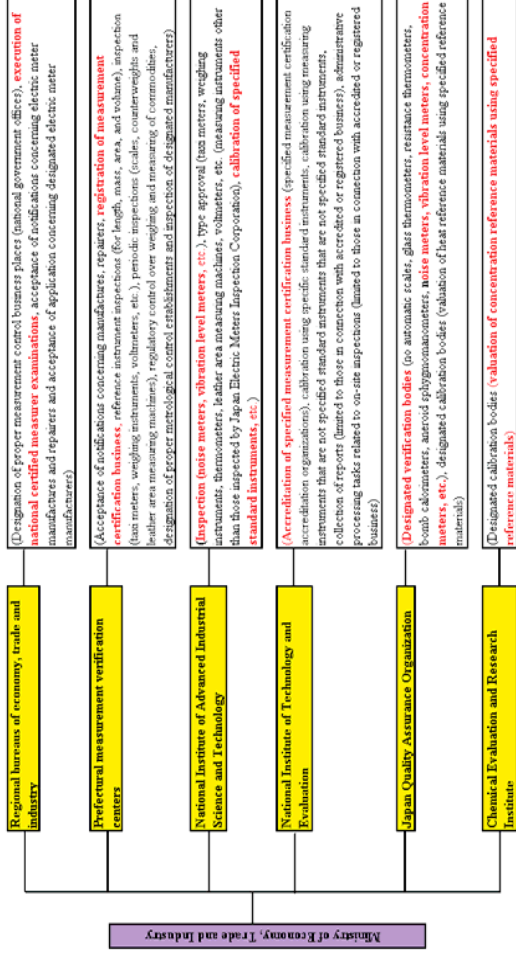
Structure of the Measurement Law (JETRO, Feb.2007)



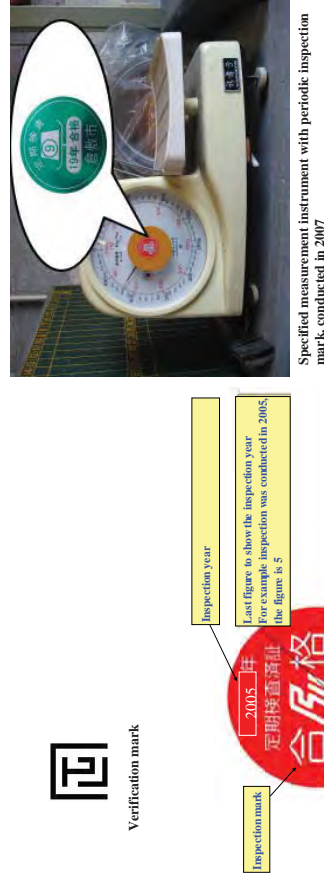
Key Points of the Measurement Law

- Measuring instruments are needed fit for official guarantee of accuracy
- Specified measuring instruments must meet set accuracy standards through methods such as verification and/or periodic inspection to check their conformity to set technical standards in terms of structure and instrumental error.
- Don't use specified measuring instruments without verification mark or periodic inspection mark.

Related Institutions to the Measurement Law



Verification and Periodic Inspection Mark



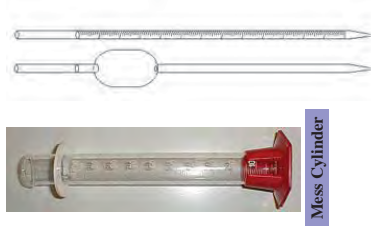
Acceptable error of vessel for measuring volume

Name	Acceptable error
100 ml Mess cylinder	± 0.5 ml
100 ml Mess flask	± 0.1 ml
25 ml hole pipette	± 0.03 ml
25 ml burette	± 0.03 ml

At 20.



Mess Flask



Mess Cylinder

Mess Pipette



Burette

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Parties not necessary registration as a measurement certification business

- ◆ National and local public organizations
- ◆ Some independent administrative institutions
 - National Institute of Advanced Industrial Science and Technology,
 - National Institute of Technology and Evaluation,
 - National Institute of Occupational Safety and Health,
 - Japan and National Institute for Environmental Studies
- Organizations registered under another law

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Specified measuring instruments used for certification of noise/ vibration level or concentration

Name of Specified Measurement Instrument
• Ordinary noise meter and precise noise meter
• Vibration level meter
• Glass electrode pH meter
Automatic Air Monitoring Analyzer
• Oxygen meter using zirconium (maximum level: 5 to 25 v/v %)
• Magnetic oxygen meter (maximum level: 5 to 25 v/v %)
• SO ₂ meter using electricity conductivity (maximum level: more than 50 v/v ppm)
• SO ₂ meter using ultra violet (maximum level: more than 50 v/v ppm)
• NOx meter using ultra violet (maximum level: more than 25 v/v ppm)
• Non- dispersion infrared rays SO ₂ meter
• Non- dispersion infrared rays NOx meter
• Non- dispersion infrared rays CO meter (minimum scale: less than 100 v/v ppm and 100 to 200 v/v ppm with maximum level of 5 v/v %)
• Chemical luminescence NOx meter (maximum level: more than 25 v/v ppm)



Noise Meter (RION)

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Classification of environmental measurement certification business

- Relating to the concentration of substances in air, water or soil, excluding specified substance (dioxins)
- Relating to the concentration of dioxins in air, water or soil .Accredited certified measurement business for specified concentration (only dioxins)
- Sound pressure level
- Oscillating acceleration level

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Registration Criteria

- Arrangement of measurement instruments
- Arrangement of certified environmental measurer (analysts)
- Copy of accreditation (only for specified measurement certification)



Required documents for registration

- Outline of the company, certificates of the company's regime
- Outline of measurement certification business
 - planned number of measurement certification, objects of the measurement such as concentration, vibration, noise
- List of instruments, facilities and equipment for measurement
 - Name, type, specification, installation place
- Measurement methods along with instruments, facilities and equipment for measurement (Note) (Environmental measurement certification relating to the concentration)
 - Copy of the certified environmental analyst
 - Copy of the health insurance card of the certified environmental measurer (analyst)
- Copy of acceptance of wastewater and air pollution control facilities (Environmental measurement certification relating to the concentration of a substance in air, water or soil, excluding specified substances (dioxins) and measurement certification relating to the concentration of dioxins in air, water or soil)
- Copy of accreditation by National Institute of Technology and Evaluation or Japan Chemical Laboratory Association. (Specified measurement certification business)
- Floor plan to show the installations and storage of instruments, facilities, equipment for measurement certification, and laboratory
- Information map to the laboratory from the nearest station

Note:

- 1) As for the specified measuring instruments (except pH meter), copies of verification certifications by JQA (Japan Quality Assurance Organization) for specified measuring instruments or inspection certifications to meet criteria by designated manufacturers to be attached.
- 2) As for the level recorder used with noise meter or oscillating acceleration level meter, copy of inspection certification by JQA (Japan Quality Assurance Organization) to be attached

List of analyzer, facilities and equipment for measurement of concentration and specified concentration of water or soil

A. Facilities necessary for registration application designated by Ministry of Economy, Trade and Industry		Required performance	
No.	Specified measurement instruments and other equipment and facilities	No.	Analysis instruments or apparatus
1	Analysis instruments, apparatus and standard substances	11	Inductively Coupled Plasma (ICP) atomic emission spectrometry
2	Mass balance (Electronic scale, etc.)	12	ICP-Mass spectrometry
3	Pure water production apparatus, or pure water	13	Ion-chromatograph
4	Exhausted gas treatment facility	14	Ion selective electrode
5	Wastewater treatment facility	15	Spectrophotometer
6	Glass electrode, pH detector	16	Fluorescence Spectrophotometer
7	Glass electrode, pH indicator	17	Purge-trap concentration apparatus
		18	Headspace concentration apparatus
		19	Automatic DO analyzer
B. An example of analysis instruments or apparatus necessary for analysis methods of the target parameters		Analysis instruments or apparatus	
No.	Analysis instruments or apparatus	No.	Analysis instruments or apparatus
1	Glass-made thermometer	6	Microwave ashing system
2	Electric thermometer (thermocouple/resistance type)	7	Shaker
3	Atomic Absorption Spectrophotometer	8	Incubator
4	Mercury analysis apparatus	9	Automatic titration apparatus
5	Gas Chromatograph	10	Fume hood
6	Gas Chromatograph-Mass Spectrometry		
7	High Performance Liquid Chromatograph		
8	DO meter		
9	Automatic pH meter		
10	Automatic COD analyzer		
C. An example of equipment necessary for analysis		Equipment	
No.	Equipment	No.	Equipment
1	Drier to get a fixed weight	6	Microwave ashing system
2	Water bath	7	Shaker
3	Centrifuge	8	Incubator
4	Electric furnace	9	Automatic titration apparatus
5	Concentration apparatus: Distillation, Extraction, Separation Column, etc.	10	Fume hood

Issuance of Registration

◆ On-site inspection to confirm the application by prefectural measurement verification centers

- Existence and location of the enterprise and laboratory
- Rolls and authorities of certified environmental analyst
- Measurement instruments, equipment and facilities reported
- Necessary date of issuing registration: about 15 days after receiving application



Fume Hood

Items to be regulated in the business regulations

To submit the business regulations to the prefectural governor **within three months** after the registration.

- ◆ Classification of measurement certification business
- ◆ Organization chart and rolls
- ◆ Methods of measurement (JIS, regulations, notices, etc by Ministries with the enacted year)
- ◆ Keeping, maintenance, inspection and correction of the specified measurement instruments and other measurement instruments, equipment and facilities
- ◆ **Matters concerning measurement certification report including:**
 - Declaration of measurement certification
 - Number of measurement certification and date of issuing measurement certification
 - Name, address, registration number of the enterprise issuing measurement certification
 - Name of the certified environmental analyst and registration number
 - Customer's name
 - Name of the sample
 - Date of taking sample and by who
 - Parameters to be measured
 - **Measurement method of each parameter**
 - **Measurement result**
 - **Minimum limit of determination**
 - In case of partially out-sourcing, name, address of the out-sourcing measurement certification business and concrete description of parameters
 - Others like origin of the sample
- ◆ Execution report of measurement certification and storage of certification report
- ◆ Matters concerning partially out-sourcing
- ◆ Others necessary for measurement certification business



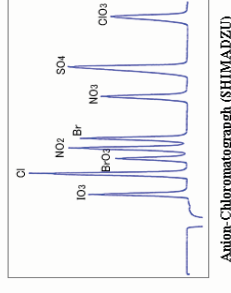
Purge & trap concentration equipment (CDS Analytical Inc.)

An Example of Minimum Limit of Determination and Significant Figure-1

Parameter	Unit	Minimum limit of Determination of River Water	Environmental criteria (River water)	Significant figure
pH			6.5 - 8.5*	2
Dissolved Oxygen (DO)	mg/l	0.5	7.5**	3
Biochemical oxygen demand (BOD ₅)	mg/l	0.5	1*	2
Chemical oxygen demand (CODMn)	mg/l	0.5	-	2
Suspended solid (SS)	mg/l	1	25*	2
Total coliform	cfu/100 ml	1	50*	2
n-hexane extract	mg/l	1	-	2
Total Nitrogen as N	mg/l	0.03	-	2
Total phosphorus as P	mg/l	0.003	-	2
Cadmium (Cd)	mg/l	0.001	0.01	2
Total cyanide (CN)	mg/l	0.001	ND	2
Lead (Pb)	mg/l	0.001	0.01	2
Hexavalent chromium (Cr ⁶⁺)	mg/l	0.005	0.05	2
Arsenic (As)	mg/l	0.001	0.01	2
Total mercury (T-Hg)	mg/l	0.0005	0.0005	2
Alkyl-Hg	mg/l	0.0005	ND	2
Poly Biphenyl Chloride (P-PCB)	mg/l	0.0005	ND	2
Di-chloromethane	mg/l	0.002	0.02	2
Butyl chloride carbon (CCl ₄)	mg/l	0.0002	0.002	2
1,1-dichloroethane	mg/l	0.0004	0.004	2
1,1-dichloroethylene	mg/l	0.002	0.02	2
cis-1,2-dichloroethylene	mg/l	0.004	0.04	2
1,1,1-trichloroethane	mg/l	0.1	1	2
1,1,2-trichloroethane	mg/l	0.0006	0.006	2
Tri-chloroethylene	mg/l	0.003	0.03	2

On-site inspection by prefectural measurement verification center

- ◆ Approximately every three years
- ◆ Inspection includes management and technical aspects (**Management aspects**)
 - If the certified environmental analyst is doing his/her obligations properly
 - If the business regulations are in conformity to actual situation
 - If each process from receiving order to analysis or measurement and issuance of certification report is working properly
 - Others



Anion-Chromatogram (SHIMADZU)

- (**Technical aspects**)
 - If the measurement instruments are well maintained
 - If the measurement methods and procedures are appropriate
 - If technical improvement is continuously implemented
 - If the preparation of certification report and the contents are appropriate
 - If the accuracy management is appropriate.

An Example of Minimum Limit of Determination and Significant Figure-2

Parameter	Unit	Minimum limit of Determination of River Water	Environmental criteria (River water)	Significant figure
1,3-dichloropropene	mg/l	0.002	0.0002	2
Thiuram	mg/l	0.0006	0.006	2
Simazine	mg/l	0.0003	0.003	2
Thiobencab	mg/l	0.002	0.02	2
Benzene	mg/l	0.001	0.01	2
Selenium (Se)	mg/l	0.001	0.01	2
NO ₂ -N and NO ₃ -N as N	mg/l	0.06	10	3
Fluorine (F)	mg/l	0.1	0.8	2
Boric acid (B)	mg/l	0.1	1	2
Phenols	mg/l	0.005	0.005**	2
Copper (Cu)	mg/l	0.01	1**	2
Zinc (Zn)	mg/l	0.05	1**	2
Iron (Fe)	mg/l	0.05	0.3**	2
Manganese (Mn)	mg/l	0.01	0.05**	2

Note
 * Standard for Classification AA (most clear water)
 ** Standard for drinking water

Problems of Current Measurement Law

1 Background

- 1) Globalization of economic activities
- 2) Necessity of trace concentration measurement
- 3) Rapid increase of substances regulated to be measured

2 Current problems of the measurement Law

- 1) Japanese environmental measurement certification system is not well known in the world.
 - Number of certified environmental analysts is more than 10,000 and the registered certified environmental measurement enterprises are more than 1,500.
- 2) Insufficient management ability
- 3) The ability of the certified environmental analyst can't catch up with the current trend

3 How to cope with

- 1) Establishment of traceability by Japan Calibration Service System (JCSS)
- 2) Acquisition of ISO 17025 accreditation to establish better management system
- 3) Acquisition of the accredited specified measurement certification business to measure trace of dioxins
- 4) Review of the current accuracy management
- 5) Consideration of re-education system of the certified environmental analyst
- 6) Participation of technical skill test for measurers

An Example of Measurement Certificate

Parameter	Measurement Result	Method of Measurement
Cadmium and its compounds (Cd)	Less than 0.01 (mg/l)	JIS K 0102 55.1
Lead and its compounds (Pb)	0.02 (mg/l)	JIS K 0102 54.1
Hexavalent chromium (Cr ⁶⁺)	Less than 0.05 (mg/l)	JIS K 0102 65.2.1
Arsenic and its compounds (As)	Less than 0.01 (mg/l)	JIS K 0102 61.2
Mercury and its compounds (Hg)	Less than 0.005 (mg/l)	Appendix chart 1, Notice by Ministry of Environment, 1971
Total Iron (Fe)	0.22 (mg/l)	JIS K 0102 57.2
Copper and its compounds (Cu)	0.07 (mg/l)	JIS K 0102 52.2
Selenium and its compounds (Se)	Less than 0.01 (mg/l)	JIS K 0102 67.2

Remarks: "Less than" means less than minimum limit of detection.
 Person's name in charge of measurement: _____

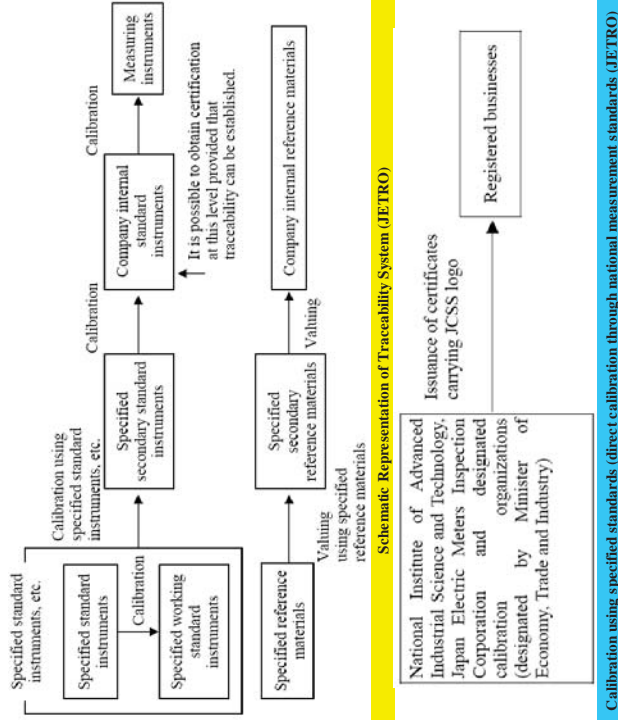
Accuracy management in environmental measurement

1 Internal accuracy management

- 1) Preparation of kinds of rules, standard operation procedure (SOP) and kinds of records
 - ◆ Handling of equipment
 - ◆ Handling of standard
 - ◆ Sampling
 - ◆ Pre-treatment
 - ◆ Handling of measurement instruments
 - ◆ Recoding of each analysis process
- 2) Periodic acquisition of data for validation of accuracy management in analysis
 - ◆ Limit of detection value (LOD) of measurement instrument and analysis method: once a year
 - ◆ Recovery rate evaluation: 80 - 120 %
 - ◆ Operational blank and travel blank test.
 - ◆ Repeated measurement: Differences are less than 20 % (The figure depends on the method) of the average, to be executed approximately 10 % of the number of samples.

2 External accuracy management by cross-check, participation to skill evaluation tests, etc

- ◆ Confirmation of measurement reliability
- ◆ Establishment of measurement value
- ◆ Improvement and confirmation of measurement skill of the measurer



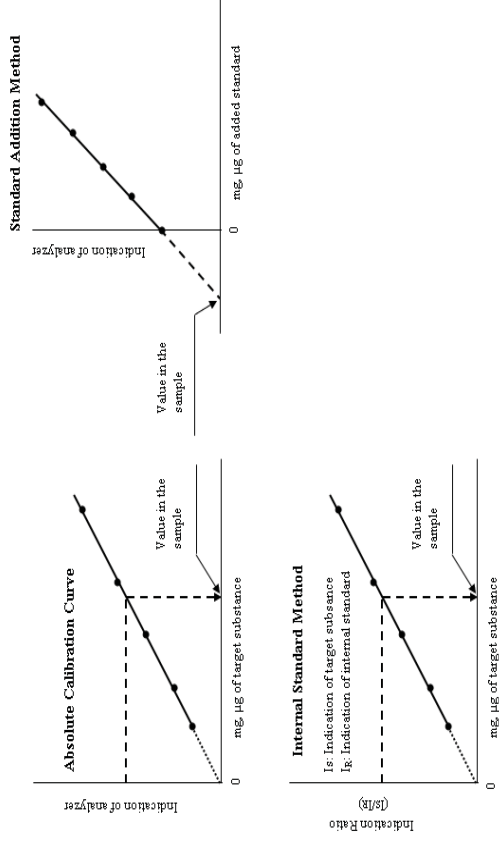
Calibration using specified standards (direct calibration through national measurement standards (JETRO))

Attention in using measurement instruments

Measurement Instrument	What to be paid attention to
Spectrophotometer	<ul style="list-style-type: none"> Understand the principal of analysis procedure Understand coloring agents with other elements Adjust pH to the appropriate range Add buffer, masking, reaction agents as designated Appropriate pre-treatment such as distillation, solvent extraction, etc Reaction temperature Right wave length Blank test
Flame atomic Absorption Spectrophotometer	<ul style="list-style-type: none"> Understand spectrometric, physical and chemical interferences and countermeasures Use background correction, solvent extraction, interference restriction agent, etc Use high temperature flame as designated Use internal standard method calibration curve Procedure of ignition and stop of flame Blank test
Electric heating atomic Absorption Spectrophotometer	<ul style="list-style-type: none"> Use background correction for Al, Cr, V Use Palladium(II) nitrate for Cd, Pb to avoid element loss in ashing process Use solvent extraction if necessary Repeat measurement at least three times Blank test
Inductively Coupled Plasma (ICP) atomic emission spectrometry	<ul style="list-style-type: none"> Use standard addition or internal standard calibration curve Use solvent extraction if necessary Blank test
Ion selective electrode	<ul style="list-style-type: none"> Temperature Measurement time to become stable pH adjustment Pre-treatment by adding complex-dissolving agent to change to ionic-form, distillation, adding masking agent, etc.

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Calibration Curve



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Attentions in Measurement

Parameter	What to be paid attention to
pH	<ul style="list-style-type: none"> Glass and reference electrodes are stored in water. If they are dirty, clean in a short time by dilute HCl or surfactant and wash by water flow Add KCl for reference electrode if necessary Temperature Use lithium electrode for the sample with high pH (over pH 11). Check pH, oxidation or reduction agent, supersaturated dissolved oxygen or gas Pre-treatment above if necessary
Biochemical oxygen demand (BOD ₅)	<ul style="list-style-type: none"> Use seed liquid Use the result where D.O in the incubator is consumed 40 to 70 % in five days Check the total procedure by using Glucose-Glutamine mixture standard liquid to show 220±10 mg-O/L Understandings of the advantages and disadvantages of DO measurement methods by titration
Dissolved oxygen (D.O) meter	<ul style="list-style-type: none"> Temperature and salt concentration Keep the electrode clean and wet
Conductivity meter	<ul style="list-style-type: none"> Temperature Keep the cell clean and wet Need a certain flow rate Water bath : to keep over 93 °C during the test
Chemical oxygen demand (COD(Mn))	<ul style="list-style-type: none"> Shape of triangle flask : same CI concentration Use the result where KMnO₄ solution remains 4.5 to 6.5 mL
Chemical oxygen demand (COD _c)	<ul style="list-style-type: none"> Take sample as half of K₂Cr₂O₇ remains Reagents concentrations CI concentration: Not appropriate to the sample with less than 20 mg-O/mL and high concentration of CI
Suspended Solid (SS) under 2 mm	<ul style="list-style-type: none"> Take sample as more than 5 mg of dries SSS remained. Preferably 20 to 40 mg. Heating temperature and time
n-hexane extracted substances	<ul style="list-style-type: none"> Not use grease on the cock of the separation flask with short leg Check the nature of the extracted substances such as emulsion, turbidity, etc. Consider to use soxhlet extractor.

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Attentions in Measurement

Parameter	What to be paid attention to
Pre-treatment of analysis of heavy metals	<ul style="list-style-type: none"> Understand the applications of dissolving procedures of metals by acids Don't use HNO₃-H₂SO₄ when use AA or ICP and Pb Understand the advantages and disadvantages of evaporation concentration, co-sedimentation, vaporizing, ion-exchange, solvent extraction, etc.
Cu, Zn, Pb, Cd, Mn, Fe, Ni, Co by AA or ICP	<ul style="list-style-type: none"> Use solvent extraction, if necessary. Use background correction Avoid contamination from glass apparatus and environment Prepare of mixed standard solutions of Zn, Pb, Cd, Mn, Fe, Ni, Co for calibration curve in using ICP
Cr	<ul style="list-style-type: none"> Concentrate by co-sedimentation, solvent extraction in case of low concentration of Cr Pre-treatment: distillation Understand the meanings of the added reagents pH at reaction with reaction agent, reaction time, temperature
Phenols (Distillation, Spectrophotometer)	<ul style="list-style-type: none"> Pre-treatment: oxidation at high temperature and high pressure by oxidation agent Not suitable for the sample with high concentration of organic matters, seawater, sample with more than 1mg/L of Cr In case of the existence of high concentration of organic matters, use total amount nitrogen method
T-N (Oxidation, ultra violet Spectrophotometer)	<ul style="list-style-type: none"> Pre-treatment: oxidation at high temperature and high pressure by oxidation agent Understand the limit of the application of the sample, not suitable for the sample with high concentration of organic matters, Cr, etc.
T-P (Oxidation, visible Spectrophotometer)	<ul style="list-style-type: none"> Pre-treatment: oxidation at high temperature and high pressure by oxidation agent Understand the limit of the application of the sample, not suitable for the sample with high concentration of organic matters, Cr, etc.
Common	<ul style="list-style-type: none"> Grade of pure water

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Classification and Required Quality of Pure Water

Parameter ^{*1}	Classification and required quality			
	A1	A2	A3	A4
Conductivity (mS/m at 25 °C)	Less than 0.5	Less than 0.1 ^{*2*3}	Less than 0.1 ^{*2}	Less than 0.1 ^{*2}
TOC (mg/l)	Less than 1	Less than 0.5	Less than 0.2	Less than 0.05
Zn (µg/l)	Less than 0.5	Less than 0.1	Less than 0.1	Less than 0.1
SiO ₂ (µg/l)	-	Less than 50	Less than 5.0	Less than 2.5
Cl (µg/l)	Less than 10	Less than 2	Less than 1	Less than 1
SO ₄ ²⁻ (µg/l)	Less than 10	Less than 2	Less than 1	Less than 1

Note

- *1 Parameters may be selected by analysis method. If there is the criterion on the water to be used in the analysis method, follow it.
- *2 The value of effluent from water purification equipment by direct introduction of it to the detector of conductivity meter
- *3 In case of direct introduction of the effluent from membrane equipment after final ion-exchange equipment to the detector of conductivity meter, the value should be less than 0.01 mS/m at 25 °C

What to be paid attention to in analysis of industrial wastewater (Additional)

2 General

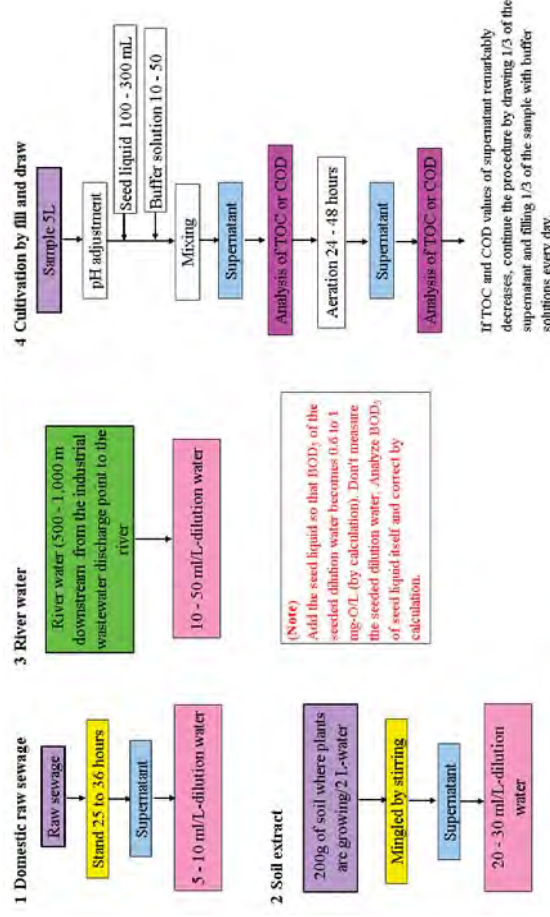
- ◆ Preparation of calibration curve
- ◆ There is a range of calibration curve. Don't use the lower and upper value of the calibration curve.
- ◆ Understanding of the importance of pre-treatment, in using spectrophotometer, particular, and even in using AA, ICP, Gas chromatography
- ◆ Confirmation of recovery rate of extraction, distillation operation, etc.
- ◆ Effective time of prepared agents, standards and indicators.
- ◆ Blank test
- ◆ Cleaning of beaker, flask, extraction and/or distillation apparatus, measurement instruments, etc to prevent from contamination
- ◆ Error among the cell for spectrophotometer
- ◆ How to distribute the sample with suspended solid
- ◆ Stability of the measurement instruments before measuring
- ◆ Understanding of the meaning of the significant figure and decision
- ◆ Preparation of analysis flowchart with remarks

What to be paid attention to in analysis of industrial wastewater (Additional)

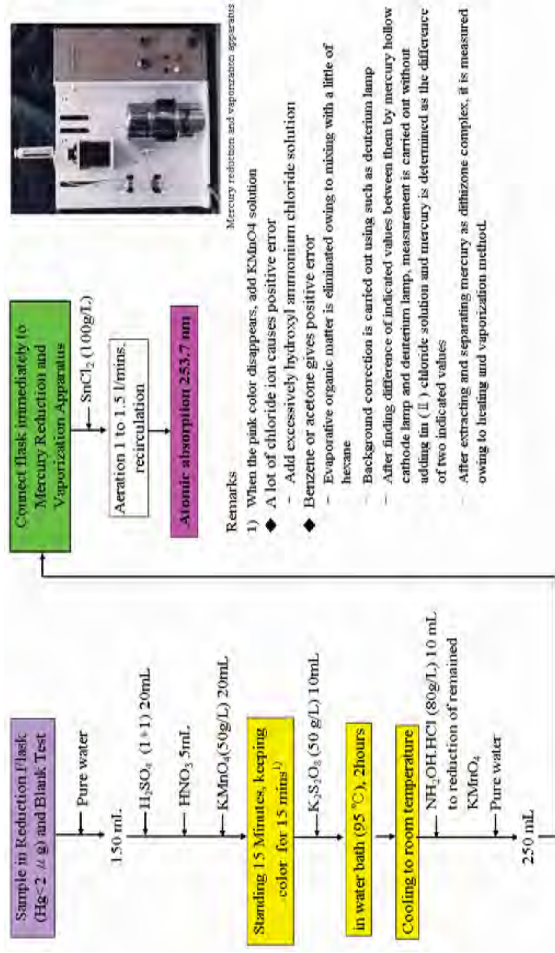
1 BOD₅

- ◆ When TDS exceeds 3,000 mg/L in incubation bottle, the BOD₅ value extremely becomes low because of high level of salt hinders bacteria's activity.
- ◆ Number of bacteria in incubation bottle needs 10⁵ cfu/ml. Accordingly, filtered sample by membrane needs seeding for analysis of BOD₅ because bacteria are also filtered by membrane. .
- ◆ Seeding will be always necessary.
- ◆ Add the seed liquid so that BOD₅ of the seeded dilution water becomes 0.6 to 1.0 mg-O/l (by calculation of BOD₅ of seed liquid itself)
- ◆ When BOD₅ value of standard solution does not show 220±10 mg-O/l, the procedure should be reviewed.
- ◆ Analyze DO1 (DO of first day) 15 minutes after preparation of sample dilu to prevent inorganic reduction agent from consuming oxygen.
- ◆ DO discrepancy during five days in incubator bottle should be 0.2 mg-O/l or less.
- ◆ Starch indicator should be prepared just before filtration.

Preparation of Seed Liquid



An Example of Analytical Flowchart (Hg)

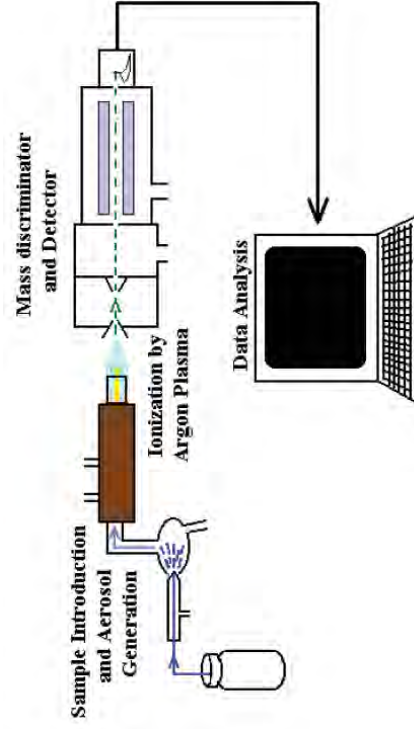


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Recommendations

- ◆ Don't end up only analyzing and measuring. Use the results for plant operation, consultation, etc. When the results are not what you expected, you should pursue the causes and consider the procedures to improve.
- ◆ Find the correlation among the parameters to use daily operation & maintenance, BOD₅-CODer-SS, for example. If you find the correlation, you don't need analyze all parameters every time. Formulate a database from the results.
- ◆ In case of using simple analysis method, not official, compare the results with the one got by official method. If there is no co-relation, don't use the simple method. It only causes the confusion.
- ◆ During analysis, you should pay attention to if there is an unusual phenomenon, for example, in color, generation of turbidity or settlements and so on. This abnormality will give you some hints in the trouble of the plant and analysis procedure. Analysis or measurement is not a routine work.

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Schematic flow of ICP-MS by Jenna Worley and Steve Kvech

Thank you for your attention. See you again

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Workshop Material

**Monitoring and Evaluating
of
Business Plan
for
Implementing WUSC Management Model**

August 27th, 2013

Agenda

1. WUSC management model
2. Business planning
3. Monitoring and Evaluation of business plan
4. Case

Objective:

- Technical/knowledge transfer on Monitoring and Evaluation of business plan
- Encourage to self monitoring and evaluation by WUSC on their business plan (whom already prepare business plan with our program)

Remarks:

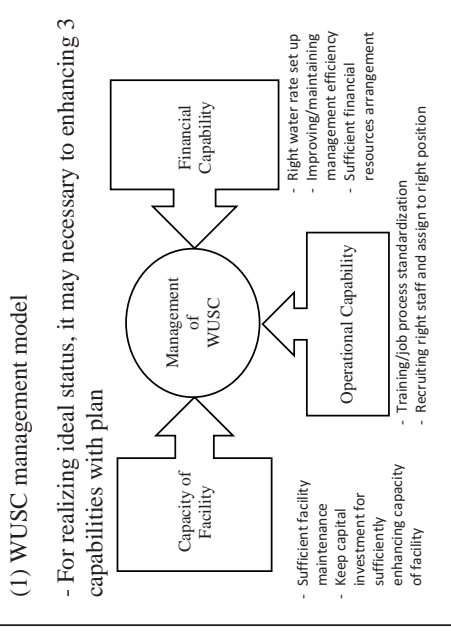
Content is already introduced on last February to WSSDO staff of Jhapa and Morang, as well as participants from Gauradaha WUSC

1. WUSC management model

2. Business planning
3. Monitoring and Evaluation of business plan
4. Case

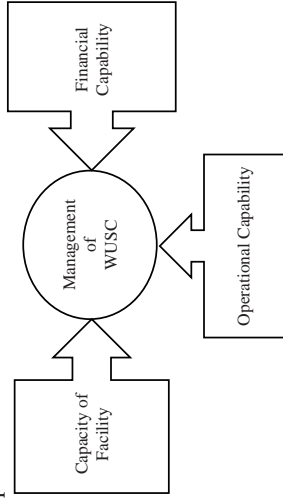
(1) WUSC management model

Ideal state of WUSC
-WUSC provides safe water affordably in stable manner, to maximum people in their jurisdiction with reasonable cost



(1) WUSC management model

- For realizing ideal status, it may necessary to enhancing 3 capabilities



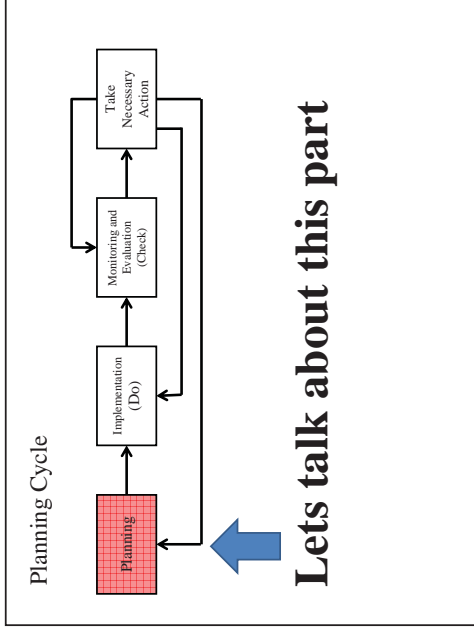
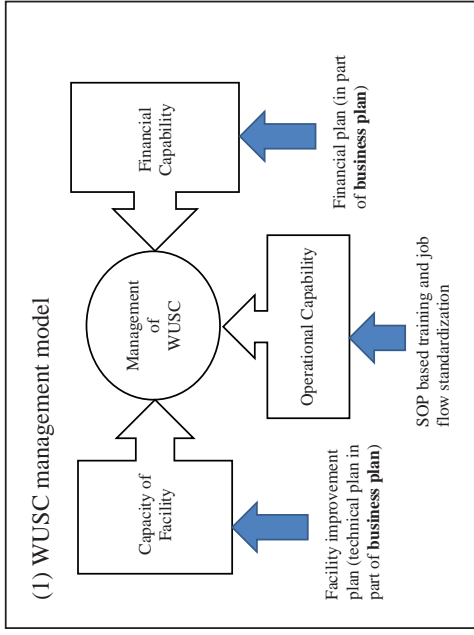
(1) WUSC management model

Ideal state of WUSC

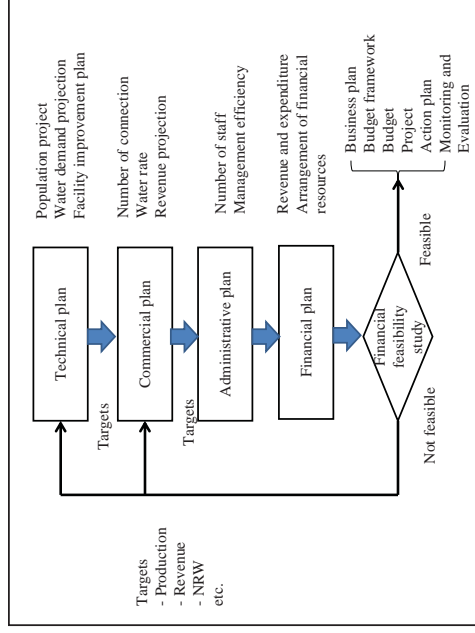
-WUSC provides safe water affordably in stable manner, to maximum people in their jurisdiction with reasonable cost

Realize with

- 1) Target setting
- 2) **Business planning**
- 3) Implementing and
- 4) Training based on SOP



1. WUSC management model
- 2. Business planning**
3. Monitoring and Evaluation of business plan
4. Case



Technical Plan

- Main aim of technical plan to know whether existing facility meet the water demand or not
- Population
- Service Coverage
- Population served
- Consumption per day per capita
- Facility improvement plan and capital cost
- Facility operation and maintenance cost
(power/fuel for pumping, chemical for purification, spare parts, repair and maintenance cost)

Administrative Plan

- Focus on number of staff considering labor efficiency and maintaining quality of services
- If staff is shortage, quality is drop, if over staffed, effect management efficiency
- Number of staff
- Salaries and wages
- Office management cost
- Labor efficiency
- Computerization

Commercial Plan (Customer Service Plan)

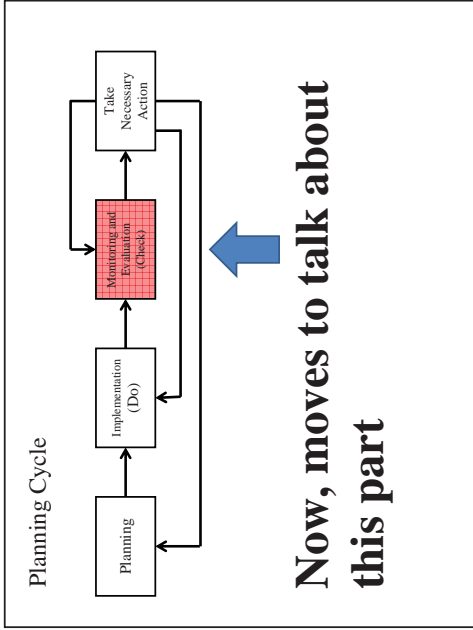
- Commercial plan mainly focus on additional connection and water rate and based on this revenue from sales of water is calculated
- Number of additional connection
- Number of connection
- Average consumption per connection
- Water rate
- Collection Efficiency
- Revenue from sales of water and services

Financial Plan

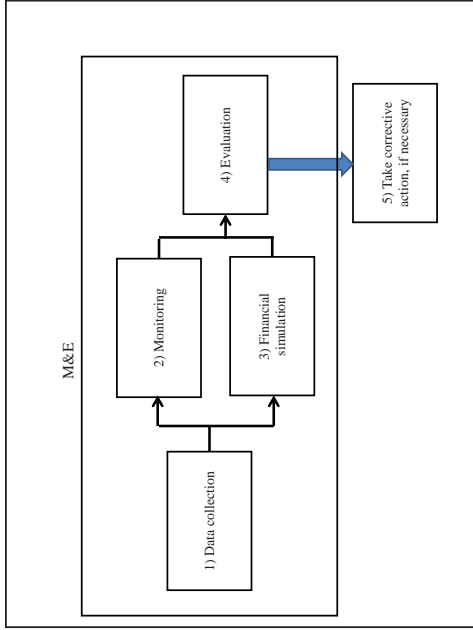
- Financial plan mainly focus on revenue and expenditure, revenue of sales of water but it may not be sufficient mainly during capital investment, so in this case may required grant or loan (financial resources arrangement plan)
- End balance may better keep at least 3-5% positive against revenue from sales of water (this is cash on hand for emergency)
- Revenue
- Expenditure
- Financial resources arrangement plan

E. Target and key performance indicator	2013	2014	2014	2014	2014	2014	2017	2018	2019
(A) Customer service indicator	100%	100%	100%	100%	100%	100%	100%	100%	100%
(B) Coverage ratio	27%	37%	38%	40%	41%	41%	42%	43%	43%
(C) Population served	14,840	17,340	19,640	21,480	23,130	24,492	26,682	27,685	28,685
(D) Average consumption per connection	27	28	28	28	28	28	28	28	28
(E) Average revenue per connection	1,852	2,152	2,452	2,752	3,052	3,352	3,652	3,952	4,252
(F) Profitability	100%	100%	100%	100%	100%	100%	100%	100%	100%
(G) Production Volume	20,04	4,032	4,032	4,032	4,032	4,032	4,032	4,032	4,032
(H) LFW	11%	8%	8%	8%	8%	8%	8%	8%	8%
(I) M2V	13%	10%	10%	10%	10%	10%	10%	10%	10%
(J) Number of connections per staff	13	13	13	14	14	14	17	18	18
(K) Revenue from operational activity	2,948	2,992	3,032	3,072	3,112	3,152	3,192	3,232	3,272
(L) Revenue from operational activity	100%	100%	100%	100%	100%	100%	100%	100%	100%
(M) Revenue from operational activity	100%	100%	100%	100%	100%	100%	100%	100%	100%
(N) Revenue from operational activity	100%	100%	100%	100%	100%	100%	100%	100%	100%
(O) Revenue from operational activity	100%	100%	100%	100%	100%	100%	100%	100%	100%
(P) Cash balance	4,032	4,032	4,032	4,032	4,032	4,032	4,032	4,032	4,032
(Q) Cash balance	100%	100%	100%	100%	100%	100%	100%	100%	100%

Sample M&E sheet prepared in the business plan
Based on this, you must modify and prepare your M&E form



1. WUSC management model
2. Business planning
3. Monitoring and Evaluation of business plan
4. Case

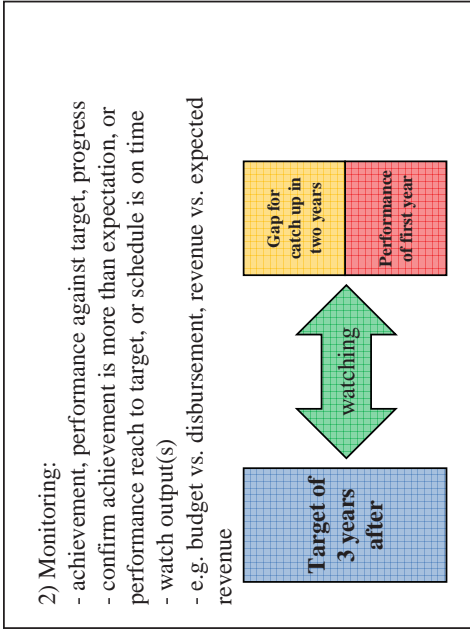


Sample monitoring format (for financial plan)

1) - 3) – from financial report
4) Unit cost – operational express excluding depreciation divide by production

Account	Target	Actual
101 Financial		
11 Income Statement		
111 Sales of water and services	1000 R	1000 R
112 Other non water revenue	1000 R	1000 R
113 Operational Expenses	1000 R	1000 R
114 Personnel and fuel for pumping	1000 R	1000 R
115 Chemicals for purification	1000 R	1000 R
116 Staff and part-time maintenance	1000 R	1000 R
117 Other (including depreciation)	1000 R	1000 R
118 Depreciation	1000 R	1000 R
119 Other	1000 R	1000 R
120 Other (including depreciation)	1000 R	1000 R
121 Depreciation	1000 R	1000 R
122 Other	1000 R	1000 R
123 Other (including depreciation)	1000 R	1000 R
124 Depreciation	1000 R	1000 R
125 Other	1000 R	1000 R
126 Other (including depreciation)	1000 R	1000 R
127 Depreciation	1000 R	1000 R
128 Other	1000 R	1000 R
129 Other (including depreciation)	1000 R	1000 R
130 Depreciation	1000 R	1000 R
131 Other	1000 R	1000 R
132 Other (including depreciation)	1000 R	1000 R
133 Depreciation	1000 R	1000 R
134 Other	1000 R	1000 R
135 Other (including depreciation)	1000 R	1000 R
136 Depreciation	1000 R	1000 R
137 Other	1000 R	1000 R
138 Other (including depreciation)	1000 R	1000 R
139 Depreciation	1000 R	1000 R
140 Other	1000 R	1000 R
141 Other (including depreciation)	1000 R	1000 R
142 Depreciation	1000 R	1000 R
143 Other	1000 R	1000 R
144 Other (including depreciation)	1000 R	1000 R
145 Depreciation	1000 R	1000 R
146 Other	1000 R	1000 R
147 Other (including depreciation)	1000 R	1000 R
148 Depreciation	1000 R	1000 R
149 Other	1000 R	1000 R
150 Other (including depreciation)	1000 R	1000 R
151 Depreciation	1000 R	1000 R
152 Other	1000 R	1000 R
153 Other (including depreciation)	1000 R	1000 R
154 Depreciation	1000 R	1000 R
155 Other	1000 R	1000 R
156 Other (including depreciation)	1000 R	1000 R
157 Depreciation	1000 R	1000 R
158 Other	1000 R	1000 R
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160 Depreciation	1000 R	1000 R
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163 Depreciation	1000 R	1000 R
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166 Depreciation	1000 R	1000 R
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169 Depreciation	1000 R	1000 R
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181 Depreciation	1000 R	1000 R
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196 Depreciation	1000 R	1000 R
197 Other	1000 R	1000 R
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199 Depreciation	1000 R	1000 R
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244 Depreciation	1000 R	1000 R
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247 Depreciation	1000 R	1000 R
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249 Other (including depreciation)	1000 R	1000 R
250 Depreciation	1000 R	1000 R
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252 Other (including depreciation)	1000 R	1000 R
253 Depreciation	1000 R	1000 R
254 Other	1000 R	1000 R
255 Other (including depreciation)	1000 R	1000 R
256 Depreciation	1000 R	1000 R
257 Other	1000 R	1000 R
258 Other (including depreciation)	1000 R	1000 R
259 Depreciation	1000 R	1000 R
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262 Depreciation	1000 R	1000 R
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265 Depreciation	1000 R	1000 R
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268 Depreciation	1000 R	1000 R
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271 Depreciation	1000 R	1000 R
272 Other	1000 R	1000 R
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274 Depreciation	1000 R	1000 R
275 Other	1000 R	1000 R
276 Other (including depreciation)	1000 R	1000 R
277 Depreciation	1000 R	1000 R
278 Other	1000 R	1000 R
279 Other (including depreciation)	1000 R	1000 R
280 Depreciation	1000 R	1000 R
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283 Depreciation	1000 R	1000 R
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286 Depreciation	1000 R	1000 R
287 Other	1000 R	1000 R
288 Other (including depreciation)	1000 R	1000 R
289 Depreciation	1000 R	1000 R
290 Other	1000 R	1000 R
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292 Depreciation	1000 R	1000 R
293 Other	1000 R	1000 R
294 Other (including depreciation)	1000 R	1000 R
295 Depreciation	1000 R	1000 R
296 Other	1000 R	1000 R
297 Other (including depreciation)	1000 R	1000 R
298 Depreciation	1000 R	1000 R
299 Other	1000 R	1000 R
300 Other (including depreciation)	1000 R	1000 R

- 2) Monitoring
- *) Confirmation of achieving targets
 - MAT and WUSC check the achievement of these targets, and find reason when performances are not reaching the target.
 - Important thing is, find the reason and fix the problem.





2) Monitoring: Technical Plan

iv) Confirmation of achieving targets

- Service coverage
- Population served
- Water demand
- Production
- Accounted water
- UFW
- Water quality – 100%?
- Service hours – 24 hours?
- Leakage repair – 100%?



2) Monitoring: Commercial Plan

ii) Confirmation of achieving targets

- Billed water
- NRW
- Average consumption per connection
- Number of connection
- Collection amount
- Collection efficiency
- Customer complaints – replay ratio is 100%?



2) Monitoring: Commercial Plan

i) Water rate

- If water rate improvement is scheduled, check
- Conduct public hearing meeting, and how and what attendant comments?
- Water rate improvement is on schedule or late?
- Confirm new water rate makes financial soundness (need to increase more/soon?)



2) Monitoring: Administrative Plan

i) Confirmation of achieving targets

- Number of staff
- Labor efficiency



2) Monitoring: Financial Plan

i) Confirmation of achieving targets

- Revenue
- Expenditure

3) Financial simulation

- Reset baseline on actual data and:
 - cash balance is positive or negative?
 - future construction project would be feasible or not? then
- reconfirm cost estimation of construction project (specially when construction closes within two years)
- reconfirm water rate improvement schedule
- reconfirm financial resources arrangement

3) Financial simulation

- Achievement of revenue target and budget target
- Simulation for confirm sufficiency of financial plan (no need to change financial plan/business plan?)



May be accelerating facility improvement plan
 May be increase water tariff more
 May be need more financial assistance

Shifting baseline to 2012, and fulfill actual data on FY end of June 2012

	2011	2012	2013	2014	2015	2016	2017	2018
27 Financial plan								
2701 Revenue	1,752	1,752	1,752	1,752	1,752	1,752	1,752	1,752
27010 Revenue from water	1,752	1,752	1,752	1,752	1,752	1,752	1,752	1,752
27011 Revenue from others	0	0	0	0	0	0	0	0
2702 Revenue from operational activity	5,707	5,707	5,707	5,707	5,707	5,707	5,707	5,707
27020 Revenue from water	5,707	5,707	5,707	5,707	5,707	5,707	5,707	5,707
27021 Revenue from others	0	0	0	0	0	0	0	0
2703 Revenue from investment	1,841	1,841	1,841	1,841	1,841	1,841	1,841	1,841
27030 Revenue from water	1,841	1,841	1,841	1,841	1,841	1,841	1,841	1,841
27031 Revenue from others	0	0	0	0	0	0	0	0
2704 Revenue from other	153	153	153	153	153	153	153	153
27040 Revenue from water	153	153	153	153	153	153	153	153
27041 Revenue from others	0	0	0	0	0	0	0	0
2705 Revenue from other	1,037	1,037	1,037	1,037	1,037	1,037	1,037	1,037
27050 Revenue from water	1,037	1,037	1,037	1,037	1,037	1,037	1,037	1,037
27051 Revenue from others	0	0	0	0	0	0	0	0
2706 Revenue from other	4,628	4,628	4,628	4,628	4,628	4,628	4,628	4,628
27060 Revenue from water	4,628	4,628	4,628	4,628	4,628	4,628	4,628	4,628
27061 Revenue from others	0	0	0	0	0	0	0	0
2707 Cash balance of operational activities	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
27070 Cash balance of water	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
27071 Cash balance of other	0	0	0	0	0	0	0	0
2708 Revenue for capital investment	844	844	844	844	844	844	844	844
27080 Revenue from water	844	844	844	844	844	844	844	844
27081 Revenue from others	0	0	0	0	0	0	0	0
2709 Revenue from financial activity	183	183	183	183	183	183	183	183
27090 Revenue from water	183	183	183	183	183	183	183	183
27091 Revenue from others	0	0	0	0	0	0	0	0
2710 Revenue	8,699	8,699	8,699	8,699	8,699	8,699	8,699	8,699
27100 Revenue from water	8,699	8,699	8,699	8,699	8,699	8,699	8,699	8,699
27101 Revenue from others	0	0	0	0	0	0	0	0
2711 Expenditure	20,319	20,319	20,319	20,319	20,319	20,319	20,319	20,319
27110 Expenditure from water	20,319	20,319	20,319	20,319	20,319	20,319	20,319	20,319
27111 Expenditure from others	0	0	0	0	0	0	0	0
2712 Cash balance	2,407	2,407	2,407	2,407	2,407	2,407	2,407	2,407
27120 Cash balance of water	2,407	2,407	2,407	2,407	2,407	2,407	2,407	2,407
27121 Cash balance of other	0	0	0	0	0	0	0	0

Same as this original business plan?



- 3) Financial simulation
- Financial simulation not only means change baseline figure with actual on part of financial plan.
- Most data on financial plan comes from other plans.
- Change first technical plan, then commercial plan, and administrative plan.
- On Excel format, changing these plans automatically effects to financial plan.



- 3) Financial simulation
- ii) Commercial plan
- Number of connection
- Average consumption per connection
- Water rate



- 3) Financial simulation
- i) Technical plan:
- Production volume
- Accounting water volume (for UFW)
- Billing water (for NRW)
- Capital investment
- Power cost
- Chemical cost
- Repair and maintenance cost



- 3) Financial simulation
- iii) Administrative plan
- Number of staff
- Salaries and wages
- Administration cost

✚

3) Financial simulation

iv) Financial plan

- Therefore update data on financial plan are:
- Revenue from sales of water
- Revenue from other services
- Financial revenue (interest revenue, etc.)
- Financial cost (repayment to loan, etc.)
- Revenue for capital investment (grant/subsidiary)
- Capital investment (if there is differ on capital investment for technical plan)



4) Evaluation:

- Judge result and effort meet objectives
- watch outcome(s)
- e.g. customer service enhance customer satisfaction?

- (1) Customer services
 - How good WUSC provide services to customer?
 - How good WUSC achieve the mission and objectives?
- (2) Capability
 - How properly WUSC operate water supply system for achieve the requirement of customer services?
- (3) Management Efficiency
 - How efficiently WUSC operate water supply system?
- (4) Financial soundness
 - Could sustain financial independency and bear future financial demand while improving customer services?





Judge 4 items

Sample of Performance Indicators

How good WUSC provide services to customer, or how good WUSC achieve the mission and objectives

Customer Services

- Quality of water
- Coverage (service population)
- Service hours (regarding consumption volume)
- Minimum charge rate/unit price
- etc.

Could sustain financial independency and bear future financial demand while improving customer services

Operation and Maintenance

- Production volume
- etc.

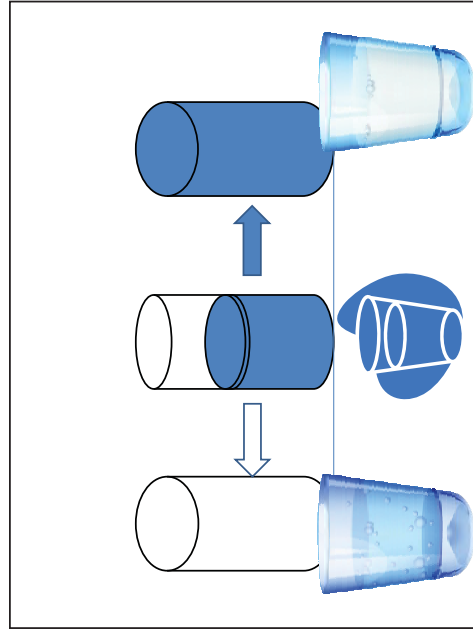
How properly WUSC operate water supply system for achieve the requirement of customer services

- ##### Efficiency
- UFW/NRW
 - Billing collection ratio
 - Connection/staff
 - etc.

How efficiently WUSC operate water supply system

Financial performance

- Operation ratio/revenue and expenditure
- Profitability
- current ratio
- debt ratio/loan and amortization
- etc.



Typical performance indicators for monitoring and also evaluate performance of WUSC's activity.

Basically performance indicator use for measure of achievement what WUSC should do as mission and objectives of the organization:

Objectives and mission of WUSC:

- Provide safe water to user (potable water)
- Provide water to maximum user (increasing service coverage as much as possible)
- Provide water affordably (24 hours a day, 365 days per year distribution with sufficient water pressure)
- and
- Provide water with reasonable cost (cheap as much as possible while avoiding negative cash balance)

Sample evaluation format

Item	Unit	Target	Result
(1) Customer service			
E1.1 Water Quality	%	100%	0%
E1.2 - Chlorination test	%	100%	0%
E1.3 Service coverage and P	%	0%	0%
E1.4 Service hours	hours/day	0	0
E1.5 Unit price/minimum charge	%	0%	0%
E1.6 Complaints response ratio	%	0%	0%
E1.7 Evaluation			

- 1) Water Quality
 - Bacteriological test: test result should be 100% meet with national standard
 - Chlorination test: test result should be 100% meet with national standard
- 2) Service coverage ratio: should be more than target. Actual calculated based on number of connection.
- 3) consumption: should be more than national standard. Normally minimum requirement is 65 liter per day per capita and ideally 115 liter per day per capita.
- 4) Service hours: 24 hours
- 5) Unit price/minimum charge: better more than 75% but less than 90%.
- 6) Complaints response ratio: 100%?

Sample evaluation format

Item	Unit	Target	Result
(3) Management efficiency			
E3.1 UfW	%	0%	0%
E3.2 NRW	%	0%	0%
E3.3 Collection Efficiency	%	0%	0%
E3.4 Labor efficiency	connections/shift	0	0
E3.5 Evaluation			

- 1) UfW: better less than 20%.
- 2) NRW: better less than 25%.
- 3) Collection Efficiency: better more than 95%.
- 4) Labor efficiency: normally around 120 for 500 to 1,000 connections, 150 for 1,000 to 2,000, and 200 for 2,000 to 3,000, but depend on facility and system.

Sample evaluation format

Item	Unit	Target	Result
(2) Capability			
E2.1 Capacity	cap. meters/day	0	0
E2.2 Production volume	cap. meters/day	0	0
E2.3 Accounted water	cap. meters/day	0	0
E2.4 Billed Water	cap. meters/day	0	0
E2.5 Gap with water demand	%	0	0
E2.6 Evaluation			

- 1) Water demand: calculate water demand per day per capita on plan multiples population served on plan as target, and compare water demand calculated by number of minimum level. If water demand is more than 75 liter per day per capita, it is more than minimum level. If more than national standard, it is good.
- 2) Production volume: target is planned. Compare with actual production.
- 3) Accounted water: target is planned. Compare with actual accounted water measured.
- 4) Billed Water: target is planned. Compare with actual billed water measured.
- 5) Gap with water demand: differ of 1 and 2).

Sample evaluation format

Item	Unit	Target	Result
(4) Financial soundness			
E4.1 Revenue (cash)	000 R	0	0
E4.2 Profit (cash base)	000 R	0	0
E4.3 Profit (acc. statement base)	000 R	0	0
E4.4 Profitability (cash base)	%	0%	0%
E4.5 Profitability (income statement base)	%	0%	0%
E4.6 Operating ratio	%	0%	0%
E4.7 Current ratio	%	0%	0%
E4.8 Evaluation			
(5) Evaluation and recommendation:			

- 1) Revenue (cash): target on financial plan and actual on cash flow statement.
- 2) Expenditure (cash): target on financial plan and actual on cash flow statement.
- 3) Profit/loss (cash base): cash balance target on financial plan and actual on cash flow statement. Simply calculate 1 minus 2 and it should be positive.
- 4) Profitability (cash base): Simply calculated 3) divided by 1) and better more than 5%.
- 5) Profitability (income statement base): simply calculate figured on income statement. Profit before tax divide with revenue, and better more than 3%, but also better less than 5%.
- 5) Operating ratio: calculate operation expense divide by operation revenue (both on income statement) and should be less than 100%. Smaller is better.
- 6) Current ratio: calculate current liability divided by current asset (both on balance sheet) and should be less than 100%. Smaller is better.

1. WUSC management model

2. Business planning

3. Monitoring and Evaluation of business plan

4. Case

4. Case: Dhulabari WUSC

Remarks:

- Non financial data is hearing base, not success to collect their accurate data and copy of their data sheet

- This is for case and for make sample, not official M&E for Dhulabari WUSC

Original Technical Plan in 2011

A. Engineering plan	Unit	2013	2014	2015	2016	2017
(1) Population growth	no.	46,000	46,000	46,000	46,000	46,000
(2) Population ratio	%	2.1%	2.1%	2.1%	2.1%	2.1%
(3) Coverage ratio	%	50%	53%	55%	57%	59%
(4) Population served		20,000	21,651	22,958	24,278	25,598
(5) Consumption/capacity/day	liter	65	65	65	65	65
(6) Water Demand	cmd/day	1,242	1,421	1,578	1,731	1,851
(7) Intake Water Volume	cmd/day	2,500	3,004	3,103	3,100	3,100
(8) Production Volume	cmd/day	2,300	3,104	3,103	3,100	3,100
(9) UFW	%	12%	12%	12%	12%	12%
(10) Accounting water	cmd/day	2,200	2,729	2,728	2,728	2,728
(11) WWSR	%	17%	17%	17%	17%	17%
(12) Possible revenue water	cmd/day	2,125	2,603	2,628	2,628	2,628
(13) Feasible improvement (C1)	/600 NR		13,092			
(14) Preventive maintenance (C1)	/600 RP					
(15) Subtotal capital investment (C1)	/600 RP		13,092			
(16) Subtotal O&M investment (C1)	/600 RP		1,194			
(17) Total investment	%	8%	8%	8%	8%	8%
(18) Indicator for inflation		0	1	2	3	4
(19) Increases of power cost (C1)	/600 NR	dampp				
(20) Fixed OP	/600 NR	dampp	144			
(21) Variable cost for pumping	/600 NR	dampp	75			
(22) Investment for chemical (C1)	/600 NR	dampp	346	314	307	1,046
(23) Fixed cost (C2)	/600 NR	dampp	2			
(24) Chemical for production	/600 NR	7	6	10	11	13
(25) Increases of share parts, spare, and	/600 NR	dampp	298			
(26) Fixed O&M	/600 NR	401	1,051	2,062	2,444	2,628
(27) O&M cost excluding salaries and	/600 NR	2,083	2,224	2,343	2,453	2,578
(*) Price of year 2011						
NR=Not Feasible year above year end, e.g. July 2008-June 2009-above 2009.						

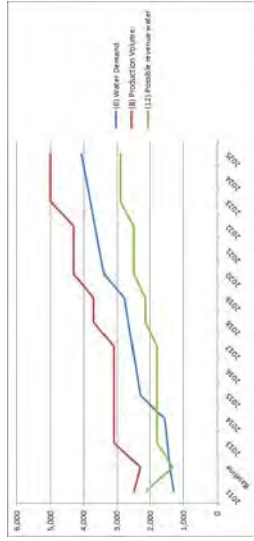
Original Commercial Plan in 2011

B. Customer service plan	Unit	2013	2014	2015	2016	2017
(28) Number of additional connection	dampp	273	233	221	221	221
(29) Number of active connection	dampp	2,247	2,743	2,964	3,183	3,403
(30) Average family size	person/d	6	6	6	6	6
(31) Avg. consumption per connected customer	lit/d	12	12	12	12	12
(32) Consumption of 0.1500 (5)	cmd/day	11	11	11	11	11
(33) Consumption of 0.1500 (5)	cmd/day	11	11	11	11	11
(34) Water rate (maintenance charge)	NR	80	90	100	100	100
(35) Water rate (commodity charge) %NR		12	12	12	14	14
(36) Collection efficiency %		99%	99%	99%	99%	99%
(37) Expected monthly revenue from sale of water	\$/month	4,685	4,111	4,493	4,864	5,112
(38) Expected annual revenue from sale of water	/600 NR	4,685	4,111	4,493	4,864	5,112

Yellow is target data transfer to monitoring sheet

Orange is automatically calculated target also transfer to monitoring sheet

Financial simulation (technical)



Capacity may not meet with demand
Water shortage may in 2015

Financial simulation (financial)

	unit	2011	Baseline	2013	2014	2015	2016	2017
D1 Financial plan								
(58) Revenue from sales of water	1000 NRE	4658	5337	5619	4433	6472	6928	7367
(59) Revenue from sales of electricity	1000 NRE	1012	1456	1416	1241	1812	1838	2028
(60) Revenue from operation of facility	1000 NRE	181	181	181	181	181	181	181
(61) Sales tax	1000 NRE	1705	2058	3195	3499	3726	4024	4344
(62) Power	1000 NRE	595	324	359	378	408	441	476
(63) Chemicals	1000 NRE	7	18	19	21	23	24	26
(64) Spare parts, maintenance and repair	1000 NRE	1491	1472	1506	1717	1854	2049	2165
(65) Other O&M and administration	1000 NRE	4378	4584	4738	4928	5145	5389	5654
(66) Depreciation	1000 NRE	4378	4584	4738	4928	5145	5389	5654
(67) Cash balance of operational activities	1000 NRE	1374	-97	-3102	-2924	-1289	-1594	-3124
(68) Revenue for capital investment	1000 NRE	944	1511	0	0	0	0	0
(69) Capital expenditure	1000 NRE	772	1511	0	0	0	0	0
(70) Revenue from financial facility	1000 NRE	163	163	163	163	163	163	163
(71) Revenue from other	1000 NRE	0	0	0	0	0	0	0
(72) Revenue	1000 NRE	6809	21076	46466	5674	8234	8837	9438
(63) Expenditure	1000 NRE	5110	22667	72348	8648	9673	10447	12564
(64) Cash balance	1000 NRE	1709	-97	-3102	-2974	-1389	-1599	-3134
(67) Balance	1000 NRE	2487	2138	-984	-3938	-5327	-6917	-10061

Issue: may be negative cash balance may keep on
Solution: increase more water tariff
improving collection efficiency
improving NRW

Financial simulation (commercial and administrative)

	unit	2011	Baseline	2013	2014	2015	2016	2017
B: Commercial and administrative plan								
(80) Number of additional connection	sum	2247	2303	2748	2968	3188	3409	3703
(81) Number of active connection	sum	6	6	6	6	6	6	6
(82) Average tank size	percent	12	12	12	12	12	12	12
(83) Avc. consumption per connected demand	liters/day	11	11	11	11	11	11	11
(84) Capacity of (3) with (5)	sum	8	8	8	8	8	8	8
(85) Capacity of (3) with (6)	sum	8	8	8	8	8	8	8
(86) Capacity of (3) with (7)	sum	8	8	8	8	8	8	8
(87) Capacity of (3) with (8)	sum	8	8	8	8	8	8	8
(88) Capacity of (3) with (9)	sum	8	8	8	8	8	8	8
(89) Capacity of (3) with (10)	sum	8	8	8	8	8	8	8
(90) Capacity of (3) with (11)	sum	8	8	8	8	8	8	8
(91) Capacity of (3) with (12)	sum	8	8	8	8	8	8	8
(92) Capacity of (3) with (13)	sum	8	8	8	8	8	8	8
(93) Capacity of (3) with (14)	sum	8	8	8	8	8	8	8
(94) Capacity of (3) with (15)	sum	8	8	8	8	8	8	8
(95) Capacity of (3) with (16)	sum	8	8	8	8	8	8	8
(96) Capacity of (3) with (17)	sum	8	8	8	8	8	8	8
(97) Capacity of (3) with (18)	sum	8	8	8	8	8	8	8
(98) Capacity of (3) with (19)	sum	8	8	8	8	8	8	8
(99) Capacity of (3) with (20)	sum	8	8	8	8	8	8	8
(100) Capacity of (3) with (21)	sum	8	8	8	8	8	8	8
(101) Capacity of (3) with (22)	sum	8	8	8	8	8	8	8
(102) Capacity of (3) with (23)	sum	8	8	8	8	8	8	8
(103) Capacity of (3) with (24)	sum	8	8	8	8	8	8	8
(104) Capacity of (3) with (25)	sum	8	8	8	8	8	8	8
(105) Capacity of (3) with (26)	sum	8	8	8	8	8	8	8
(106) Capacity of (3) with (27)	sum	8	8	8	8	8	8	8
(107) Capacity of (3) with (28)	sum	8	8	8	8	8	8	8
(108) Capacity of (3) with (29)	sum	8	8	8	8	8	8	8
(109) Capacity of (3) with (30)	sum	8	8	8	8	8	8	8
(110) Capacity of (3) with (31)	sum	8	8	8	8	8	8	8
(111) Capacity of (3) with (32)	sum	8	8	8	8	8	8	8
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(114) Capacity of (3) with (35)	sum	8	8	8	8	8	8	8
(115) Capacity of (3) with (36)	sum	8	8	8	8	8	8	8
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(118) Capacity of (3) with (39)	sum	8	8	8	8	8	8	8
(119) Capacity of (3) with (40)	sum	8	8	8	8	8	8	8
(120) Capacity of (3) with (41)	sum	8	8	8	8	8	8	8
(121) Capacity of (3) with (42)	sum	8	8	8	8	8	8	8
(122) Capacity of (3) with (43)	sum	8	8	8	8	8	8	8
(123) Capacity of (3) with (44)	sum	8	8	8	8	8	8	8
(124) Capacity of (3) with (45)	sum	8	8	8	8	8	8	8
(125) Capacity of (3) with (46)	sum	8	8	8	8	8	8	8
(126) Capacity of (3) with (47)	sum	8	8	8	8	8	8	8
(127) Capacity of (3) with (48)	sum	8	8	8	8	8	8	8
(128) Capacity of (3) with (49)	sum	8	8	8	8	8	8	8
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(130) Capacity of (3) with (51)	sum	8	8	8	8	8	8	8
(131) Capacity of (3) with (52)	sum	8	8	8	8	8	8	8
(132) Capacity of (3) with (53)	sum	8	8	8	8	8	8	8
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(138) Capacity of (3) with (59)	sum	8	8	8	8	8	8	8
(139) Capacity of (3) with (60)	sum	8	8	8	8	8	8	8
(140) Capacity of (3) with (61)	sum	8	8	8	8	8	8	8
(141) Capacity of (3) with (62)	sum	8	8	8	8	8	8	8
(142) Capacity of (3) with (63)	sum	8	8	8	8	8	8	8
(143) Capacity of (3) with (64)	sum	8	8	8	8	8	8	8
(144) Capacity of (3) with (65)	sum	8	8	8	8	8	8	8
(145) Capacity of (3) with (66)	sum	8	8	8	8	8	8	8
(146) Capacity of (3) with (67)	sum	8	8	8	8	8	8	8
(147) Capacity of (3) with (68)	sum	8	8	8	8	8	8	8
(148) Capacity of (3) with (69)	sum	8	8	8	8	8	8	8
(149) Capacity of (3) with (70)	sum	8	8	8	8	8	8	8
(150) Capacity of (3) with (71)	sum	8	8	8	8	8	8	8
(151) Capacity of (3) with (72)	sum	8	8	8	8	8	8	8
(152) Capacity of (3) with (73)	sum	8	8	8	8	8	8	8
(153) Capacity of (3) with (74)	sum	8	8	8	8	8	8	8
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(155) Capacity of (3) with (76)	sum	8	8	8	8	8	8	8
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(157) Capacity of (3) with (78)	sum	8	8	8	8	8	8	8
(158) Capacity of (3) with (79)	sum	8	8	8	8	8	8	8
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(160) Capacity of (3) with (81)	sum	8	8	8	8	8	8	8
(161) Capacity of (3) with (82)	sum	8	8	8	8	8	8	8
(162) Capacity of (3) with (83)	sum	8	8	8	8	8	8	8
(163) Capacity of (3) with (84)	sum	8	8	8	8	8	8	8
(164) Capacity of (3) with (85)	sum	8	8	8	8	8	8	8
(165) Capacity of (3) with (86)	sum	8	8	8	8	8	8	8
(166) Capacity of (3) with (87)	sum	8	8	8	8	8	8	8
(167) Capacity of (3) with (88)	sum	8	8	8	8	8	8	8
(168) Capacity of (3) with (89)	sum	8	8	8	8	8	8	8
(169) Capacity of (3) with (90)	sum	8	8	8	8	8	8	8
(170) Capacity of (3) with (91)	sum	8	8	8	8	8	8	8
(171) Capacity of (3) with (92)	sum	8	8	8	8	8	8	8
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(173) Capacity of (3) with (94)	sum	8	8	8	8	8	8	8
(174) Capacity of (3) with (95)	sum	8	8	8	8	8	8	8
(175) Capacity of (3) with (96)	sum	8	8	8	8	8	8	8
(176) Capacity of (3) with (97)	sum	8	8	8	8	8	8	8
(177) Capacity of (3) with (98)	sum	8	8	8	8	8	8	8
(178) Capacity of (3) with (99)	sum	8	8	8	8	8	8	8
(179) Capacity of (3) with (100)	sum	8	8	8	8	8	8	8
(180) Capacity of (3) with (101)	sum	8	8	8	8	8	8	8
(181) Capacity of (3) with (102)	sum	8	8	8	8	8	8	8
(182) Capacity of (3) with (103)	sum	8	8	8	8	8	8	8
(183) Capacity of (3) with (104)	sum	8	8	8	8	8	8	8
(184) Capacity of (3) with (105)	sum	8	8	8	8	8	8	8
(185) Capacity of (3) with (106)	sum	8	8	8	8	8	8	8
(186) Capacity of (3) with (107)	sum	8	8	8	8	8	8	8
(187) Capacity of (3) with (108)	sum	8	8	8	8	8	8	8
(188) Capacity of (3) with (109)	sum	8	8	8	8	8	8	8
(189) Capacity of (3) with (110)	sum	8	8	8	8	8	8	8
(190) Capacity of (3) with (111)	sum	8	8	8	8	8	8	8
(191) Capacity of (3) with (112)	sum	8	8	8	8	8	8	8
(192) Capacity of (3) with (113)	sum	8	8	8	8	8	8	8
(193) Capacity of (3) with (114)	sum	8	8	8	8	8	8	8
(194) Capacity of (3) with (115)	sum	8	8	8	8	8	8	8
(195) Capacity of (3) with (116)	sum	8	8	8	8	8	8	8
(196) Capacity of (3) with (117)	sum	8	8	8	8	8	8	8
(197) Capacity of (3) with (118)	sum	8	8	8	8	8	8	8
(198) Capacity of (3) with (119)	sum	8	8	8	8	8	8	8
(199) Capacity of (3) with (120)	sum	8	8					

Evaluation					
		Unit	Target	Result	*
E31	(3) Management efficiency				
	(1) UPW	%	17%	28%	
E32	(2) NRW	%	15%	42%	
E33	(3) Collection Efficiency	%	99%	80%	
E34	(4) Labor efficiency	commiss/km staff	114	123	100
E39	Reason for space for improving - NRW is too high as well as collection efficiency is too low				
(4) Financial soundness					
		Unit	Target	Result	*
E41	(1) Revenue (cash)	/000 R	20,400	7,817	4,131
E42	(2) Expenditure (cash)	/000 R	20,319	8,361	5,208
E43	(3) Profit/loss (cash base)	/000 R	801	-544	
E44	(4) Profitability (cash base)	%	0.4%	-7.0%	
E45	(5) Profitability (income statement base)	%	-	28%	
E46	(5) Operating ratio	%	-	65%	
E47	(6) Current ratio	%	-	0%	
E49	Evaluation: need to improve and shifting to positive cash balance However effort for increasing revenue and reduce expenditure may significant * excluding capital investment on original plan				
(5) Evaluation and recommendation					
WUSC may need to improve and may need comprehensive approach					

- Q&A
 - Comments
 - Discussion
 - Argument/disagreement
- Thank you very much

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Monthly Data Sheet (1)



February 2011

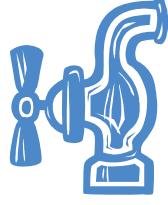
1. Objective

2. Structure

3. Data and calculation

4. Q&A

5. Discussion



Agenda

1. Objective
2. Structure
3. Data and calculation
4. Q&A
5. Discussion

1. Objective

- Monitoring management performance
- Monitoring progress of improvement

Process of prepare MDS: monthly data sheet is very simple

- 1) Collect necessary information in daily routine work
- 2) Compile and make MDS report monthly
- 3) Monitoring performance on the MDS

Water demand

- Requirements:
- (1) quality of water
 - safe/not surely safe
 - (2) water supply capacity
 - shortage/excess
 - (3) water supply volume
 - shortage/affordable

Other user service demand

- (1) connection service
- (2) on time billing
- (3) replay to complaints

Management efficiency demand

- (1) Management efficiency
 - NRW
- connection/staff
- water bill collection efficiency

financial demand

- (1) financial safety
- (2) financial stability
- (3) financial sustainability
- (4) financial efficiency

- contamination
- leakage and leakage repair/prevention
- facility maintenance

- slow/delay of replay

- low efficiency
- low collection efficiency leads to cash shortage/deficit

- cash shortage/deficit
- concerns for future and sustainability

Monitoring performance indicators

Sample of Performance Indicators

How good WUSC provide services to users, or how good WUSC achieve the mission and objectives

Customer Services

- quality of water
- coverage (Service population)
- service hours
- minimum charge/unit price (average monthly consumption volume)
- complaint replay
- etc.

Could sustain financial independency and bear future financial demand while improving customer services

Financial performance

- operation ratio/revenue and expenditure
- profitability/cash balance
- current ratio
- debt ratio/loan and amortization
- etc.

Activities of WUSC

Operation and Maintenance

- production volume
- water demand vs. supply
- leakage preventing/repair
- etc.

How properly WUSC operate water supply system for achieve the requirement of customer services

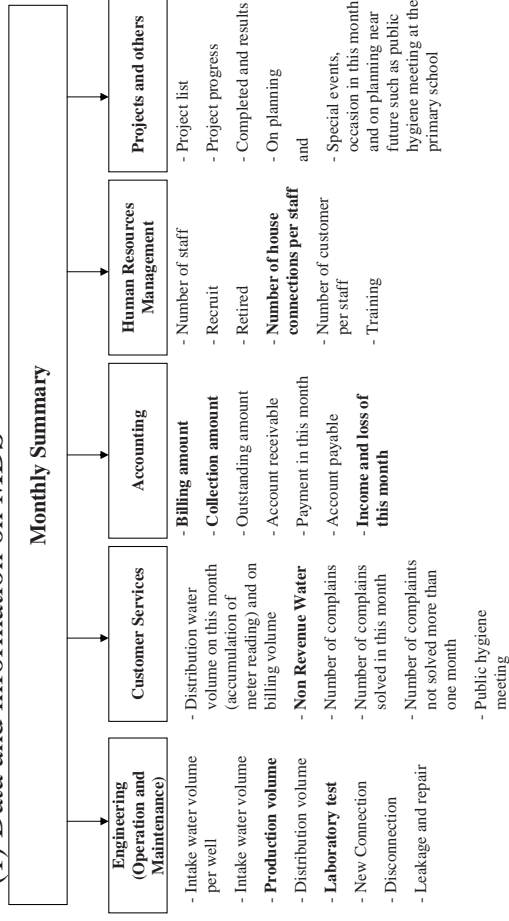
Efficiency

- NRW
- billing collection ratio
- connection/staff
- etc.

How efficiently WUSC operate water supply system

2. Structure

(1) Data and information on MDS



1. Objective

2. Structure

3. Data and calculation

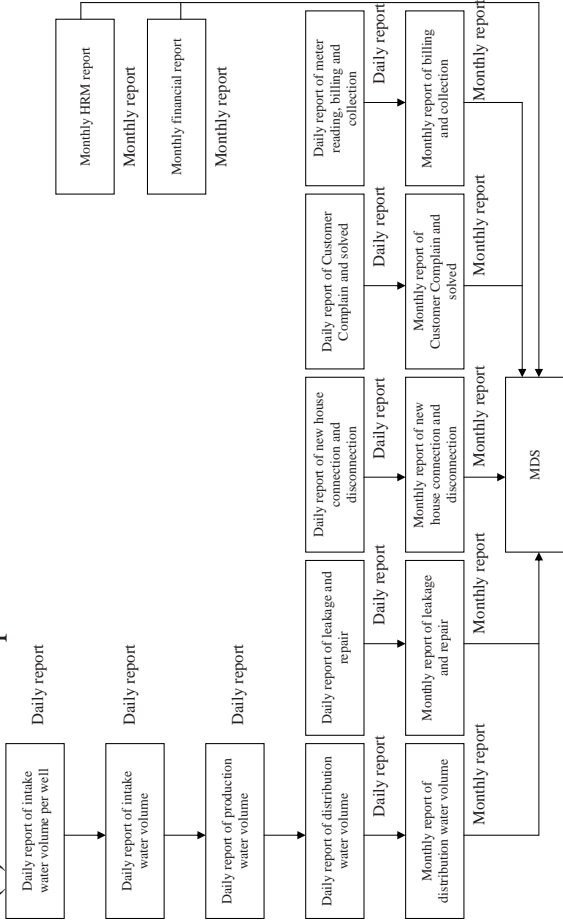
4. Q&A

5. Discussion



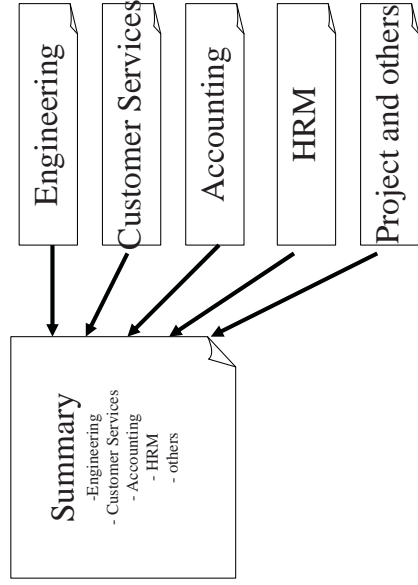
2. Structure

(2) Data collection process



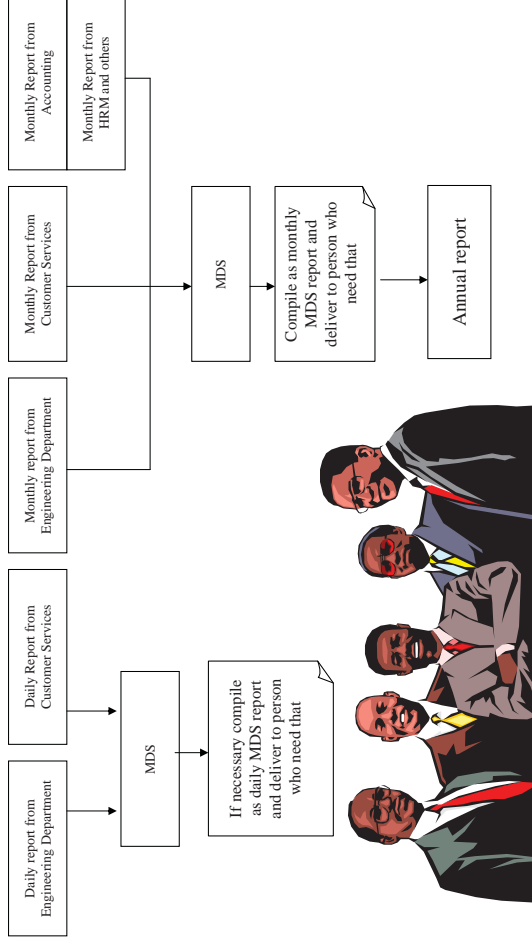
2. Structure

(3) Summarize SUMMARY



2. Structure

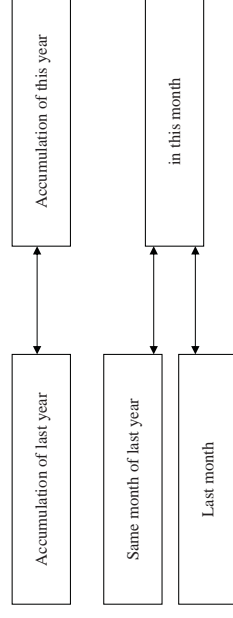
(2) Data collection process



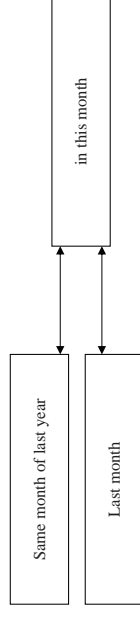
2. Structure

(4) Analysis

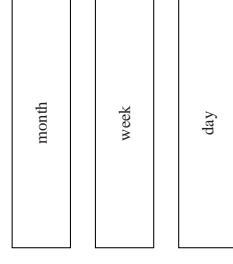
COMPARISON



RATIO



AVERAGE



Increase/decrease and why?

2. Structure

(5) Report structure

- 1) Customer service information
- 2) Billing and collection information
- 3) Financial information
- 4) HRM information
- 5) Others

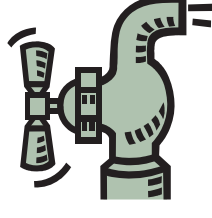
1. Objective

2. Structure

3. Data and calculation

4. Q&A

5. Discussion



3. Data and calculation

Case of Water District in Philippines

- Water District is a sort of water authority, or water supply public company aims non profit organization but manage financially and politically independent, and provide utility service to people of jurisdiction
- WD requested to prepare business plan, arrange financial resources, and improving water supply facility for response to water demand of their jurisdiction
- WD could decide water rate, but requested to get approval from LWUA: Local Water Utility Association, central government agency for supervising rural water supply policy, because WD has responsibility to maintaining operational and financial soundness
- LWUA requests to water rate of WD for full cost recovery as well as concerns to poor people, as water is basic human need

3. Data and calculation

- International donor agency and local government sometimes provide grant, subsidiary or low interest rate loan
- LWUA is windows of assistance by international donor agencies
- LWUA provides technical and financial assistance. Their financial assistance including grant and low interest rate loan, as well as financial capacity assessment, advise to prepare business plan and other management advisory services.
- Grant or loan from LWUA would disburse to bank account, and WD can draw from that bank account
- WD requested to have certain portion of deposit for prepare disaster, emergency and accident (2% of revenue from sales of water to bank account, if not falls to deficit and/or negative cash balance)

3. Data and calculation

- WD request to prepare monthly data sheet and financial statements, and submit to LWUA (monthly)
- LWUA keep monitoring and supervising based on several analysis including management efficiency of WD meets standard and semi standard, including NRW, collection efficiency, connection per staff and operation ratio. If WD stagnant in law efficiency, LWUA will provide management advise for improving management soundness.
- LWUA will provide financial assistance by request, but basic condition are, keep positive cash balance for more than two fiscal years, and management efficiency meets with standards.



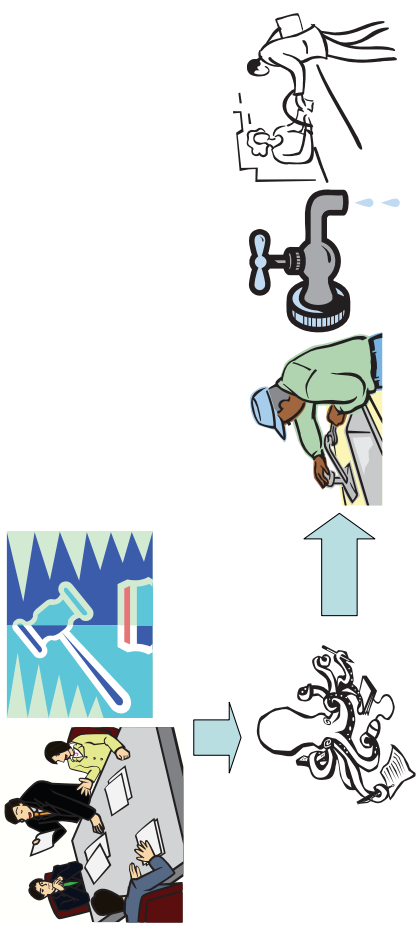
3. Data and calculation

1. Service connection data

- 1.1 Total service – number of connected water faucet
- 1.2 Total active – number of faucet provide water within (1.1)
- 1.3 Total metered – number of faucet attached meter within (1.1)
- 1.4 Total billed – number of faucet charges bill within (1.2)
- 1.5 Population served - formula is (1.2) * average family members
- 1.6 Changes:
 - 1.6a New connection – new connection start to supply water
 - 1.6b Reconnected – faucet reconnected and start service
 - 1.6c Disconnected – faucet disconnected and stop service
- 1.7 Customer in areas: number % active

3. Data and calculation

- Roles of board of directors for WD are different with one for WUSC. The are focus on supervising of operation, policy making and policy decision making, but not touch management. Management responsibility is fully leaves to general manager.



3. Data and calculation

2. Present and effective water rate

- 2.1 Minimum charge
- 2.2 Commodity charge

3. Data and calculation

3. Billing and collection data

3.1 Billing (Water Sales) *)

- Bill forwarded from previous month

a. current (metered)

b. current (flat rate)

c. penalty charges

- totals

Note:

*) prepare both this month and year-to-date

3. Data and calculation

3.3 on time paid in this month

3.4 year-to-date collection efficiency

3.5 year to date collection ratio

3.6 Account Receivable (beginning)

Notes:

- On time paid ratio should be more than 80% (standard)

- Year to date collection efficiency and ratio should be more than 95% (standard)

- formula:

3.3 On Time Paid This Month	(3.2b) x 100 (3.1b) x (3.2b)
3.4 Collection Efficiency, YTD	(3.2b) + (3.2b) x 100
3.1 Totals	
3.2 Totals x 100	
3.1 Totals + A/R Beginning	

3. Data and calculation

3. Billing and collection data

3.2 Collection (Water Sales) *)

a. current account

b1. arrears (current month)

b2. arrears (previous month)

c. arrears (previous year)

- totals

Note:

*) prepare both this month and year-to-date

3. Data and calculation

MONTHLY DATA SHEET
Water & Sewer District
CCC# _____
For the Month Ending _____

1. SERVICE CONNECTION DATA		1.6 Changes: New _____ Reconnected _____ Disconnected _____	
1.1 Total Services _____	1.2 Total Active _____	1.7 Customer In Arrears _____	
1.3 Total Meters _____	1.4 Total Billed _____	Number: _____	%Active _____
1.5 Population served _____			
2. PRESENT WATER RATES: EFFECTIVE		Date Approved: _____	
LWUA Approved: Yes () No ()	No. Of _____	Meter In _____	
Domestic/Government _____	Conn. _____	Charge _____	
Commercial/Industrial _____			
3. BILLING AND COLLECTION DATA		This Month _____ Year to Date _____	
3.1 Billing (Water Sales)			
a. Current Metered _____			
b. Current Flat Rate _____			
c. Penalty Charges _____			
TOTAL _____			
3.2 Collection (Water Sales)			
a. Current Account _____			
b. Arrears (CY) _____			
c. Arrears (PY) _____			
TOTAL _____			
3.3 On Time Paid This Month		(3.2b) x 100	
		(3.1b) x (3.2b)	
3.4 Collection Efficiency, YTD		(3.2b) + (3.2b) x 100	
		3.1 Totals	
3.5 Collection Ratio, YTD		(3.2b) + (3.2b) x 100	
		3.1 Totals	
3.6 A/R Beginning:		3.2 Totals x 100	
		3.1 Totals + A/R Beginning	

3. Data and calculation

4. Financial data *)

4.1 Revenue

- a. operating
- b. non-operating
- total

4.2 Expenses

- a. salaries and wages
- b. pumping cost (fuel, oil, electricity)
- c. chemicals (treatment)
- d. other O&M expenses
- e. depreciation
- f. financial cost
- g. others
- totals

Note:

*) prepare both this month and year-to-date

3. Data and calculation

4.5 miscellaneous financial data

- a. Loan funds (total)
 - 1. cash on hand
 - 2. cash in bank
- b. WD funds (total)
 - 1. cash on hand
 - 2. cash in bank
- 3. investment
- 4. working fund
- 5. reserves
- c. inventories
- d. A/R customer
- e. customer deposit
- f. loan payable
- g. payable to supplier and other creditors
- h. total debt service

3. Data and calculation

4.3 net income (loss)

4.4 cash flow report **)

- a. receipt
- b. disbursement
- c. net receipt (after disbursement) - formula is a-b
- d. cash balance, beginning
- e. cash balance, ending

Note:

*) prepare both this month and year-to-date

***) Not means account system can change to cash based, but manager and accountant must pay attention to cash position. These data are available on cash ledger.

The image shows a financial statement form with two main columns: 'This Month' and 'Year to Date'. The form is divided into several sections:

- 4. FINANCIAL DATA**
 - 4.1 REVENUE
 - a. Operating
 - b. Non-Operating
 - TOTALS
 - 4.2 EXPENSES
 - a. Salaries and wages
 - b. Chemicals
 - c. Other O&M Expenses
 - d. Depreciation
 - e. Interest Expenses
 - f. Other kind debts
 - TOTAL
 - 4.3 NET INCOME (LOSS)
 - 4.4 CASH FLOW RECEIPT
 - a. Receipts
 - b. Disbursements
 - c. Net Receipt (Disbursement)
 - d. Cash Balance, beginning
 - e. Cash balance, ending
- 4.5 MISCELLANEOUS FINANCIAL DATA:**
 - a. PROJECT FUNDS (TSM)
 - 1. Project Funds, LWMA
 - 2. Other Funds
 - 3. V&D Funds (TRM)
 - Cash on Hand
 - 4. Cash in Bank
 - 5. Investments
 - 6. Working Fund
 - 7. Inventories
 - 8. A/R
 - 9. Acct. Receivables (Customers)
 - 10. Customer's Deposit
 - 11. Loan Payable
 - 12. LWMA
 - 13. L&I
 - 14. Total Debt Service
 - b. Total Debt Service
 - Interest
 - Principal

3. Data and calculation

5. Water production data

5.1 Sources of supply

- a. wells (number of wells)
total rate of capacity
basis of data

5.2 Water production with method of measurement *)

- a. pumped (cubic meters)
- b. gravity (cubic meters)
- c. totals (cubic meters)

Note:

*) prepare both this month and year-to-date

3. Data and calculation

5.4 Accounted water use *)

- a. metered billed (cubic meters)
- b. unmetered billed (cubic meters)
- c. other billed (cubic meters)
- d. metered unbilled (cubic meters)
- e. unmetered unbilled (cubic meters)
- f. total accounted (cubic meters) formula is a+d
- g. total powder chlorine consumed (kg.)

5.4 Water use assessment

- a. average monthly consumption/connection
- b. accounted water (%) formula is (5.4a+5.4d) / 5.2c
- c. revenue production water (%) **) Formula is (5.4a +5.4b + 5.4c) / 5.2c

Note:

*) prepare both this month and year-to-date

**) Standard of revenue production water should be more than 75%, or NRW should be less than 25%.

3. Data and calculation

5.3 Water production cost

- a. total power consumption for pumping (Kwh)
- b. total power cost for pumping (N. Rupee)
- c. other energy cost for pumping (N. Rupee)
- d. total pumping hours (motor drive, hrs.)
- e. total pumping hours (engine drive, hrs.)
- f. total gas chlorine consumed (kg.)
- g. total powder chlorine consumed (kg.)
- h. total chlorine cost (N. Rupee)
- i. total cost of other chemical (N. Rupee)

3. Data and calculation

6. Miscellaneous data

6.1 Employees

- a. total
regular
contract (casual)
- b. number of connection per employee *)
- c. average monthly salaries/employee (N. Rupee)

6.2 Bacteriological

- a. total sample taken
- b. number of samples meeting standards
- c. number of days full chlorination

Note: *) standard is 80-100 for less than 500 connections, 120 for 600-1,500 connections, 150 for 1,500-2,000 connection, 180-200 for more than 2,000 connections, though depends on system, area covered and complexity of business and activity

3. Data and calculation

6.2 Chlorination

- a. total sample taken
- b. number of samples meeting standards
- c. number of days full chlorination

6.4 Board of directors *

- a. resolution approved
- b. policies passed
- c. directors' fee paid (N. Rupee)
- d. meeting (number)
 1. held
 2. regular
 3. special

Note: prepare both this month and year-to-date

3. Data and calculation

7. Status of various development

- 7.1 financial arrangement
- 7.2 repayment to loan

7.3 engineering arrangement and progress of construction

8. Status of institutional development

- 8.1 development progress
- 8.2 user service and business system
 - a. computerization of accounting system
 - b. computerization of billing and collection system
 - c. management audit
 - d. PR and awareness activity
 - e. marketing
 - f. financial audit
 - g. others

5. WATER PRODUCTION DATA

5.1 SOURCE OF SUPPLY

MANAGER	Total Rated Capacity	Units of Data
a. Wells		
b. Springs		
c. Surface		
d. TOWERS		
e. TOTALS		

5.2 WATER PRODUCTION

THIS MONTH	Y-T-D	Method of Measurement
a. Pumped		
b. Gravity		
c. TOTALS		

5.3 WATER PRODUCTION COST

a. Total Consumption for pumping	
b. Power cost for pumping	
c. Total pumping hours (water driven)	
d. Total pumping hours (energy driven)	
e. Total pumping hours (other)	
f. Total fluid chlorine consumed	
g. Total chlorine cost	
h. Total cost of other chemical	
i. TOTAL	

5.4 ACCOUNTED WATER USE

a. Unmetered	
b. Unmetered billed	
c. Total billed (S. 4a + 5.4b)	
d. Unmetered Unbilled	
e. Total Unbilled	
f. Total Accounted (S. 4c + 5.4e)	

5.5 WATER USE ADJUSTMENT

a. Average monthly consumption/connections	
b. Average per capita/industry consumption	
c. Accounted water S. 4f x 100 / S. 2c	

6. MISCELLANEOUS DATA

6.1 EMPLOYEES

a. Total	Regular	Casual
b. No. of Connections/employees		
c. Average monthly salary/employee		

6.2 BACTERIOLOGICAL

a. Number of samples	
b. Number of negative results	
c. Test results submitted to LWMA	

6.3 CHLORINATION

a. Total samples taken	
b. Number of samples meet standard	
c. No. of days full chlorination	

6.4 BOARD OF DIRECTORS

THIS MONTH	Y-T-D
a. Resolutions Approved	
b. Policies passed	
c. Meeting Fee paid	
d. Meetings	
1. Held (No.)	
2. Regular (No.)	
3. Special (No.)	

7. STATUS OF VARIOUS DEVELOPMENT

7.1 STATUS OF LOANS as of

Types of Loans/Funds	Loans/Funds Committed	Amount	Amounts to Date
a. Early Action			
b. Interest Improvement			
c. New Service Connection			
d. SPPW FUNDOS			
e. Interest Development			
TOTAL			

7.2 STATUS OF LOAN PAYMENT TO LWMA as of

Types of Loans/Funds	Projected Collections/No	Collection This Mo.	YTD
a. Early Action			
b. Interest Improvement			
c. New Service Connection			
d. New Service Connections			
e. DAB System Water			
TOTAL			

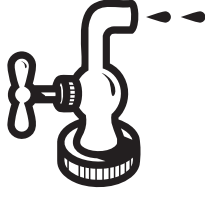
1. Objective

2. Structure

3. Data and calculation

4. Q&A

5. Discussion



7.3 OTHER ON-GOING PROJECTS

TYPE	STATUS SCHEDULE X	FUNDED B	DORE BY
1. Early Action			
2. Feasibility Study			
3. A, B, E Design			
4. A, B, E Design			
5. Project Procurement			
6. Pre-bidding			
7. Bidding			
8. Construction			
9. Commissioning			
10. Total Gas Chlorine Consumed			
11. Total Chlorine Consumed			
12. Total Chlorine Consumed			
13. Total Chlorine Consumed			
14. Total Chlorine Consumed			
15. Total Chlorine Consumed			
16. Total Chlorine Consumed			
17. Total Chlorine Consumed			
18. Total Chlorine Consumed			
19. Total Chlorine Consumed			
20. Total Chlorine Consumed			

8. STATUS OF INSTITUTIONAL DEVELOPMENT (To be filled up by the Advisory)

8.1 DEVELOPMENT PROGRESS INDICATOR:

Phase	Estimated	Min./Max/yr	Variance	Age in MONTHS	Don't. RETURN
I					
II					

8.2 COMMERCIAL SYSTEM/AUDIT:

1. OPS-I Issued

2. OPS-II Issued

3. OPS-III Issued

4. PR Assistance

5. Marketing Assistance

6. Financial Audit

DATA:

SUBMITTED BY: _____

General Manager _____

Date: _____

NOTED BY: _____

Area Manager _____

Date: _____

VERIFIED BY: _____

LVQA Advisor _____

Date: _____

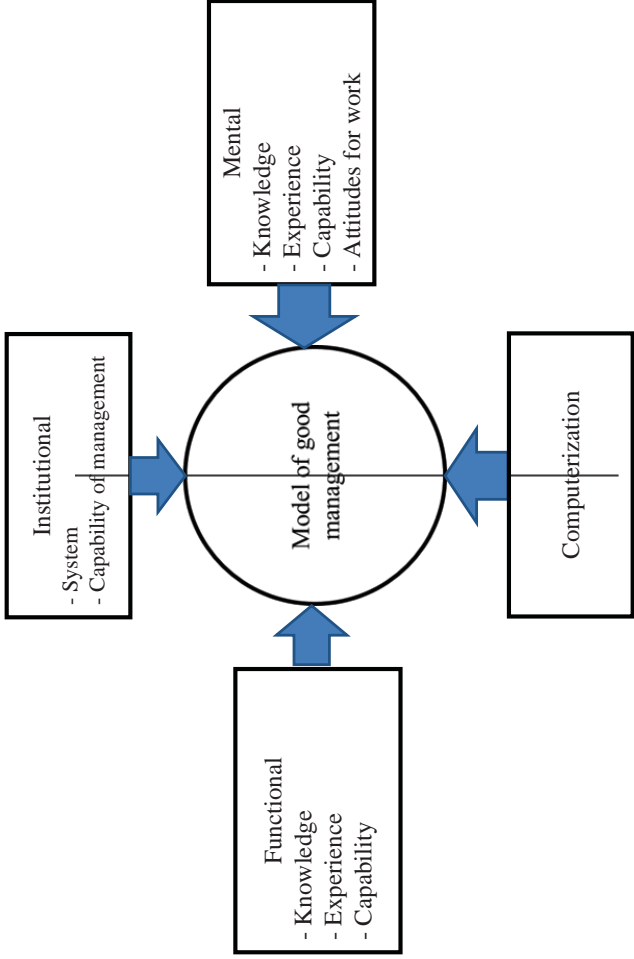
5. Discussion

- Do you have wiliness to introduce MDS system?

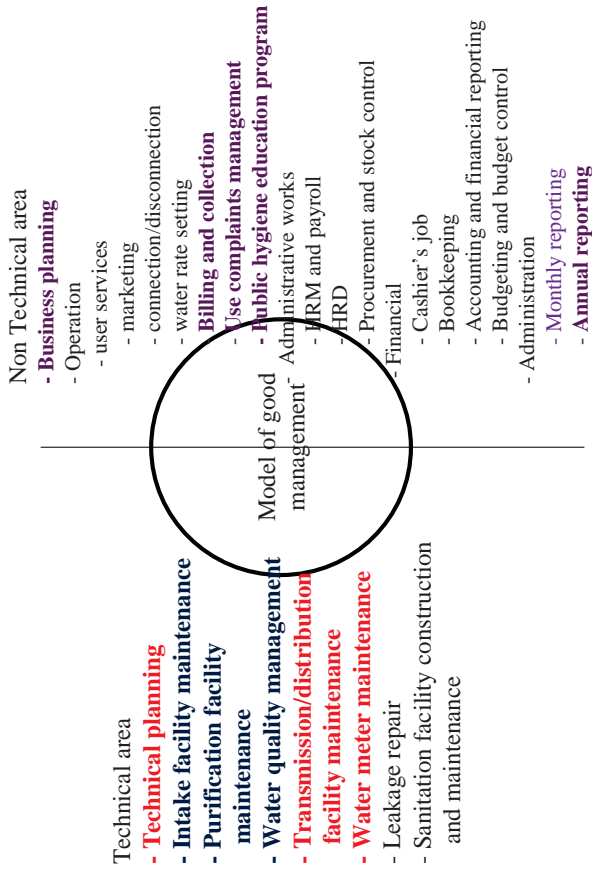
- Key performance indicator and standard

	target	JAN	FEB	MAR	APR	MAY	JUN
(1) User services							
1) Number of active connection	2,000						
2) Population served	10,000						
3) Service coverage (%)	65						
4) Water supply service hours (hrs)	18						
5) Number of complaints accepted							
6) Number of complaints solved							
7) User complaint solving ratio (%)	95%						
(2) Water supply							
1) Number of sample test							
2) Number of sample test meet quality standard							
3) Quality standard meet ratio (%)	95%						
4) Production volume (c.m.)							
5) Revenue water volume (c.m.)							
6) Average consumpto volume per connection (c.m./month)	15						
6) Number of leakage repair							
(3) Management efficiency							
1) NRW (%)	20						
2) Collection efficiency (Y-T-D) (%)	95						
3) Connections per staff	150						
3) Operational ratio (%)	200%						
(4) Financial performance							
1) Revenue (000 R)							
2) Disbursement (000 R)							
3) Cash balance (000 R)	positive						
4) End balance (000 R)							
(5) HRM							
1) Number of staff							

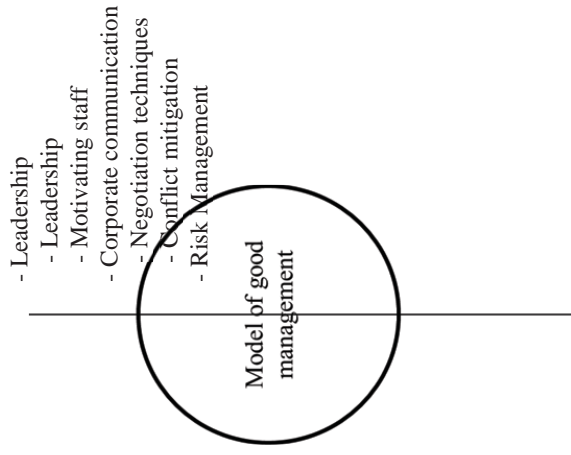
Organizational Capacity Development Model



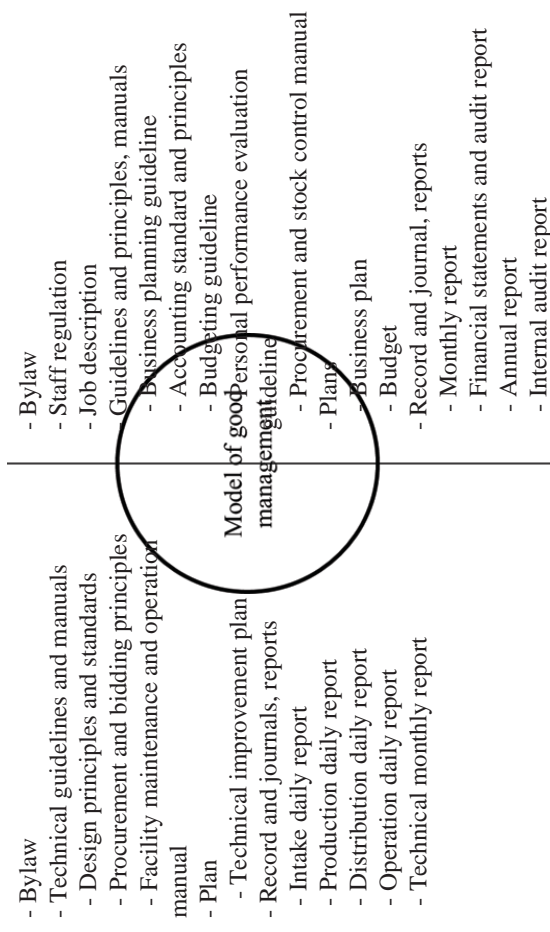
Management Model of WUSC (Functional)



Management Model of WUSC (Mental)



Management Model of WUSC (Institutional)

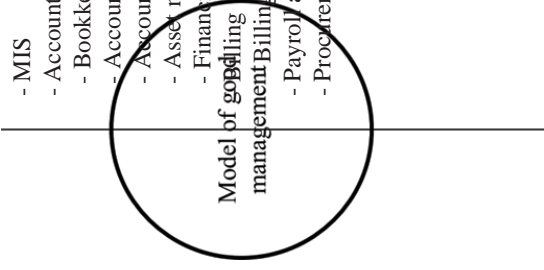


Management Model of WUSC (Computerization)

- Facility management system
- Pipeline map system
- CAD
- Hydraulic analysis system
- Network analysis system

- MIS
- Accounting system
- Bookkeeping
- Account Payable
- Account Receivable
- Asset management
- Financial reporting and analysis
- Billing and collection
- Payroll and HRM
- Procurement and stock control

Model of government management



DDI-GS-PCM

**Overview of PCM
for
Capacity Development Planning
of
Financial and Management Areas**

Workshop March 2010

DDI-GS-PCM

Agenda

- (1) Brief introduction of problem solving techniques
- (2) Introduction of PCM: Project Cycle Management
- (3) PCM

DDI-GS-PCM

- Objective of my first workshop for CD of financial and management area
- (1) To identify/reconfirming issues and problems of financial and management area
- (2) To understand structure of these issues and problems
- (3) Understand technique for problem solving


DDI-GS-PCM

(1) Brief introduction of problem solving techniques

- Two type of problems, emergent and not so emergent but critical
- 1) Emergency problem (e.g. accident)
 - Quick action for stop the crisis (trouble shooting)
- 2) not so emergent but critical (e.g. weak financial capability)
 - Required more fundamental approach
 - Concept for problem solving:
 - Resources are limited
 - Need to focus on high cost performance area, most important area with time saving manner
 - Understand structure and find area for focus

DOI-05-PCM
 (1) Brief introduction of problem solving techniques

emergent problem and accident
 10%



90%

Structured problem that makes emergent problem and accident happen again.

- Without solving this area, emergent problem and accident would be happen again.
 - There would be so many small incidents before coming to accident.

DOI-05-PCM
 (2) Introduction of PCM: Project Cycle Management

- 1) Overview
- 2) Analysis and planning
 - Stakeholder analysis
 - Problem structure analysis
 - Objective structure analysis
 - Selection of focus area
- PDM: Project Design Matrix, summary of planning
- PO: Plan of operation, action plan
- 3) Monitoring and evaluation

DOI-05-PCM
 (1) Brief introduction of problem solving techniques

- What is necessary for solving fundamental problems

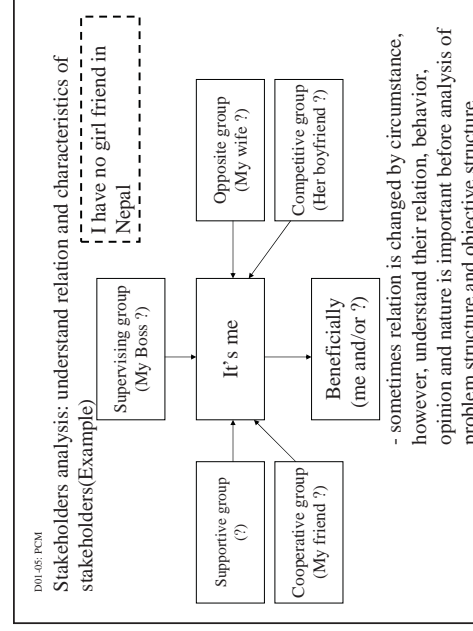
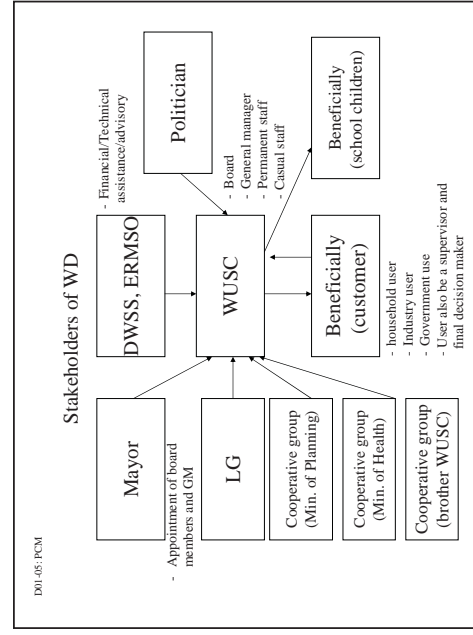
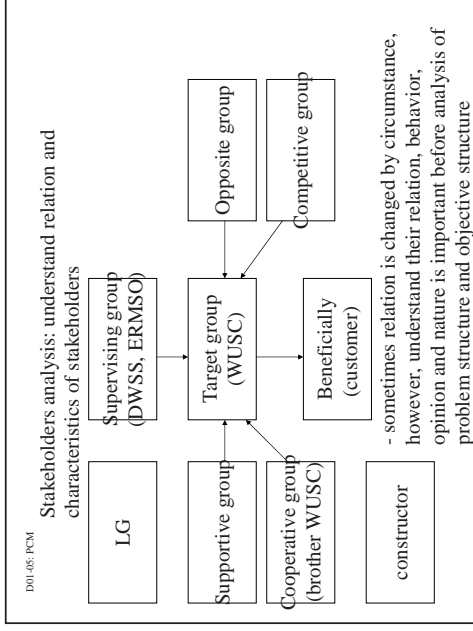
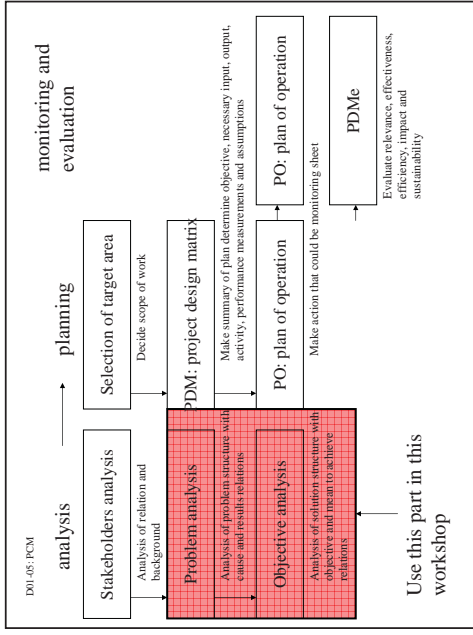
- 1) Understanding nature and character of problem (e.g. structure of problem)
- 2) Right knowledge and techniques on the problem area (e.g. financial knowledge, cash flow analysis technique)
- 3) Experiences for give you courage to tackle with problem (note: experience may useful to find solution, but not always)
- 4) Skill to create/maintain cooperation, negotiation, teamwork type leadership and communication
- 5) Skill of progress management (bird view and detail focus)

Note: people use to say, experience is most useful to solve problem. But there is not completely same problem. If that happen, that is management failure. Never be leave such stupid manager.

DOI-05-PCM
 1) Overview

- PCM: Project Cycle Management
- Methodology for manage the planning cycle
- Planning cycle: Planning, implementation and evaluation

Bibliography as text book published from FASID:
 A) Planning
 PCM: MANAGEMENT TOOL FOR DEVELOPMENT ASSISTANCE: Participatory Planning
 B) Monitoring and evaluation
 PCM: MANAGEMENT TOOL FOR DEVELOPMENT ASSISTANCE: Monitoring & Evaluation (M&E)



DDI-05-FCM

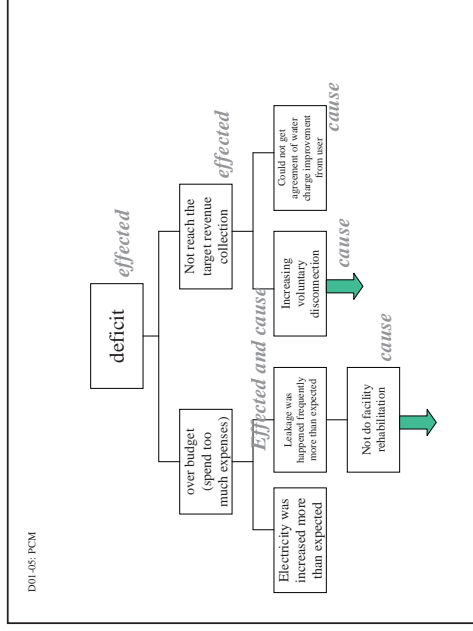
Typical problems and issues:

(1) Financial problems and issues (difficult to manage WUSC financially)

- deficit, negative cash balance
- arrears
- shortage of financial resources for capital investment (expansion, new facility)
- difficulty of water charge improvement

(2) Management problems and issues

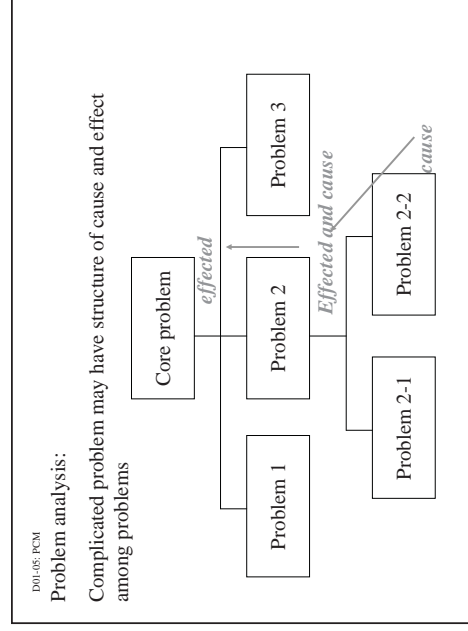
- agreement of board and user
- shortage of man power, skills,
- harmonization with stakeholders (other government organization and NGO) when need assistance

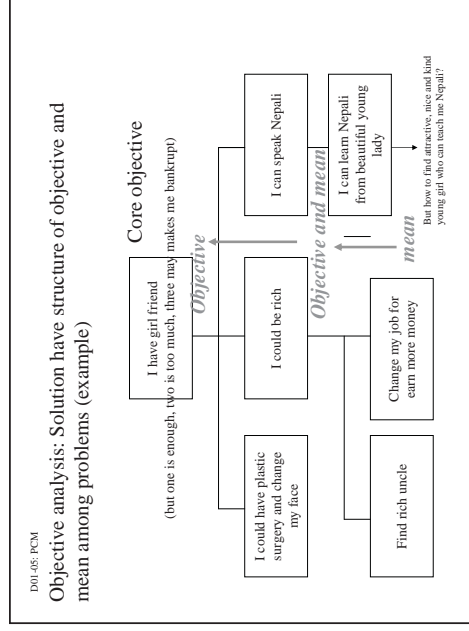
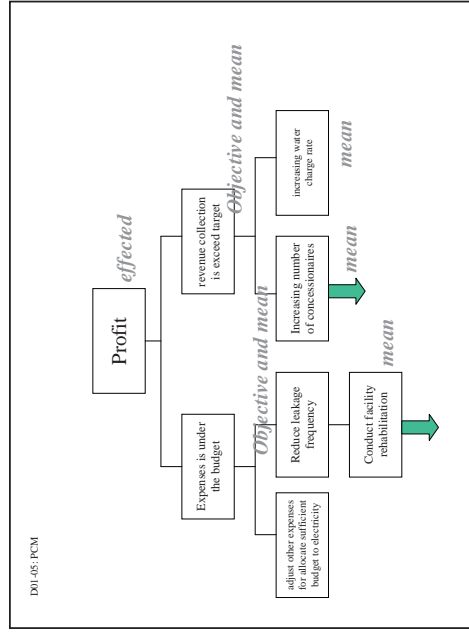
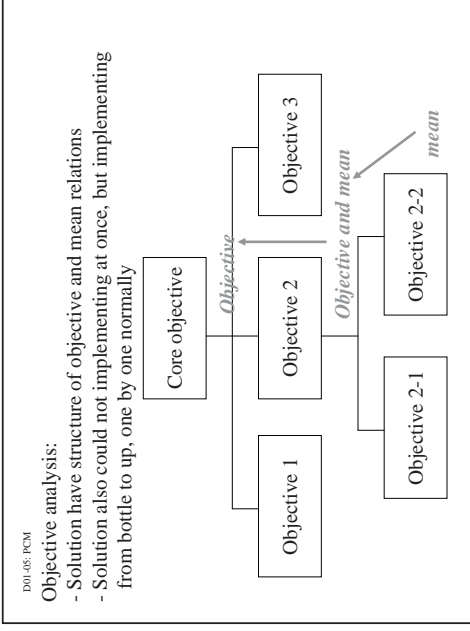
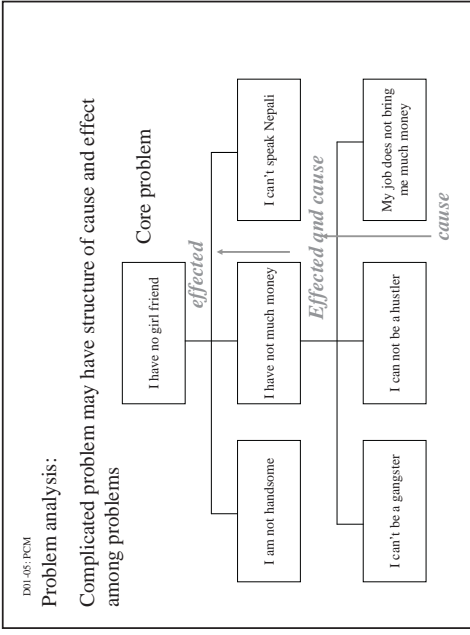


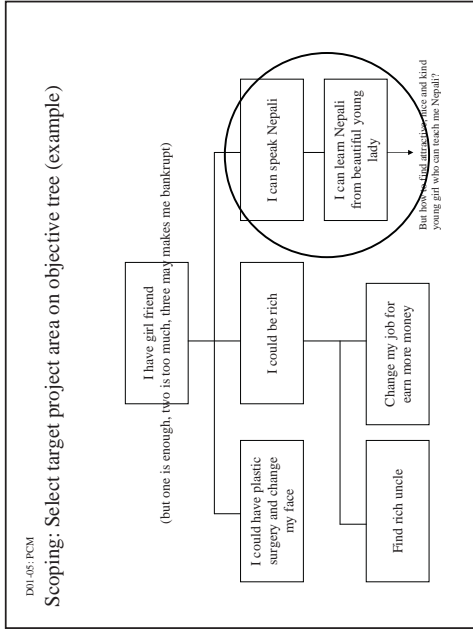
DDI-05-FCM

Problem analysis:

- problem structuralized with cause and effect relations
- problem could not solve at once, but solve from bottle to up, one by one normally







DDI-05-PCM

PDM: Project Data Matrix: Example

- a kind of summary sheet describe all elements of plan

Narrative description	verification	mean of verification	assumption
Super goal: ??????	???	?????	
Project purpose: Find girl friend	have dinner together	picture of us	
Output: Can speak Nepali	can take minibus	arrived at Swayanbumat	exist good girl can stay in Nepal
Activities 1. Buy dictionary 2. Buy conversation book	Input: 2,000 Rupee		precondition

DDI-05-PCM

(2) Introduction of PCM: Project Cycle Management

- 1) Overview
- 2) Analysis and planning
 - Stakeholder analysis: Understand background
 - Problem structure analysis: understand structure of problems
 - Objective structure analysis: understand structure of solutions
 - Selection of focus area
- PDM: Project Design Matrix, summary of planning
- PO: Plan of operation, action plan
- 3) Monitoring and evaluation

The Problem of Water Supply on Distribution Pipe

Problem on Pipeline

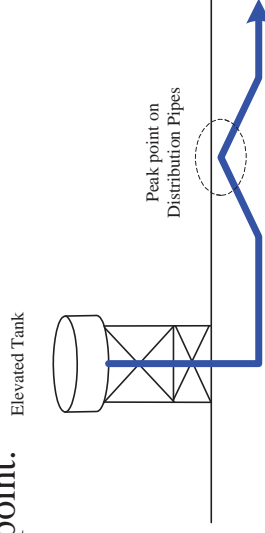
It is possible to supply water normally from the elevated tank in service area.

Water supply sometimes stops due to temporal water supply.

However, water can not be provided at a certain place in spite of resuming water supply.

1. Possible Cause

- 1) Since there may be entrapped air at a higher elevation on the pipeline, the entrapped air can hinder from conveying water through pipe.
- 2) Location of an air valve may be inappropriate.
- 3) An air valve may be malfunction but an air valve is installed at peak point.



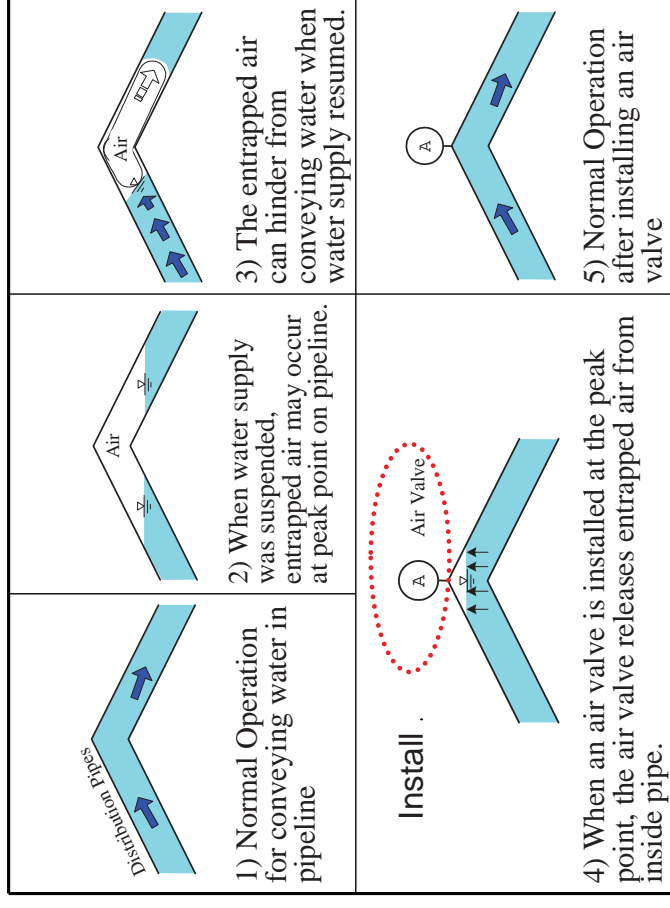
2. Entrapped Air Occurrence Point

<p>No Air Valve Distribution Pipes</p>	<p>Inappropriate Location</p>	<p>Air Valve: Malfunction</p>
<p>Nonexistence air valve at peak point on pipeline</p>	<p>In appropriate location of an air valve</p>	<p>An air valve is malfunction.</p>

3. Measure

- To confirm the geographical higher elevations on the pipe route at first, then confirm an air valve existence or nonexistence.
- When necessity of an air valve is ascertained at some higher elevations, the air valve should be installed at the point.

4. Occurrence Procedure and Measure



Proper Treatment of a Water Meter

1. Precaution for Safety (1)

- To pay attention while carrying heavy equipment and installing water meters since there are possibilities of injury.
- Not to touch directly a screw joint part on a meter case because there is a possibility of injury. To put on cotton work gloves to help prevent injury.



1. Precaution for Safety (2)

- To use appropriate tools such as wrenches for plumbing. Hindrance and accident may be caused by using inappropriate tools for plumbing.
- Not to pour hot or boiling water into the water meter. When hot water of more than 40 degrees flows in a water meter, there is a possibility to damage the inside plastic parts of the water meter.

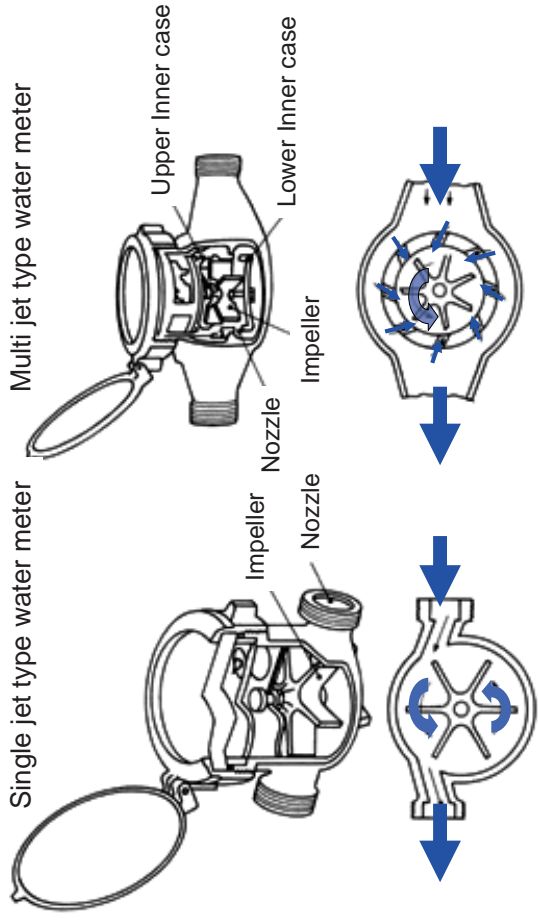


1. Precaution for Water Meter Management during Meter Storage (1)

- Not to give water meter a strong shock. When a water meter falls, there is a possibility of meter damage and might be difficult to measure the amount of flow because the shaft bearing of the impeller will be damaged.
- Not to give water meter vibration. When a water meter receives vibration for many hours, it might be difficult to measure the amount of flow because the shaft bearing of the impeller will be damaged.



Vane wheel jet type water meter



1. Precaution for Water Meter Management during Meter Storage (2)

- To cover gateway of water meter to prevent the wind blowing through the meter during water meter storage. When air blows through the water meter, it is possible that measured value can progress or revert because impeller rotates due to the wind. **To put caps on the gateway of water meter** to prevent this from happening.
- To cover gateway of water meter to prevent unwanted substances entering water meter during meter storage. When unwanted substances entered meter, it might be difficult to measure since the unwanted substance obstructs the rotation of the impeller.



2. Precaution for location of water meter installation (1)

- To install water meter in horizontal position. To set the meter horizontally with indicator upward according to the arrow shown on the meter.
- To select the place where installation and removal of a water meter are easy. Since it is necessary to replace water meter periodically (recommended in every 8 years), appropriate place for installing and removing a water meter is required.



2. Precaution for location of water meter installation (2)

- To select the place where meter reading is easy. Since it is necessary to conduct meter reading periodically, appropriate place, which is dry condition and not submerged, is required.
- To select the place where momentary pressure variation is low. It might be difficult to measure accurately because the rotation of the impeller will be increased by momentary pressure variation. The maximum working pressure, however, is 1 MPa.



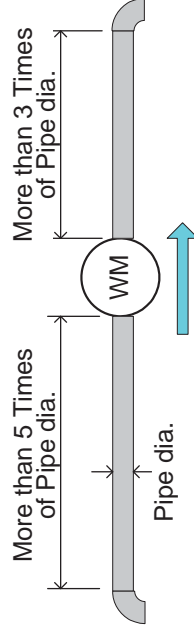
2. Precaution for location of water meter installation (3)

- To select a place where there is no influence on vibration. It might be difficult to measure accurately because the rotation of the impeller is increased by vibration.
- Not to install water meter at a submerged location.



3. Precaution for water meter installation (2)

- Pipe length of more than 5 times of a pipe diameter in the upper stream of a water meter and the pipe length of more than 3 times in the downstream are required on a pipe arrangement. When the pipe length is shorter than above mentioned length, it might be difficult to measure accurately due to the influence of a valve or a bent pipe.
- To use proper packing to fit a pipe diameter during meter installation. Water leakage at joint parts and/or water measuring error may occur due to different dimensions of packing.



3. Precaution for water meter installation (1)

- Water meter installation fitting should be the total length of the meter.
- In case of bad measurement, such as short or long, the meter can not be installed to pipes.
- When a welding junction is conducted at a pipe joint part, detach the water meter from the pipes.
- The plastic parts inside the water meter may be damaged by the high temperature of the welding.



3. Precaution for water meter installation (3)

- The inside of the pipe should always be cleaned by flowing water before installing water meter. It might be difficult to measure accurately because unwanted substances inside the pipe might obstruct the rotation of the impeller or even destroy the meter.
- To open a stop valve slowly when feeding water. When opening a stop valve hastily, the water meter might be damaged due to water hammer.



4. Examination of Instrumental error with reference (standard) water meter

Examination of Instrumental error (%) with reference (standard) water meter is conducted by using equipment.

1. Engineer excludes air by running water through the meter and service pipe.
2. Fully open the stop valve of reference (standard) water meter
3. Open the faucet slowly.
4. Fully close off the stop valve of reference (standard) water meter, and read indiscrete values of 2 meters.
5. Fully open the stop valve of reference (standard) water meter. Again fully close off the stop valve of reference (standard) water meter after running water up to fixed test flow. Read indiscrete values of 2 meters.
6. The range of an allowable instrumental error of measurement may be $\pm 10\%$ (i.e. in case of 100 L, the range of an allowable is $\pm 10\text{ L.}$)

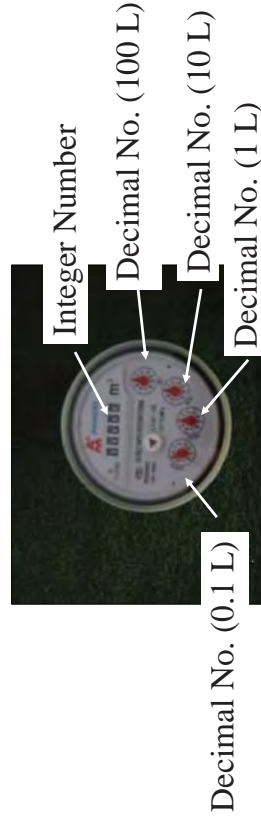
5.1 Calculation of Instrumental Error

$$E = \frac{I - Q}{Q} \times 100$$

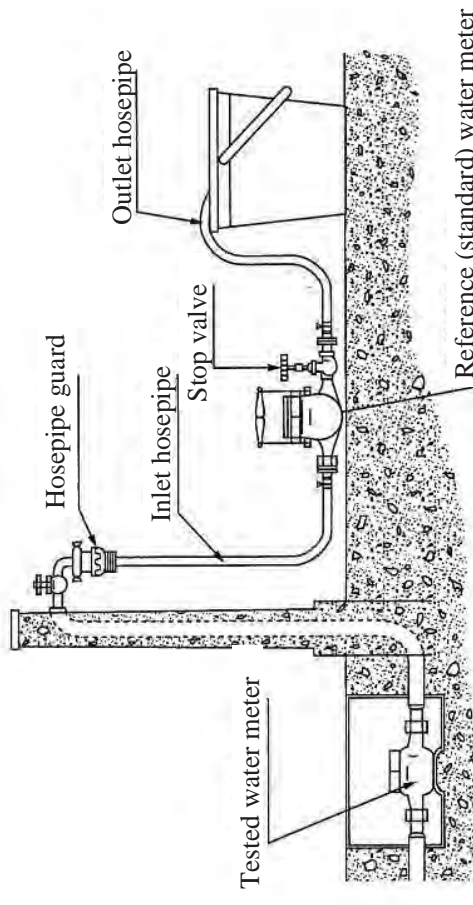
E: Instrumental error (%)

I: Indiscrete value of tested water meter (L)

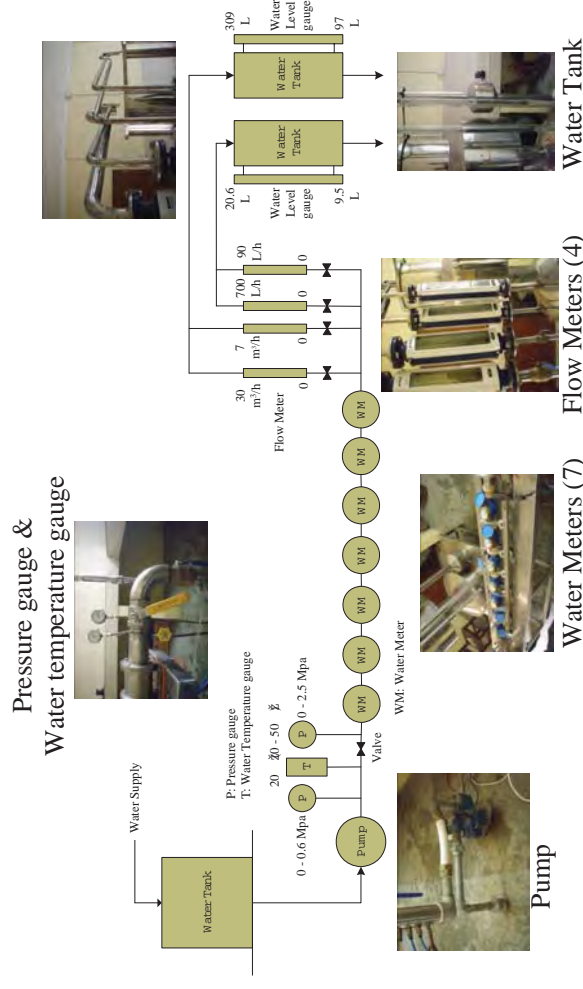
Q: Indiscrete value of reference (standard) water meter (L)



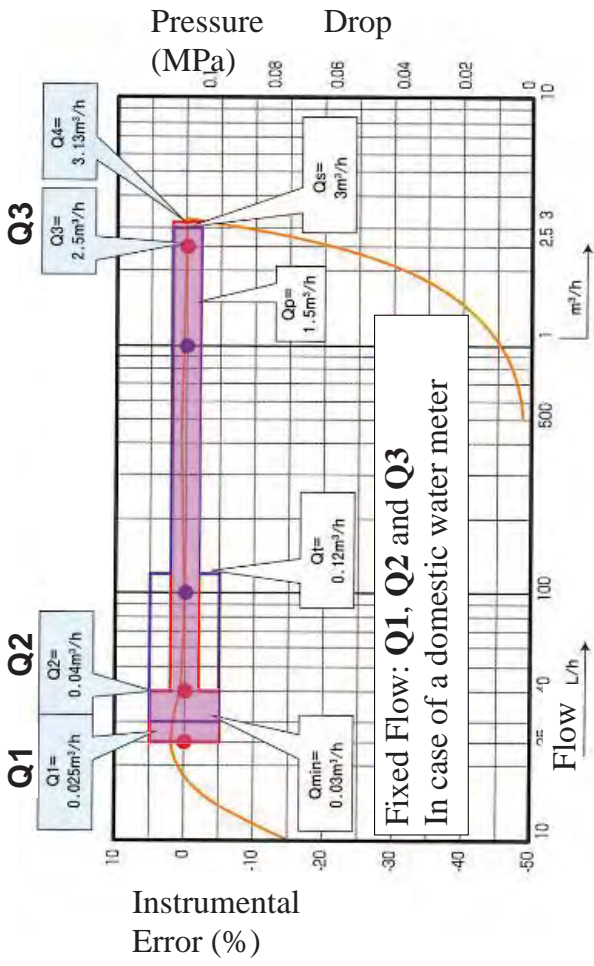
5. Examination of Instrumental error with reference (standard) water meter



6 Meter Calibration Equipment (TSC in Itahari)



6. Range of Verification Tolerance for Domestic Water Meter (15 mm)



7. Comparison of Flow



Training for Developing Public Hygiene Education Program (3)



February 2011

Objectives:

- Developing training material of awareness and hygiene education for women's group

Agenda

1. Training material for adults
2. Development of training material for adults

1. Training material for adults

2. Development of training material for adults

1. Training material for adults

- Several training material for adults, mainly focus for target group and topics

(1) Target group

- women's group, specially mother who has infant
- Sometimes appoints community health worker and sanitary worker, from retired nurse or trained community member

(2) Topics

- Save child from water born diseases
- Hygiene custom and behavior
- Conservation of water
- Development of cash income products using clean water

Community health worker, retired nurses and midwives



Health workers of Philippines come to health center for cooperation with anti schistosomiasis program assisted by JBIC: Japan Bank of International Cooperation



Modern communication tools are often used in social marketing campaigns. Here a sanitation promotion video is being shown to a group of Malawi workers. (UNICEF/Clay Andrew)

1. Training material for adults

(3) Difference of training material and method between school kid and adult

1) School kid

- Training material for school kid focus to gives comprehensive natural science and social science knowledge
- Learn with fun, think through fun

2) Adult

- Practical knowledge
- Make them presentation and think/understanding through presentation process

1. Training material for adults

- (4) Materials
- Storyboard
- Poster
- Picture card
- Demonstration
- Video
- Sometimes makes campaign goods, sticker



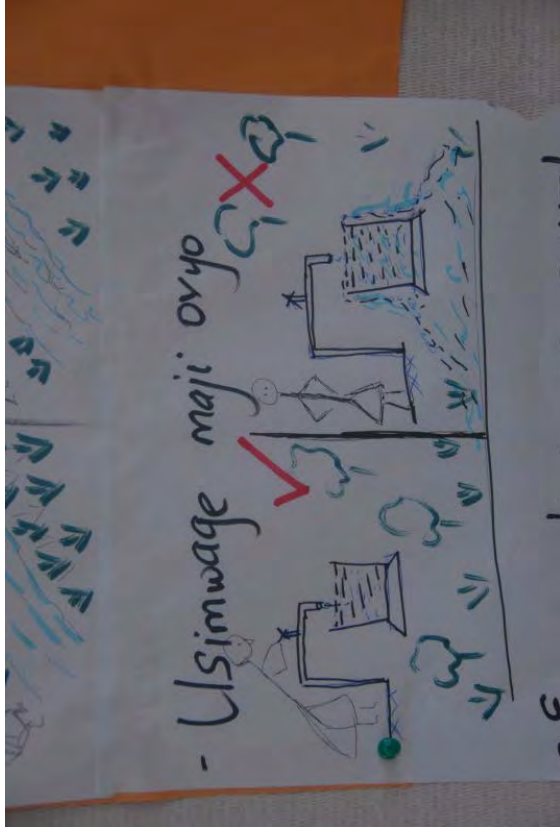
Information:

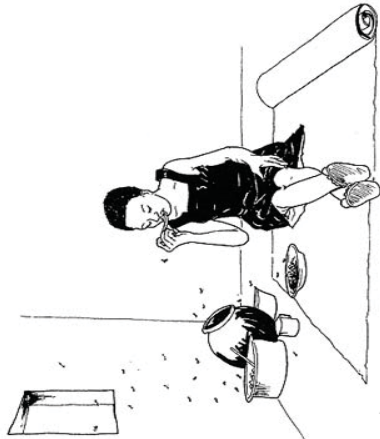
serialized poster

The purpose of this exercise is to draw on the participants' knowledge and experience and apply it to problem solving. Local awareness of disease transmission can be explored in this way. By the end of the session participants should be able to describe ways in which hygiene practices are related to the spread of water and sanitation related diseases and identify ways of preventing them.

- Participants divide into small groups and each group is given a set of randomly ordered sequential pictures showing some of the hygiene practices that transmit diseases
- Ask them to put the pictures into an ordered sequence.
- Ask them to say why they have made the particular choices and encourage discussion around the issues depicted in the pictures
- What action could be taken to improve the situation and by whom?
- Ask each group to discuss their findings with the whole group.

Storyboard: sample of water conservation





Poster for wash hand

Wash your hand well for proper hygiene

Wash your kitchen well for proper hygiene

Use shampoo for cleaning your hand and protect from contamination by micro virus



Poster for water conservation

- Water conservation: not flushing water while:
- Close the tap faucet when not use water
 - Use recycle water for plant or washing toilet
 - Use tanked water for washing (not flushing water while washing body)
 - Use glassed water for clean your mouth and teeth for proper hygiene (again not flushing water while brushing tooth)
- Water is valuable resources and need to use efficiently



Information card

Where do intestinal infections come from?

The origin of diarrhoea is: EXCRETIA

One gramme of faeces can contain:

- 10,000,000 viruses
- 1,000,000 bacteria
- 1,000 parasite cysts
- 100 parasite eggs

Infectious diarrhoeas (including dysentery, cholera and typhoid) are caused by infectious agents like viruses, bacteria and parasites. These agents get into humans via the mouth and are passed out in faeces.

ENEMY NO 1: FAECES!

Sample of poster/ sticker using in Bangladesh

- Water tariff
- conservation of water



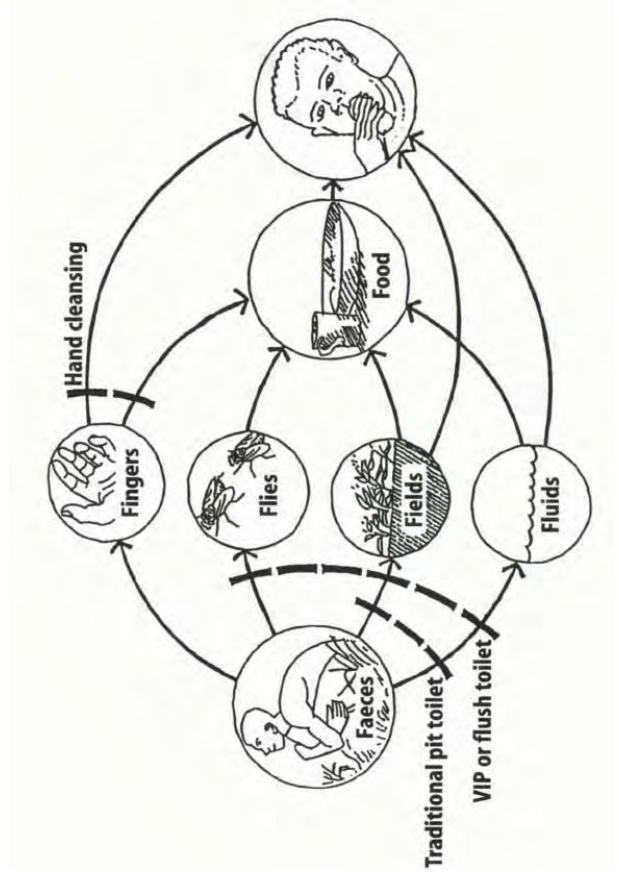
Water tariff: "Those who have paid water tariff may use water; others may not"

Zero Waist: Let's us turn off the taps that are needlessly left running

Also have such kinds of posters:

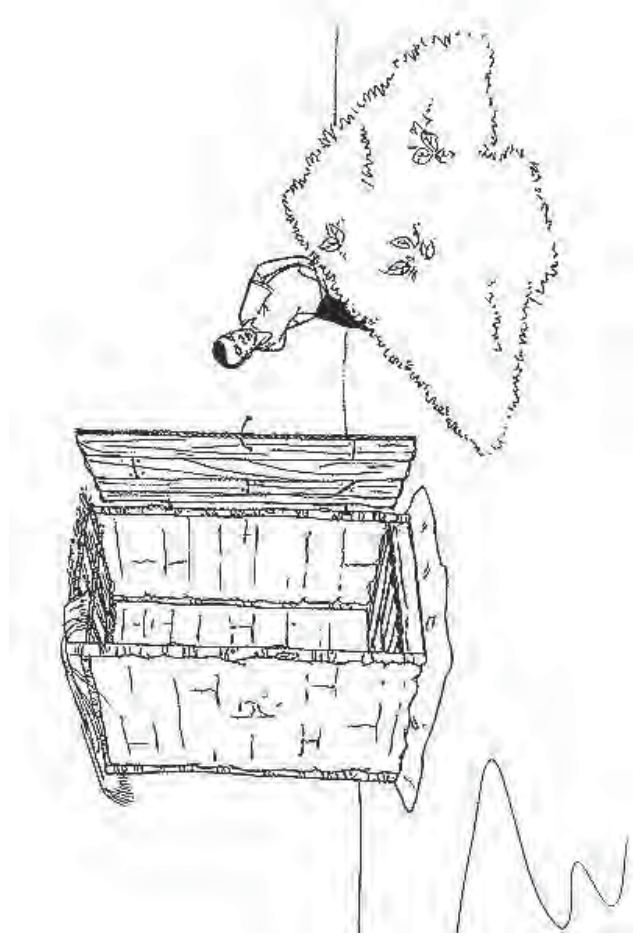
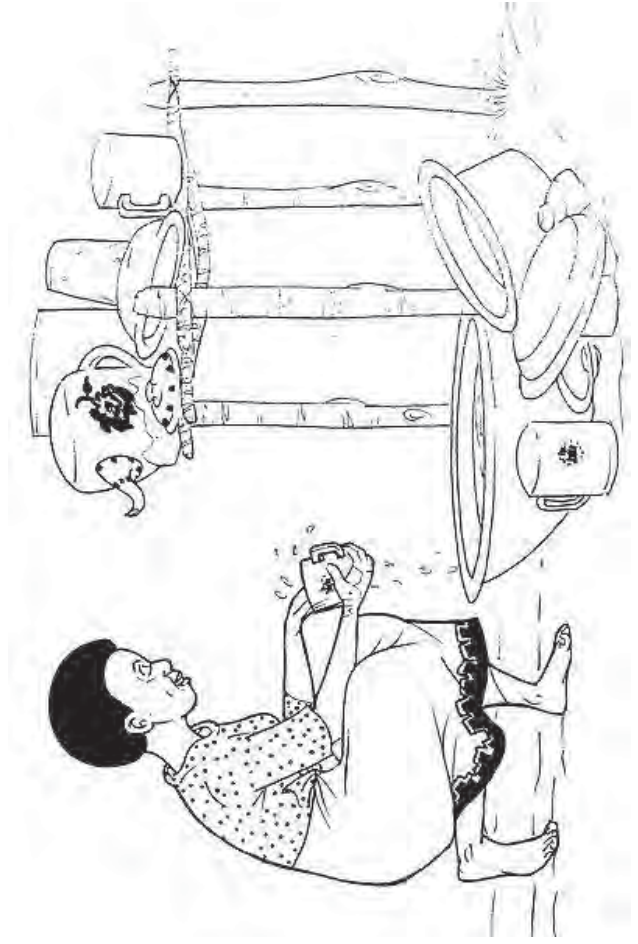
- wash your hands
- clean environment (burn or dig disposal into grand)
- use latrine

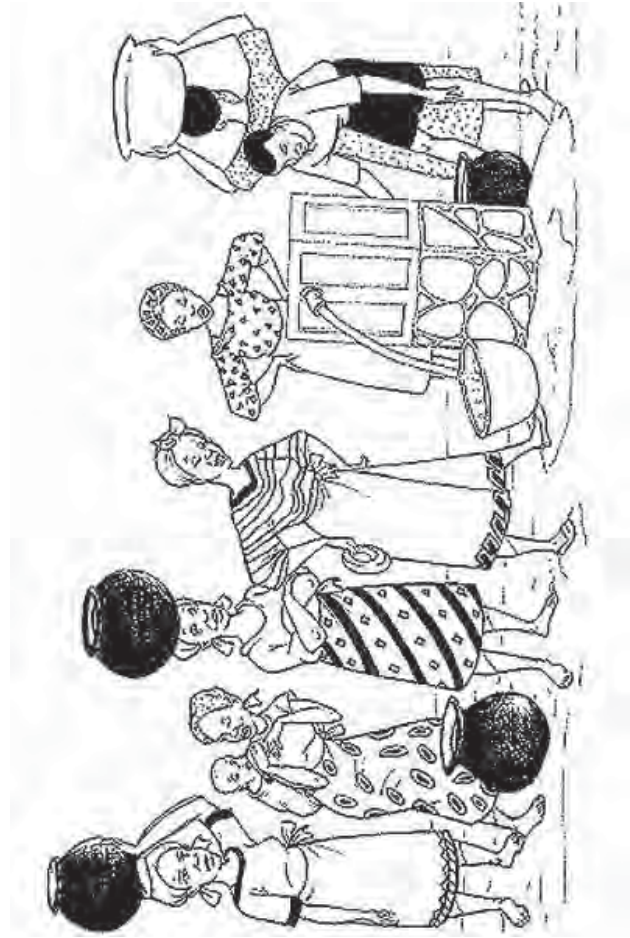
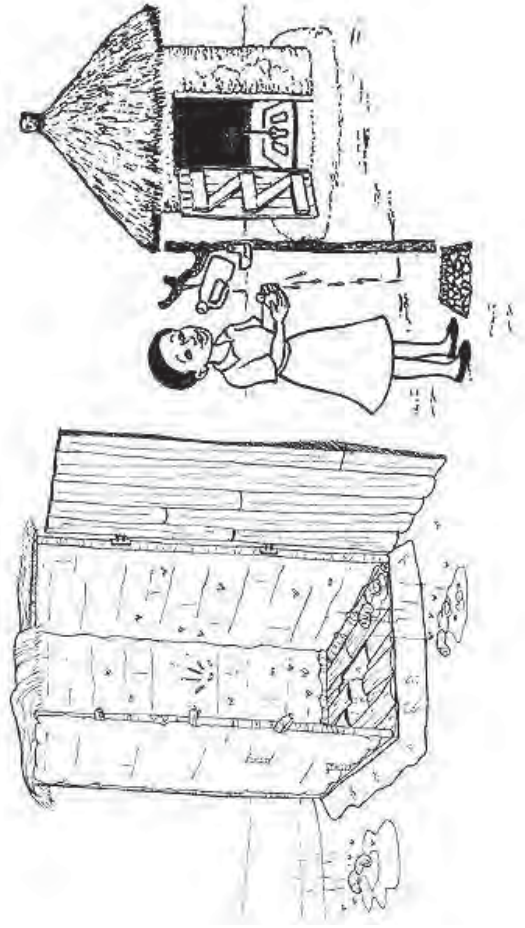
Information card



Demonstration

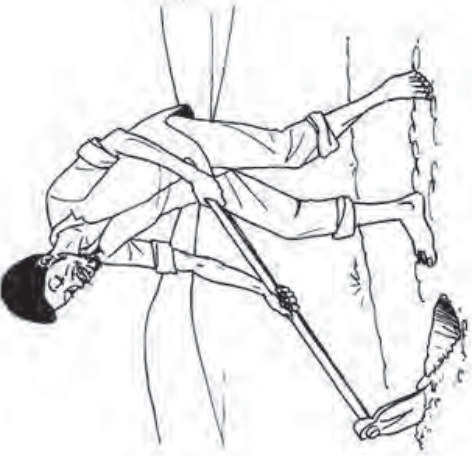
- Make a story using selected picture card
- Gives several picture card, and ask to attendants for arrange and make story, and presentation to people

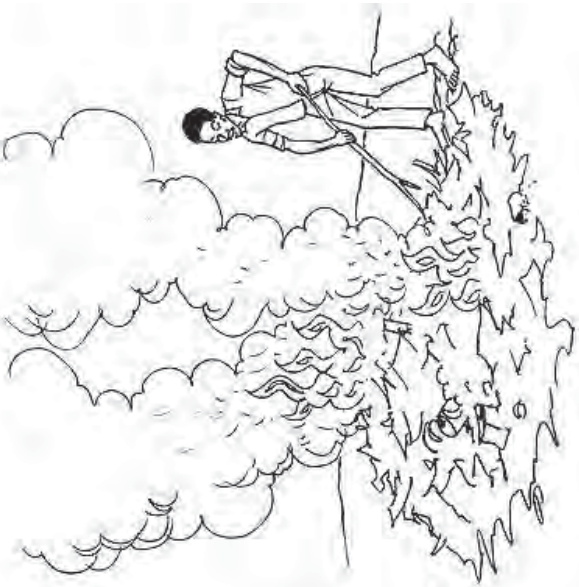
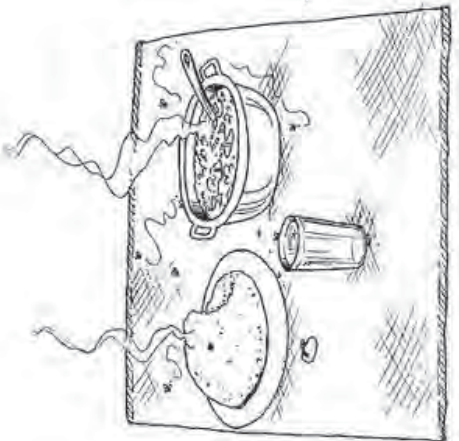


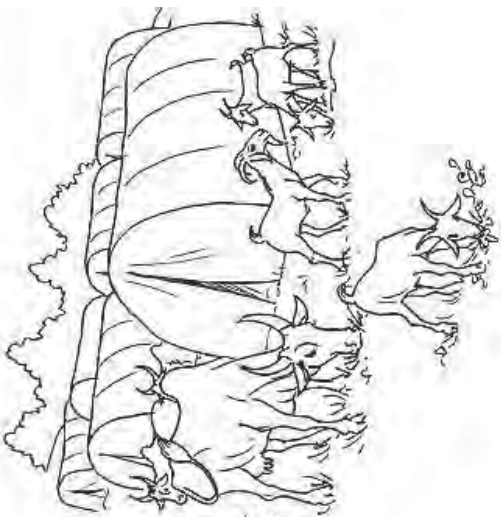
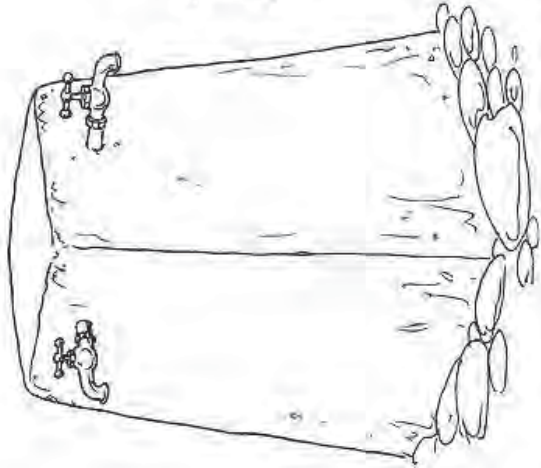
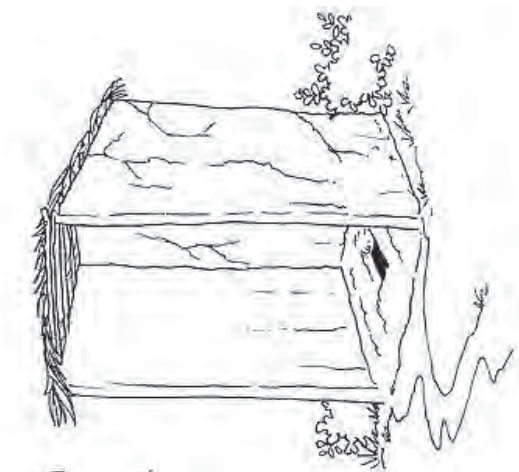
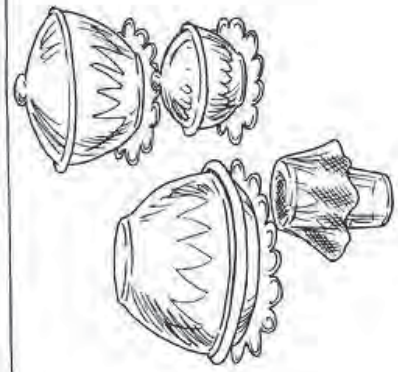
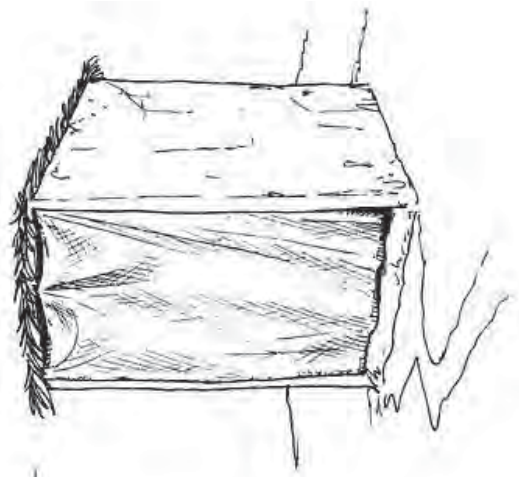


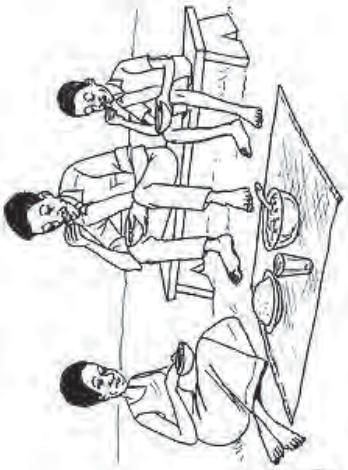
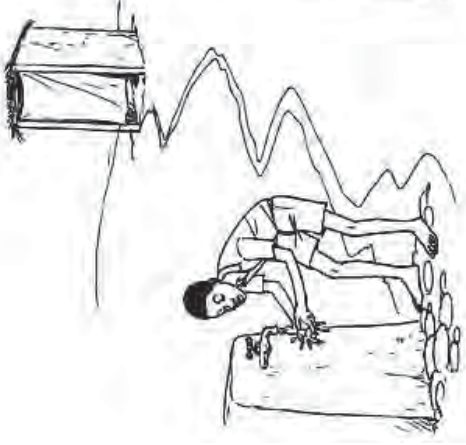
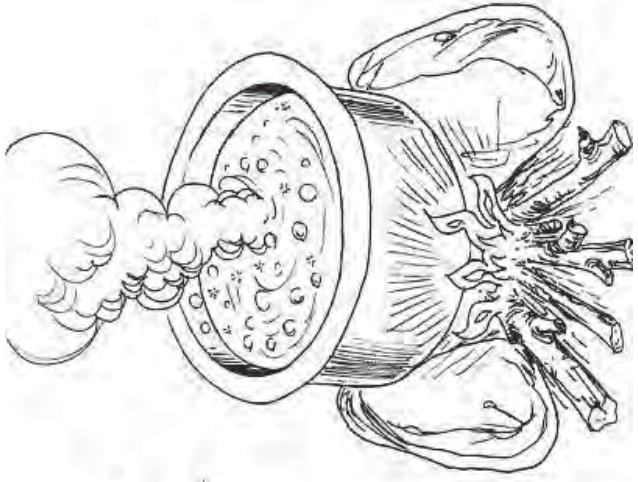
Demonstration

- Explain good and bad behavior by attendant
- Show picture and ask to attendants that behavior is good or bad, and why bad



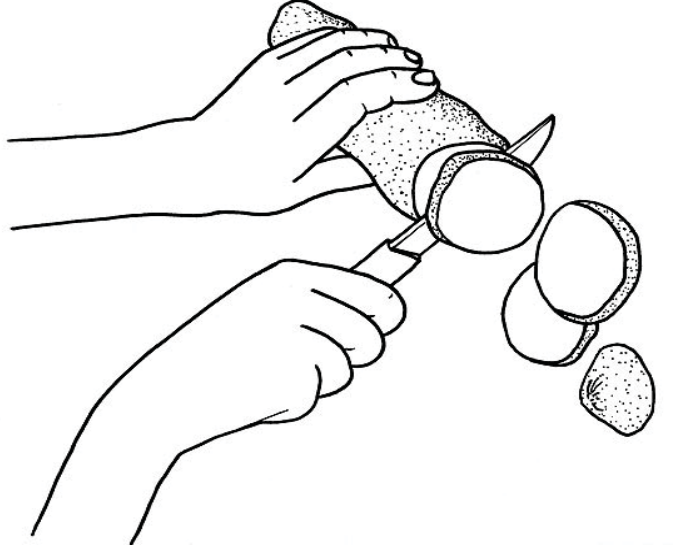
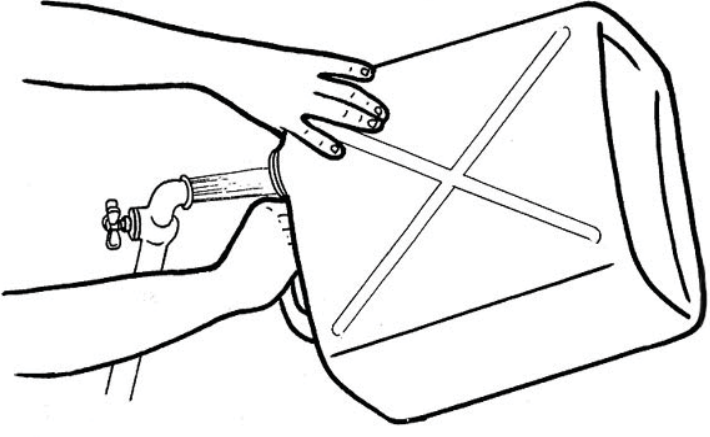


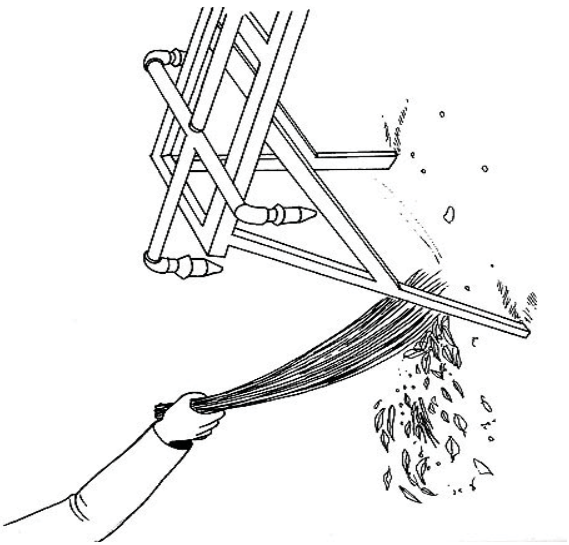
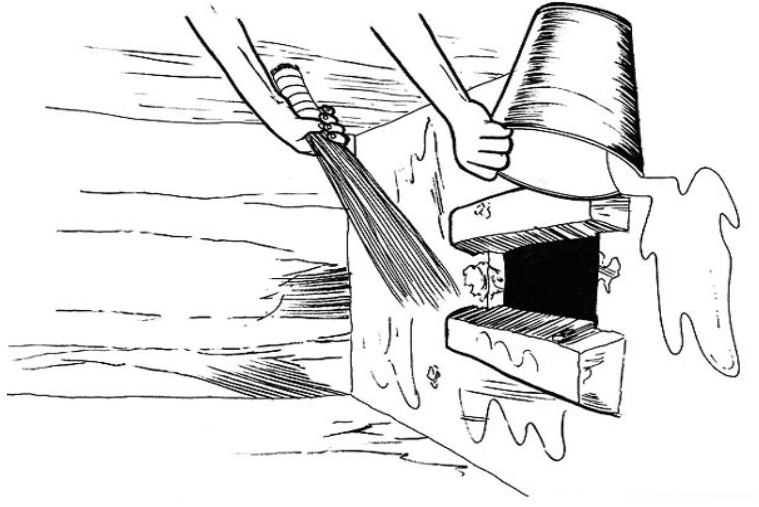
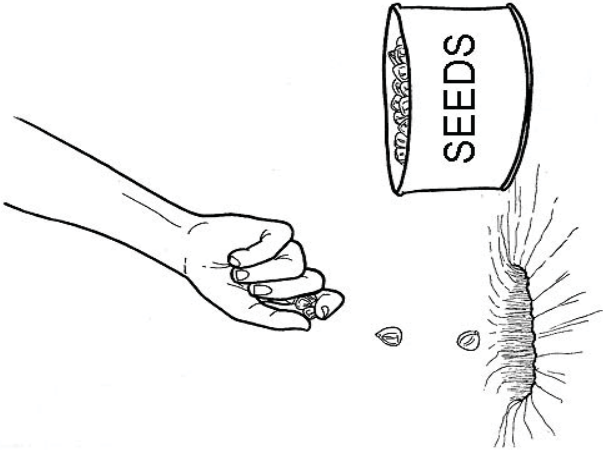




Demonstration

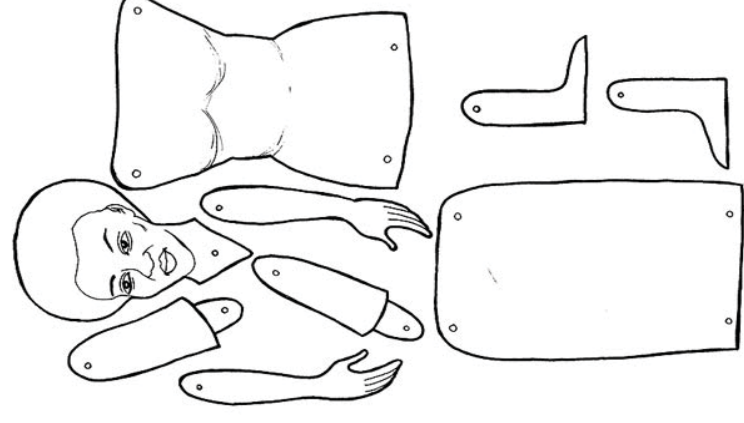
- Explain good behavior







flexiflans



Using flexiflans and flannel-graphs

The purpose of this exercise is to facilitate participants to present their views on local issues by pictures or stories using cut-out figures on a board. The exercise will also help the facilitator to gain insight into local views and priorities. The figures can be used to start open-ended discussions and are especially useful in working with people who do not have literacy skills to give a visual representation of their views.

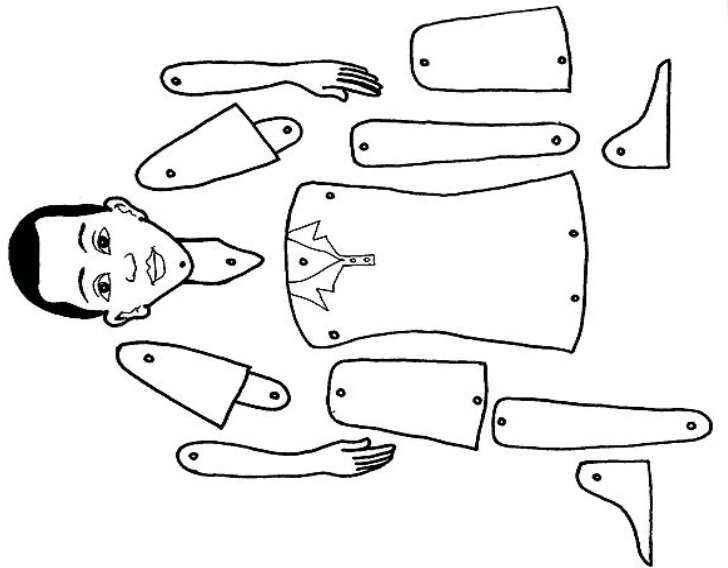
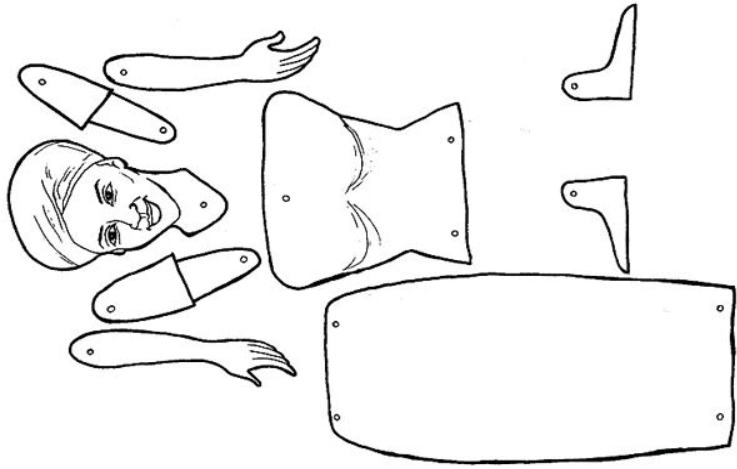
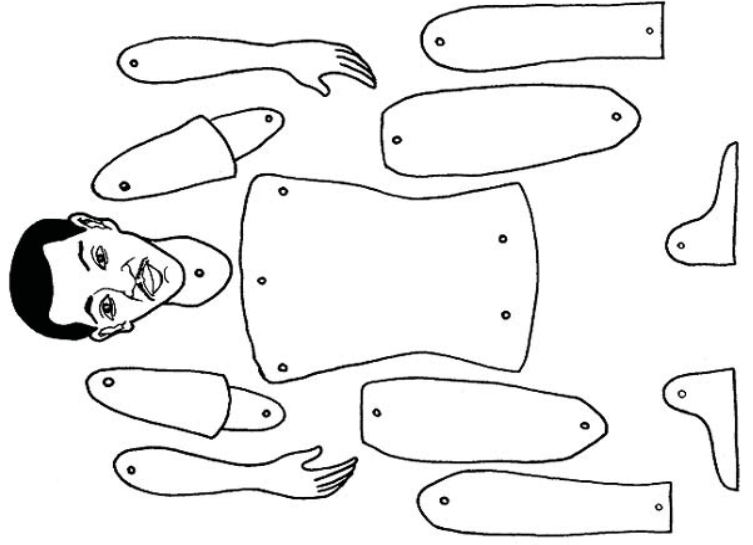
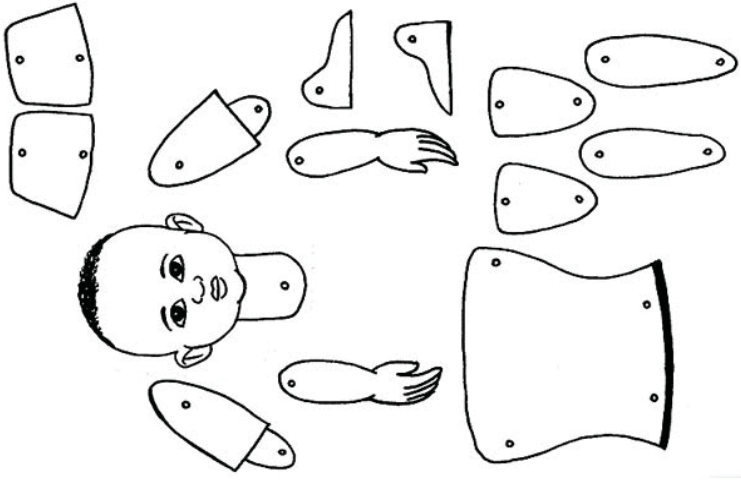
Flexiflans are paper or card cut outs of human figures with flexible arms, legs and torsos joined together with sewing thread or press studs. On the reverse side of their feet, hands and heads they have sandpaper stuck to them. When they are placed on a felt or flannel covered board they stick loosely to the board. They can be moved around the board and made to do different things while the person adjusting them tells a story or illustrate a point of view.

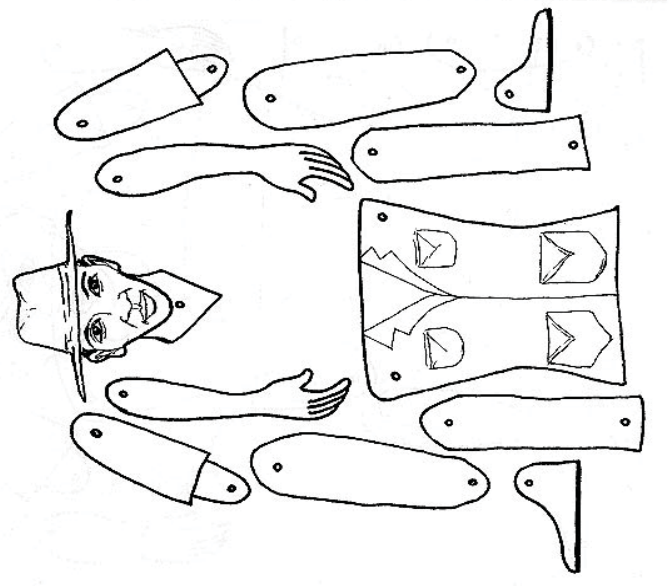
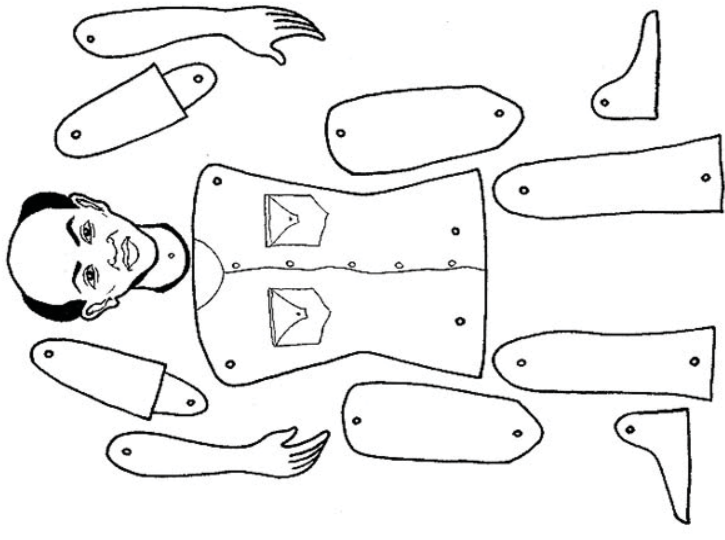
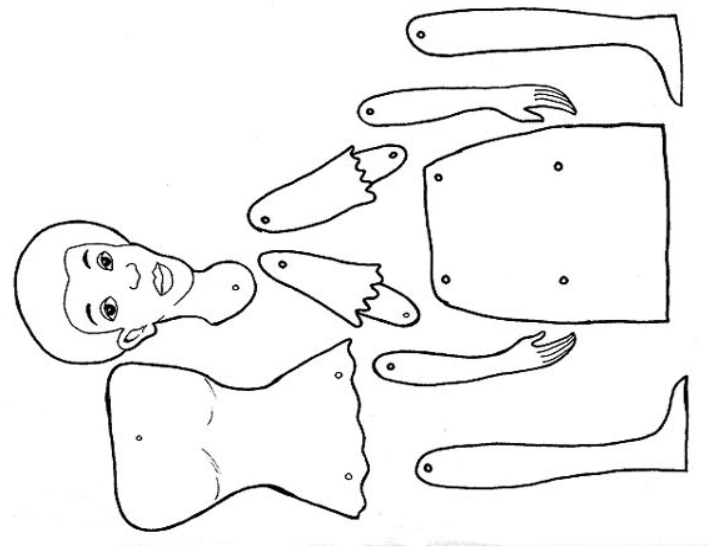
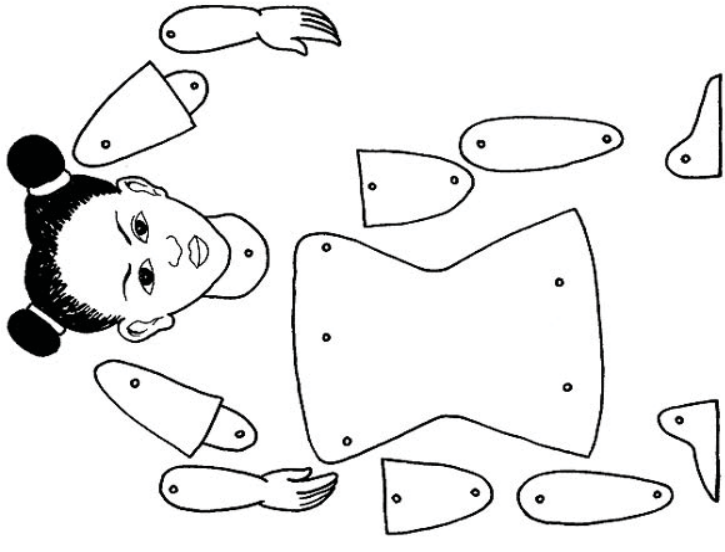
Other props such as cut outs of houses, animals trees and household implements are needed for the background context of the figures.

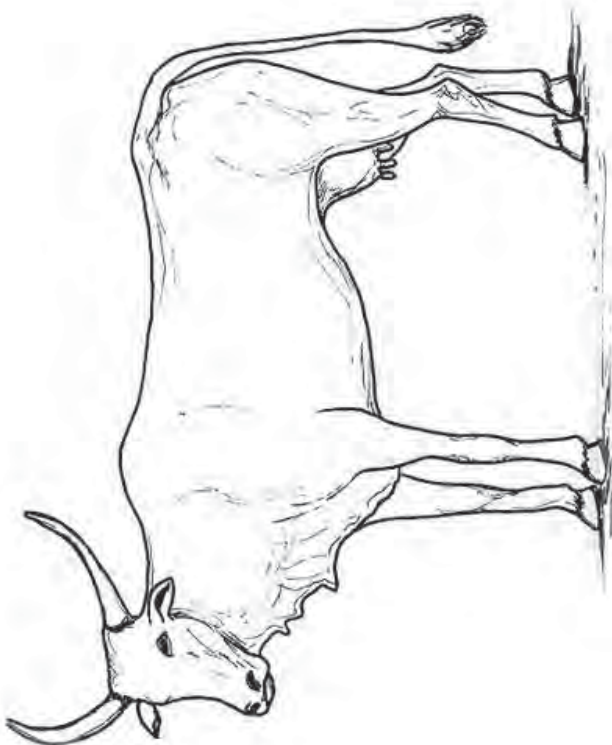
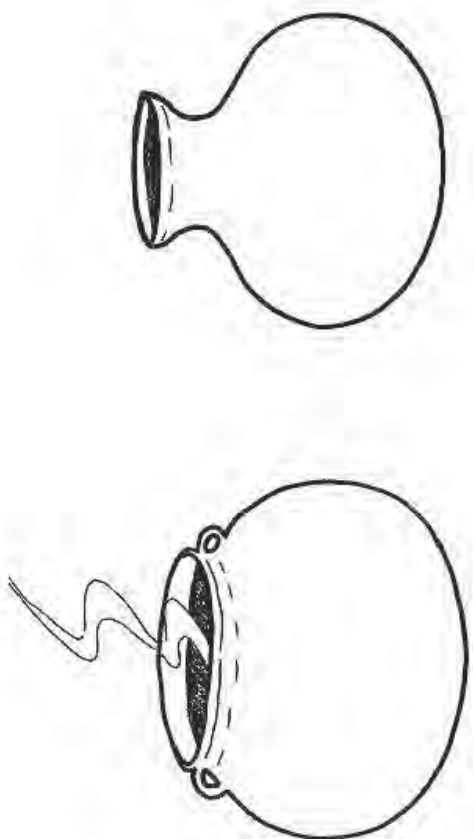
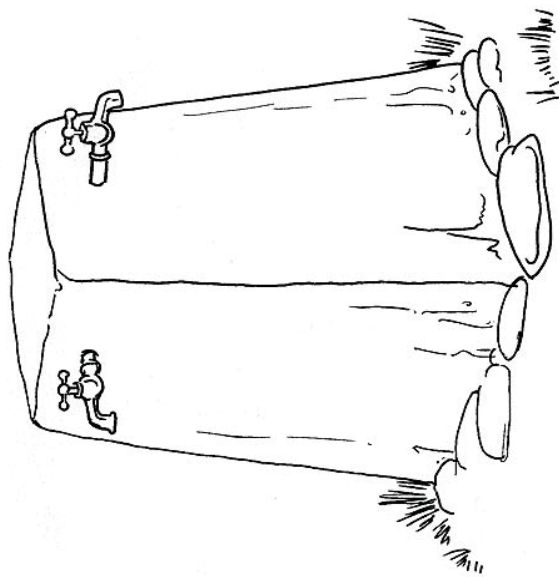
Flannel-graph figures are used in a similar way but do not have the same range of application as the limbs are not articulated. They can be made of paper or card with sandpaper stuck to their reverse sides to use on flannel boards or they can be made of flannel and stick onto sand-paper boards (or boards painted with an oil-based paint and covered with a thin layer of sand while the paint is still sticky).

To use the flexiflans and flannel-graphs effectively:

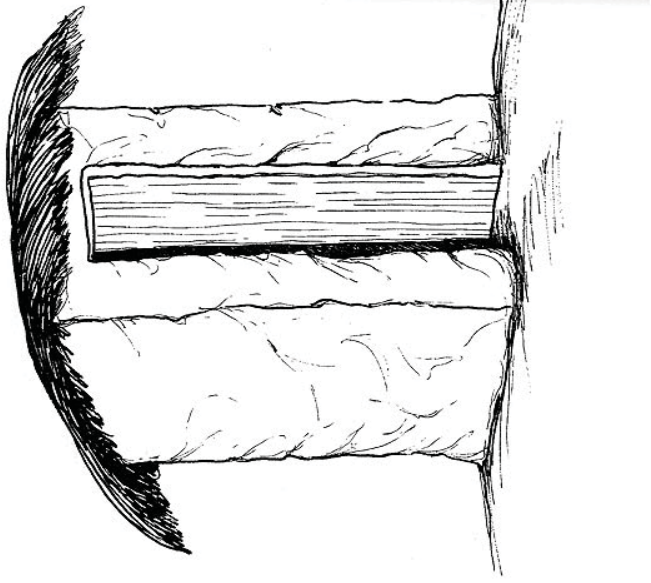
- Present a small group of participants with the flexiflan figures.
- Ask them to use the flexiflan figures as they like to tell a story about a local issue or describe a point of view.
- Encourage discussion around the issues and not priority themes and ranges of opinion.







Demonstration



1. Information of hygiene

1. All faeces should be disposed of safely. Using a toilet or latrine is the best way.
2. All family members, including children, need to wash their hands thoroughly with soap and water or ash and water after contact with faeces, before touching food, and before feeding children.
3. Washing the face with soap and water every day helps to prevent eye infections. In some parts of the world, eye infections can lead to trachoma, which can cause blindness.
4. Only use water that is from a safe source or is purified. Water containers need to be kept covered to keep the water clean.

5. Raw or leftover food can be dangerous. Raw food should be washed or cooked. Cooked food should be eaten without delay or thoroughly reheated.
6. Food, utensils and food preparation surfaces should be kept clean. Food should be stored in covered containers.
7. Safe disposal of all household refuse helps prevent illness.

1. All faeces should be disposed of safely. Using a toilet or latrine is the best way.

Many illnesses, especially diarrhoeas, come from germs found in human faeces. If the germs get into water or onto food, hands, utensils or surfaces used for preparing and serving food, they can be swallowed and cause illness.

The single most important action to prevent the spread of germs is to dispose of all faeces – both human and animal – safely. Human faeces need to be put down a toilet or latrine. The latrine needs to be kept clean. Animal faeces need to be kept away from the house, paths and areas where children play.

If it is not possible to use a toilet or latrine, everyone should always defecate well away from houses, paths, water sources and places where children play. The faeces should be buried immediately.

All faeces, even those of infants, carry germs and are therefore dangerous. If children defecate without using a toilet, latrine or potty, their faeces should be cleaned up immediately and put down the latrine or buried.

Latrines and toilets need to be cleaned frequently. Latrines should be kept covered and toilets should be flushed.

Local governments and NGOs often can help communities build sanitary latrines by giving advice on the design and construction of low-cost latrines.

2. All family members, including children, need to wash their hands thoroughly with soap and water or ash and water after contact with faeces, before touching food, and before feeding children.

Washing the hands with soap and water or ash and water removes germs. Rinsing the fingers with water is not enough – both hands need to be rubbed with soap or ash. This helps to stop germs and dirt from getting onto food or into the mouth. Washing the hands can also prevent infection with worms. Soap and water or ash and water should be placed conveniently near the latrine or toilet.

- It is especially important to wash the hands after defecating and after cleaning the bottom of a baby or child who has just defecated. It is also important to wash hands after handling animals and raw foods.

- Hands should always be washed before preparing, serving or eating food, and before feeding children. Children should be taught to wash both hands after defecating and before eating to help protect them from illness.

Children often put their hands into their mouths, so it is important to wash a child's hands often, especially after they have been playing in dirt or with animals.

Children are easily infected with worms, which deplete the body's nutrients. Worms and their eggs can be found in human and animal faeces and urine, in surface water and soil, and in poorly cooked meat. Children should not play near the latrine, toilet or defecation areas. Shoes should be worn near latrines to prevent worms from entering the body through the skin of the feet.

- Children living in areas where worms are common should be treated two to three times per year with a recommended antihelminthic medication.

4. Only use water that is from a safe source or is purified. Water containers need to be kept covered to keep the water clean.

Families have fewer illnesses when they have an adequate supply of clean water and know how to keep it free of germs.

If the water is not clean it can be purified by boiling or filtering.

Clean water sources include properly constructed and maintained piped systems, tube-wells, protected dug wells and springs. Water from unsafe sources – such as ponds, rivers, open tanks and step-wells – can be made safer by boiling. Water should be stored in a covered container to keep it clean.

Families and communities can protect their water supply by:

- keeping wells covered and installing a handpump
- disposing of faeces and waste water (especially from latrines and household cleaning) well away from any water source used for cooking, drinking or washing
- building latrines at least 15 metres away and down-hill from a water source

3. Washing the face with soap and water every day helps to prevent eye infections. In some parts of the world, eye infections can lead to trachoma, which can cause blindness.

A dirty face attracts flies, spreading the germs they carry from person to person. The eyes may become sore or infected and vision may be impaired or lost if the eyes are not kept clean and healthy.

If the eyes are healthy, the white part is clear, the eyes are moist and shiny, and vision is sharp. If the eyes are extremely dry or very red and sore, if there is a discharge or if there is difficulty seeing, then the child should be examined by a health worker as soon as possible.

Cooking food thoroughly kills germs. Food, especially meat and poultry, should be cooked all the way through.

5. Raw or leftover food can be dangerous. Raw food should be washed or cooked. Cooked food should be eaten without delay or thoroughly reheated.

- Germs grow quickly in warm food. Food should be eaten as soon as possible after cooking so it does not have time to collect germs.
- If food has to be kept for more than two hours, it should be kept either very hot or very cool.
- If cooked food is saved for another meal, it should be covered to keep off flies and insects and then thoroughly reheated before being eaten.

- always keeping buckets, ropes and jars used to collect and store water as clean as possible by storing them in a clean place, rather than on the ground
- keeping animals away from drinking water sources and family living areas
- avoiding the use of pesticides or chemicals anywhere near a water source.

Families can keep water clean in the home by:

- storing drinking water in a clean, covered container
- avoid touching clean water with unclean hands
- taking water out of the container with a clean ladle or cup
- having a tap on the water container
- not allowing anyone to put their hands into the container or to drink directly from it
- keeping animals away from stored water.

If there is uncertainty about the safety of the drinking water, local authorities should be consulted.

- Yogurt and sour porridge are good to use in meals because their acid prevents the growth of germs.

Raw food, especially poultry and seafood, usually contains germs. Cooked food can collect germs if it touches raw food. So raw and cooked foods should always be kept away from each other. Knives, chopping boards and surfaces where food is prepared should always be cleaned after preparing raw food.

- Breastmilk is the safest milk for infants and young children. Animal milk that is freshly boiled or pasteurized is safer than unboiled milk.
- Expressed breastmilk can be stored at room temperature for up to eight hours in a clean, covered container.
- Special care should be taken with preparing food for infants and small children. Their food should be freshly made and not left standing, if possible.
- Fruit and vegetables should be peeled or washed thoroughly with clean water, especially if they are to be given raw to babies or small children. Chemicals such as pesticides and herbicides cannot be seen on fruit and vegetables but nonetheless can be dangerous.

Germs on food can be swallowed and cause illness. To protect food from germs:

6. Food, utensils and food preparation surfaces should be kept clean. Food should be stored in covered containers.

- Food preparation surfaces should be kept clean
- knives, cooking utensils, pots and plates should be kept clean and covered
- cloths for cleaning dishes or pans should be washed thoroughly every day and dried in the sun. Plates, utensils and pans should be washed immediately after eating and put on a rack to dry
- food should be kept in covered containers to protect it from insects and animals
- feeding bottles or teats should not be used because they can contain germs that cause diarrhoea unless they are cleaned each time with boiling water. Children should be breastfed or fed from a clean, open cup.

7. Safe disposal of all household refuse helps prevent illness.

Germs can be spread by flies, cockroaches, rats and mice, which thrive in refuse such as food scraps and peelings from fruit and vegetables.

If there is no community-wide collection of garbage, each family needs a garbage pit where household refuse is buried or burned every day.

Keeping the household and nearby areas clean and free of faeces, refuse and waste water can help prevent disease. Household waste water can be disposed of safely by making a soak pit or a channel to the kitchen garden or to the field.

Chemicals such as pesticides and herbicides can be very dangerous if even small quantities get into the water supply or onto food, hands or feet. Clothes and containers used when handling chemicals should not be washed near a household water source.

Pesticides and other chemicals should not be used around the household or near a water source. Chemicals should not be stored in or near drinking water containers or near food. Never store food or water in pesticide or fertilizer containers.

5.

If the child is dehydrated with severe or persistent diarrhoea, only oral rehydration solution or medicines recommended by a trained health worker should be used. Other diarrhoea medicines are generally ineffective and could be harmful to the child.

6.

To prevent diarrhoea, all faeces should be disposed of in a latrine or toilet or buried.

7.

Good hygiene practices protect against diarrhoea. Hands should be thoroughly washed with soap and water or ash and water after contact with faeces, and before touching food or feeding children.

Diarrhoea

1.

Diarrhoea kills children by draining liquid from the body, thus dehydrating the child. As soon as diarrhoea starts, it is essential that the child be given extra fluids as well as regular foods and fluids.

2.

A child's life is in danger if there are several watery stools within an hour or if there is blood in the faeces. Immediate help from a trained health worker is needed.

3.

Breastfeeding can reduce the severity and frequency of diarrhoea.

4.

A child with diarrhoea needs to continue eating regularly. While recovering from diarrhoea, the child needs at least an extra meal every day for at least two weeks.

1. Diarrhoea kills children by draining liquid from the body, thus dehydrating the child. As soon as diarrhoea starts, it is essential that the child be given extra fluids as well as regular foods and fluids.

A child has diarrhoea when he or she passes three or more watery stools a day. The more numerous the watery stools, the more dangerous the diarrhoea.

Some people think that drinking liquids makes diarrhoea worse. *This is not true.* A child with diarrhoea should be given drinks as often as possible until the diarrhoea stops. Drinking lots of liquids helps to replace the fluids lost during diarrhoea.

Recommended drinks for a child with diarrhoea:

- breastmilk (mothers should breastfeed more often than usual)
- soups
- rice water
- fresh fruit juices
- weak tea with a little sugar
- coconut water
- clean water from a safe source. If there is a possibility the water is not clean, it should be purified by boiling or filtering.
- oral rehydration salts (ORS) mixed with the proper amount of clean water. (See box on page 83.)

To avoid dehydration, breastfed children should breast-feed as often as possible, and other children should drink the following amounts of liquids every time a watery stool is passed:

- for a child under the age of two years: between a quarter and a half of a large cup
- for a child aged two or older: between a half and a whole large cup.

Drinks should be given from a clean cup. A feeding bottle should never be used. It is difficult to clean bottles completely and unclean bottles can cause diarrhoea.

If the child vomits, the caregiver should wait for 10 minutes and then begin again to give the drink to the child slowly, small sips at a time.

The child should be given extra liquids until the diarrhoea has stopped.

Diarrhoea usually stops after three or four days. If it lasts longer than one week, caregivers should seek help from a trained health worker.

- refuses to eat
- has sunken eyes
- looks weak or is lethargic
- has had diarrhoea for more than one week.

If the child has *any* of these signs, help from a trained health worker is needed urgently. In the meantime, the child should be given ORS solution or other liquids.

If the child passes several watery stools in one or two hours and vomits, there is cause for alarm – these are possible signs of cholera. Cholera can kill children in a matter of hours. Seek medical help immediately.

- Cholera can spread throughout the community quickly through contaminated water or food. Cholera usually occurs in situations where there is poor sanitation and overcrowding.

- There are four steps to be taken to limit the spread of cholera or diarrhoea:

1. Dispose of all faeces in a latrine or toilet or bury them
2. Wash hands with soap or ash and water after contact with faeces
3. Use safe drinking water
4. Wash, peel or cook all foods.

2. A child's life is in danger if there are several watery stools within an hour or if there is blood in the faeces. Immediate help from a trained health worker is needed.

Parents should immediately seek help from a trained health worker if the child:

- passes several watery stools in one or two hours
- passes blood in the faeces
- vomits frequently
- has a fever
- is extremely thirsty
- does not want to drink

3. Breastfeeding can reduce the severity and frequency of diarrhoea.

Breastmilk is the best source of liquid and food for a young child with diarrhoea. It is nutritious and clean and helps fight illness and infections. An infant who is fed only breastmilk is unlikely to get diarrhoea.

Breastmilk prevents dehydration and malnutrition and helps replace lost fluids. Mothers are sometimes advised to give less breastmilk if a child has diarrhoea. *This advice is wrong.* Mothers should breastfeed more often than usual when the child has diarrhoea.

4. A child with diarrhoea needs to continue eating regularly. While recovering from diarrhoea, the child needs at least an extra meal every day for at least two weeks.

A child with diarrhoea loses weight and can quickly become malnourished. A child with diarrhoea needs all the food and fluid he or she can take. Food can help stop the diarrhoea and help the child recover more quickly.

A child with diarrhoea may not want to eat or may vomit, so feeding can be difficult. If the child is around six months of age or older, parents and caregivers should encourage the child to eat as often as possible, offering small amounts of soft, mashed foods or foods the child likes. These foods should contain a small amount of salt. Soft foods are easier to eat and contain more fluid than hard foods.

Recommended foods for a child with diarrhoea are well-mashed mixes of cereals and beans, fish, well-cooked meat, yogurt and fruits. One or two teaspoons of oil can be added to cereal and vegetables. Foods should be freshly prepared and given to the child five or six times a day.

After the diarrhoea stops, extra feeding is vital for a full recovery. At this time, the child needs to eat an extra meal a day, or breastfeed more every day, for at least two weeks. This will help the child replace the energy and nourishment lost due to diarrhoea.

A child is not fully recovered from diarrhoea until he or she is at least the same weight as when the illness began.

5. If the child is with severe or persistent diarrhoea, only oral rehydration solution or medicines recommended by a trained health worker should be used. Other diarrhoea medicines are generally ineffective and could be harmful to the child.

Diarrhoea usually cures itself in a few days. The real danger is the loss of liquid and nutrients from the child's body, which can cause dehydration and malnutrition.

A child with diarrhoea should never be given any tablets, antibiotics or other medicines unless these have been prescribed by a trained health worker.

The best treatment for diarrhoea is to drink lots of liquids and oral rehydration salts (ORS) properly mixed with water.

If ORS packets are not available, dehydration can be treated by giving the child a drink made with four level teaspoons of sugar and half a level teaspoon of salt dissolved in one litre of clean water. Be very careful to mix the correct amounts, as too much sugar can make the diarrhoea worse, and too much salt can be extremely harmful to the child. If the mixture is made a little too diluted no harm can be done and there is very little loss of effectiveness.

Measles frequently causes severe diarrhoea. Immunizing children against measles prevents this cause of diarrhoea.

Vitamin A capsules and foods that contain vitamin A help a child recover from diarrhoea. Foods that contain vitamin A include breastmilk, liver, fish, dairy products, orange or yellow fruits and vegetables, and green leafy vegetables.

6. To prevent all faeces should be disposed of in a latrine or toilet or buried.

Children and adults can swallow germs that cause diarrhoea if faeces touch the household's drinking water, food, hands, utensils or food preparation surfaces. Flies that settle on faeces and then on food also transmit the germs that cause diarrhoea. Covering food and drinking water protects them from flies.

All faeces, even those of infants and young children, carry germs and are therefore dangerous. If children defecate without using the latrine or toilet, their faeces should be cleaned up immediately and put down the toilet or buried. Keeping latrines and toilets clean prevents the spread of germs.

If there is no access to a toilet or latrine, adults and children should defecate away from houses, paths, water supplies and places where children play and then the faeces should be buried under a layer of soil.

In communities without toilets or latrines, the community should consider joining together to build such facilities.

Water sources should be kept clear of animal or human faeces.

ORS solution

A special drink for diarrhoea

What is ORS?

ORS (oral rehydration salts) is a special combination of dry salts that, when properly mixed with safe water, can help rehydrate the body when a lot of fluid has been lost due to diarrhoea.

Where can ORS be obtained?

In most countries, ORS packets are available from health centres, pharmacies, markets and shops.

To make the ORS drink

1. Put the contents of the ORS packet in a clean container. Check the packet for directions and add the correct amount of clean water. Too little water could make the diarrhoea worse.
2. Add water only. Do not add ORS to milk, soup, fruit juice or soft drinks. Do not add sugar.
3. Stir well, and feed it to the child from a clean cup. Do not use a bottle.

How much ORS drink to give?

Encourage the child to drink as much as possible.

A child under the age of two needs at least a quarter to a half of a large cup of the ORS drink after each watery stool.

A child aged two or older needs at least a half to a whole large cup of the ORS drink after each watery stool.

Diarrhoea usually stops in three or four days.

If it does not stop after one week, consult a trained health worker.

Hands should always be washed with soap and water or ash and water after defecating, after cleaning the baby's bottom, and immediately before feeding children, handling food or eating.

Young children frequently put their hands in their mouths, so it is important to keep the household area clean and to wash children's hands often with water and soap or ash, especially before giving them food.

Other hygiene measures can help to prevent diarrhoea:

- Food should be prepared and thoroughly cooked just before eating. Food left standing can collect germs that can cause diarrhoea. Alter two hours cooked foods are not safe unless they are kept very hot or very cold.
- All refuse should be buried, burned or safely disposed of to stop flies from spreading disease.

7 Good hygiene practices protect against diarrhoea.

Hands should be thoroughly washed with soap and water or ash and water after contact with faeces, and before touching food or feeding children.

Activity Sheet 5: Diarrhoea

Objective

To understand that diarrhoea is dangerous because it can both kill and cause malnutrition. It can be prevented by keeping clean, using clean water and by eating properly.

Learning points for the children:

- If the child has diarrhoea, action should be taken immediately. Do not wait for signs of severe dehydration. We can prevent serious dehydration by doing the following:
 - Giving the child plenty to drink to replace the water that is lost, as soon as the diarrhoea starts.
 - Giving the child enough food to keep him/her strong.
 - Food that contains salt is particularly important.

Activities for children

Activity 1: Collecting information about diarrhoea

- Children can collect information about diarrhoea and how common and dangerous it is. How many times have their younger brothers and sisters had diarrhoea in the last year? They can find out at what ages it is most common by counting how many times children of different ages had diarrhoea. They can see how often breast-fed babies and bottle-fed babies get diarrhoea. Which get diarrhoea the most? Why?

How many children in the community have died of diarrhoea? This information can be used later to help decide if different health activities have made a difference to children's health.

Activity 2: Knowledge of diarrhoea

- Make the group sit in a circle.
- Ask them if they or their siblings had diarrhoea recently.
- Display a picture of a child having diarrhoea in the centre of the circle. Stimulate children to discuss the reasons why the person might have diarrhoea.
- Write their reasons on the board and let the children clarify them.
- Display all the pictures depicting possible treatments and ask them to identify the treatments adopted in their village and display it around the picture of the child having diarrhoea.
- Ask them the following questions:
 - What are the reasons for choosing the treatment? Is it safe?

Fact sheet for the teacher: Diarrhoea

Diarrhoea is dangerous

Children who have diarrhoea lose a lot of water and salt, especially if they are vomiting and lose a fever. Children may die of diarrhoea, usually because they lose too much water and vital salts from their bodies and nobody helps them to drink. This loss of water and salts is called dehydration. The family should understand that the water lost in diarrhoea needs to be quickly replaced.

What to do when a child has diarrhoea?

- ACT IMMEDIATELY! Do not wait for signs of severe dehydration. We can prevent serious dehydration by doing the following:
 - Give the child plenty to drink to replace the water that is lost, as soon as the diarrhoea starts.
 - Give the child enough food to keep him/her strong.
 - Food that contains salt is particularly important.

What are the signs of dehydration?

The child is thirsty or may appear irritable, restless or half asleep. The mouth and tongue become dry, and there are few tears when the child cries. Eyes appear sunken and when the skin is pinched it returns to normal slowly. These signs only appear if the child becomes very dehydrated from diarrhoea. A child with these signs is in great danger.



Figure 37: Signs of a child who is dehydrated

Game 1: Preparing an ORS solution

- What was the effect of the treatment? Was there an improvement or did it increase diarrhoea?
- Has there been any death in the family or in the village due to diarrhoea?
- What were the costs/resources involved in the treatment?
- Did it have any harmful effects on the child after treatment?
- After you have identified the reasons and treatment methods adopted, explain them in a separate session.
 - a. What are the reasons for getting diarrhoea?
 - b. What does diarrhoea lead to?
 - c. How do you identify dehydration?
 - d. What is the safe/correct treatment method for diarrhoea?

Activity 3: Making Oral Rehydration Solution (ORS)

- Make the students work in pairs. Each pair gets a lot of sugar, salt and water from the teacher.
- Ask them to make a glass of ORS based on mixing:
 - four level teaspoons of sugar and
 - half a level teaspoon of salt dissolved in one litre of clean water.
- Ask each pair to taste the number of sugar, salt and water required for Oral Rehydration Solution.

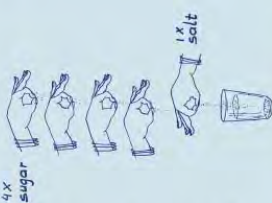


Figure 16: How to make an ORS rehydration solution

Game 2: Identifying the danger signs

- Tell the students that their thumb represents one pinch of salt and that four fingers represent four pinches of sugar.
- After students have understood this, the teacher calls out sugar salt, alternately in a fast and tricky manner and the students have to respond with the correct action by holding up the thumb or fingers.
- Students who take the wrong action are eliminated from the game!

Activity 4: Collecting information about diarrhoea

- Children can collect information about diarrhoea and how common and dangerous it is. How many times have their younger brothers and sisters had diarrhoea in the last year? They can find out at what ages it is most common by counting how many times children of different ages had diarrhoea. They can see how often breast-fed babies and bottle-fed babies get diarrhoea. Which get diarrhoea the most? Why?

How many children in the community have died of diarrhoea? This information can be used later to help decide if different health activities have made a difference to children's health.

Activity 5: Knowledge of diarrhoea

- Make the group sit in a circle.
- Ask them if they or their siblings had diarrhoea recently.
- Display a picture of a child having diarrhoea in the centre of the circle. Stimulate children to discuss the reasons why the person might have diarrhoea.
- Write their reasons on the board and let the children clarify them.
- Display all the pictures depicting possible treatments and ask them to identify the treatments adopted in their village and display it around the picture of the child having diarrhoea.
- Ask them the following questions:
 - What are the reasons for choosing the treatment? Is it safe?

How can diarrhoea be prevented?

Take the child to a health worker if any of these danger signs of dehydration begin or if the diarrhoea lasts more than two days. Keeping the child liquid, the oral rehydration drink is best while going to the health centre.

Diarrhoea can be prevented by:

- Keeping ourselves and our surroundings clean.
- Eating properly so the child grows well.
- Using clean water.

Stools, dirt and rubbish contain germs that can cause diarrhoea. These germs can be carried by flies as well as on dirty hands. Keep these germs away from food and drinking water. Wash your hands and remember to wash the children's hands too.

- After using the toilet: if there is no one, make sure that the whole family passes stools far off from the house and far from any water. Stools passed close to the house should be taken away and buried.
- After cleaning children who have defecated.
- Before cooking or eating.
- Before feeding children.

Treating diarrhoea

1. Let the child drink plenty of fluids

The most important thing is to be sure that the child drinks as much liquid as he or she has lost, from the time the diarrhoea starts. Rehydration is putting back into the child's body the water that has been lost because of the diarrhoea and vomiting.

Anything that puts water back into the child helps to fight dehydration, e.g.

- Many of the herbal teas and soups that mothers give to children.
- Mother's breast milk which gives the child both food and water. It is important to continue breast-feeding a baby with diarrhoea. Milk in a bottle is never as good as breast milk.
- Rice water (the water in which rice has been boiled) or any other liquid in which food has been cooked, with a little salt, is an excellent liquid for preventing dehydration.
- Any other liquid drink, e.g. coconut water, lime or lemon water, diluted fruit juice, weak tea or soups.

2. Do not give drinks that are very sweet

Do not give drinks that are very sweet, such as fizzy drinks and sweet tea, as this can make the diarrhoea worse. Giving lots of liquid to a child with diarrhoea may at first increase the amount of diarrhoea. This is all right. Most of the fluid will still be absorbed and the body is trying to get rid of the germs in the diarrhoea. A child with diarrhoea needs one cup/glass of liquid (small glass for a small child) each time he/she passes a loose stool.

3. Continue feeding

Sometimes mothers stop giving food to a child who has diarrhoea. This is a mistake. The sick child needs food so that s/he has enough strength to fight the illness. Breast milk is the safest and best food for babies. Encourage older children to take their usual food, several times each day. Be patient. Sick children need to be encouraged to eat.

4. Give medicines

Medicines are not important for most cases of children with diarrhoea and in all cases are less important than fluids and food. NEVER give medicines without the advice of a health worker.

1. Training material for adults

- Sometimes provide techniques and knowledge to make cash create-able local goods using local material and safe water
- a) Coconut wine: made from coconut juice coming from cut of coconut tree and ferment for one or two days using very clean pot, and bottling. Using safe and clean water for washing pot, tools and glass bottle is very important. Boiling for few minutes to kill germ, caps and seal. Percentage of alcohol is only around 3%. But please care for sterilization and ensure safe to drink. In many tropical country, people make spirits from this coconut wine.
- b) Milk wine: made from ferment milk, like yogurt. But should be cold weather. In Mongolia, this drink is famous and called Kumis. I heard some people living near boarder of Tibet also make this type of drink.

1. Training material for adults

- c) Tamarind juice: made from seed of Tamarind, sour but sweet.
- d) Sweet Tamarind: made from seed of Tamarind, sour but sweet. Some people added pepper and chili for hot and sour taste. Pick up the seed, wash with clean and safe water, and dry keep avoiding contamination by insect. In Philippines, people make dry covering net for keep avoiding insect.
- Please make such products after master techniques of sterilization perfectly. I don't know in Nepal, but normally I got support by JICA expert of food processing, or local expert of food processing whom teaching food processing for faculty of agriculture in the university. I hope you can also get assistance from such professional.



A Pakistani boy lies semi-conscious from diarrhoeal dehydration.



1. Training material for adults

2. Development of training material for adults

2. Development of training material for adults

- Develop story board (like storyboard for school kids)

- 1) Decide target group (women's group)
- 2) Select topics including story board
- 3) Arrange sequence and story streamline
- 4) Draw pictures and added short explanation
- 5) Edit and make trial presentation
- 6) Review and discuss for improving