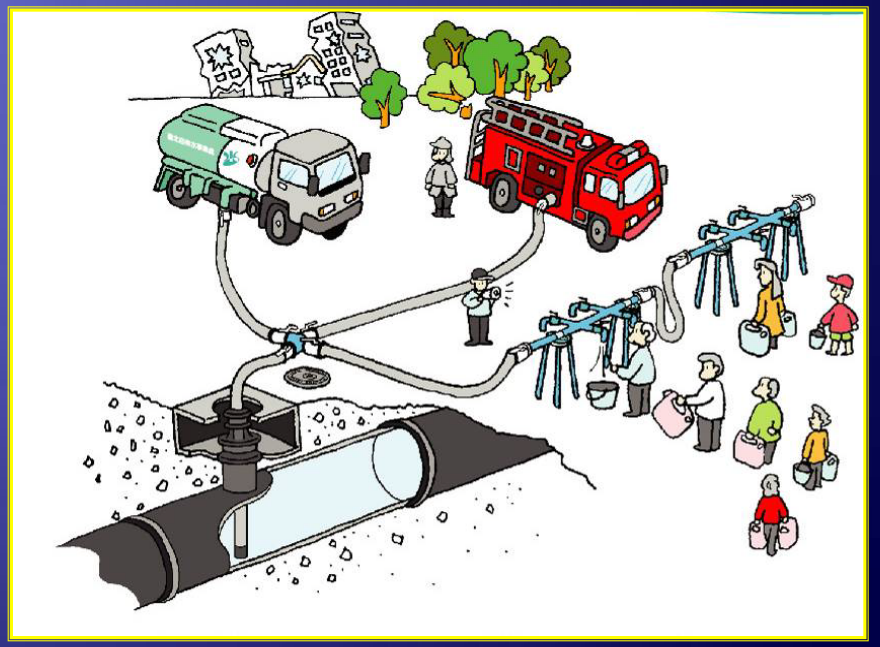
Introduction of Emergency Water Supply Facilities in Taipei Metropolis

H.H.Ju、K.P.Chang、S.J.Shue、S.L.Teng、S.C.Lin



Outline

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  - Water drawing equipment on transmission mains
  - Pipe-form and Concrete Storage Tanks
- Pipe-form emergency storage tank
  - Model Experiment
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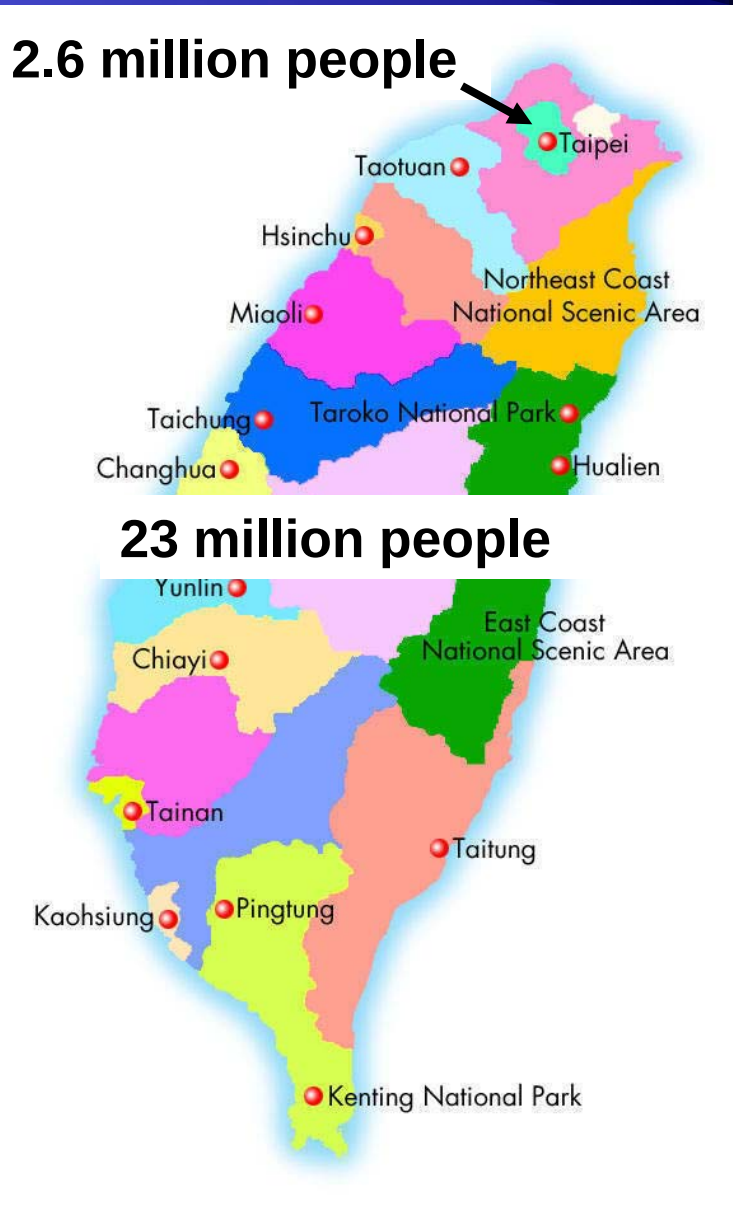
Introduction (1/2)

- 2.6 million people in Taipei.
- Earthquakes took place in Taiwan frequently.
- Earthquake could damage the water supply equipment and pipeline and interrupt normal water supply .
- In view of city disaster prevention and protection facilities, the establishment of emergency water storage facilities is one of the most important tasks.



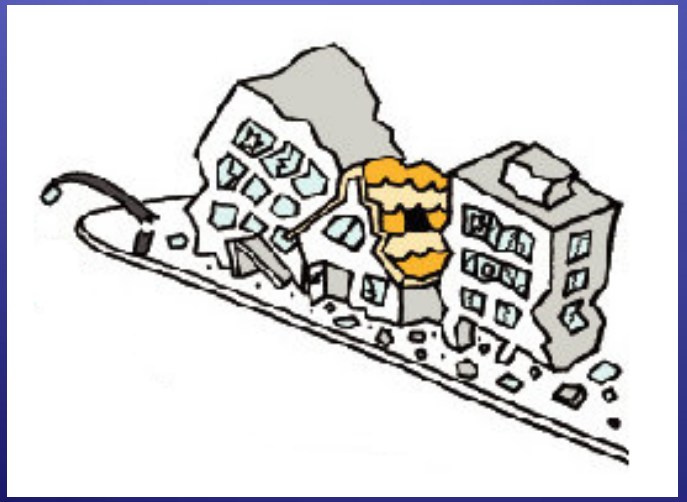
Introduction (2/2)

- In 2004, Taipei City Government instructed Taipei Water Department (TWD) to review the places that are capable to store water and to plan facilities for emergency use.
- Following this instruction, TWD drew an Emergency Water Supply Plan.

Emergency water supply plan

Target of the Plan

To establish emergency water supply storage facilities, which enable TWD to maintain basic drinking water supply to the public at 3 liters per capita for 4 weeks, when a sizable disaster damages the water supply system.



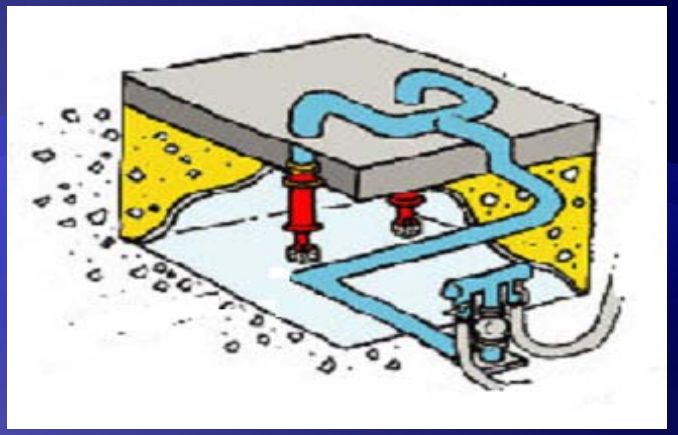
Content of the Plan

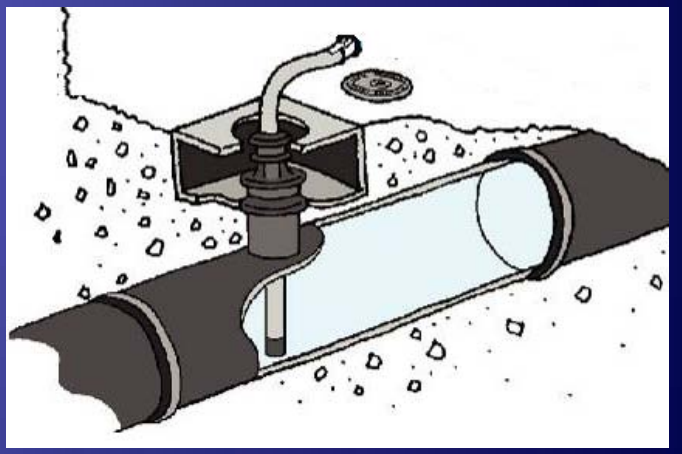
Three kinds of facilities：

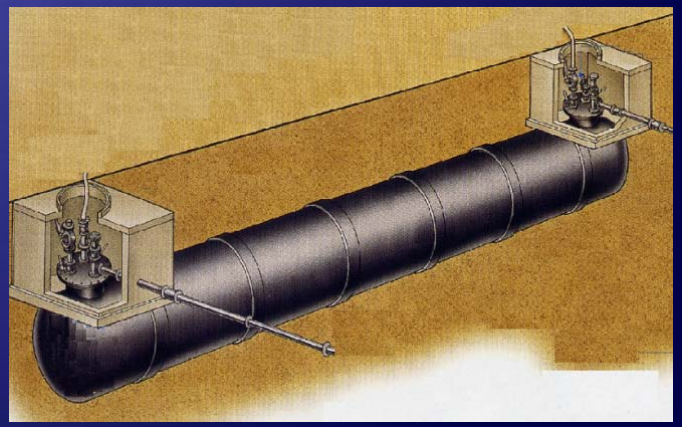
1. Establishing emergency water supply drawing station beside the distribution tanks.

2. Installing water drawing equipment which could draw clear water from the large-size pipes through the air relieve valves.

3. Establishing underground pipe-form tanks or reinforced concrete water tanks in the shelter parks.



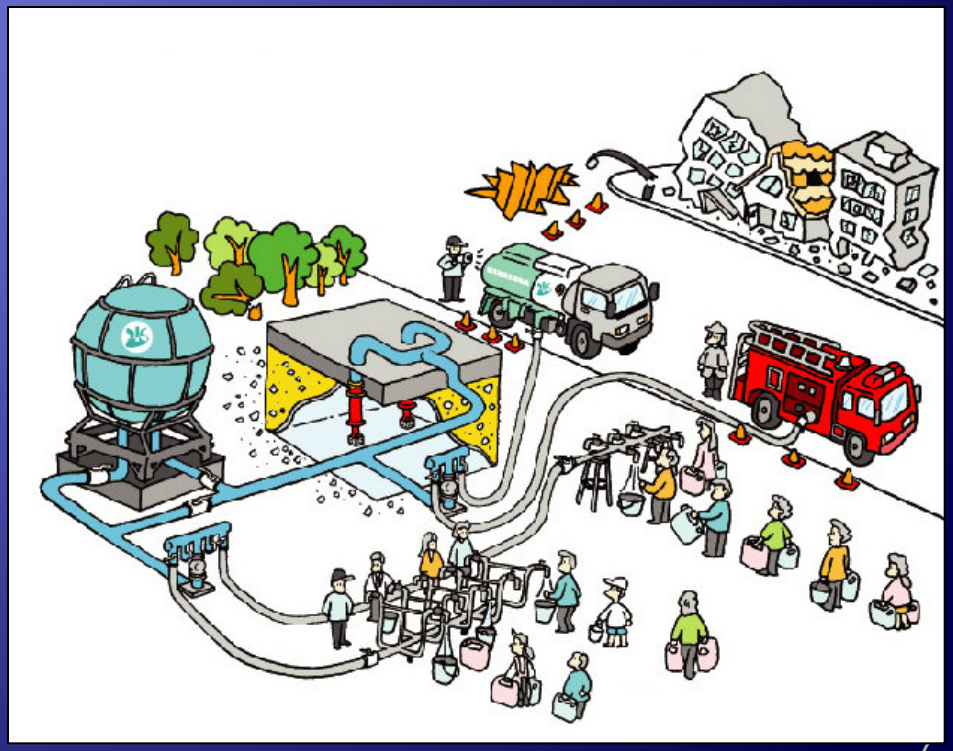




1.The Drawing Station of Distribution Tank

- Pump out the water stored in the distribution tank to storage tank or supply tower and then flow to the drawing ports through branch pipes.

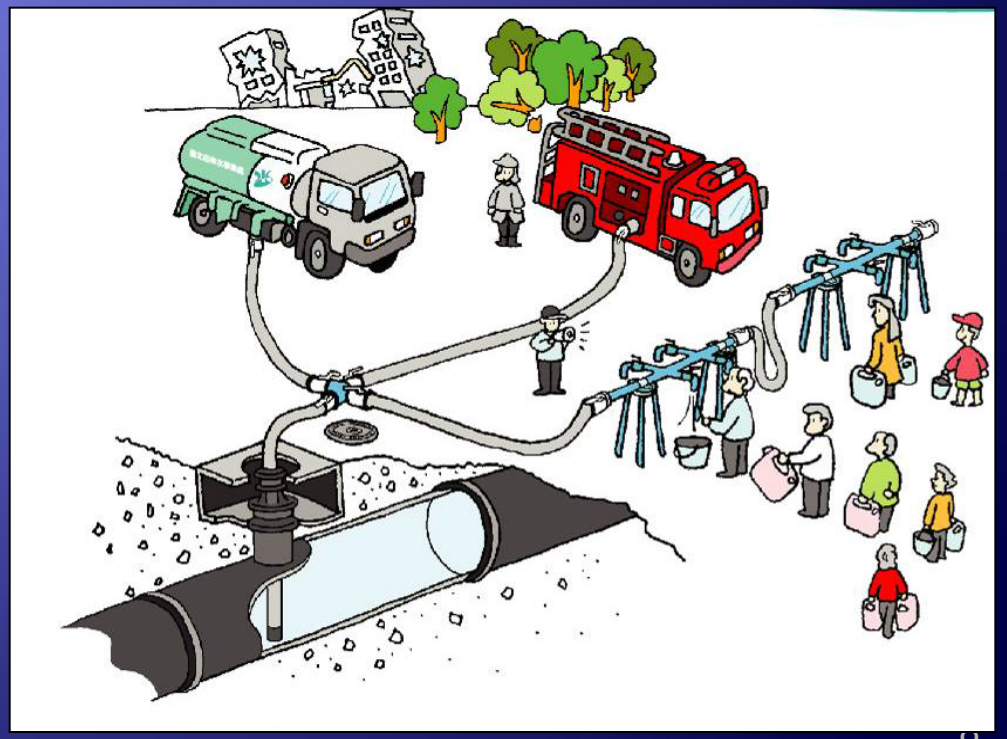
- TWD has completed emergency water drawing stations in 11 distribution tanks.



2.The Drawing Station of transmission Mains

- When water mains broke, the relative lower section of transmission mains is deposited with substantial volume of water and will be a source of emergency water supply.

- TWD has presently completed 19 emergency water drawing stations on transmission mains.

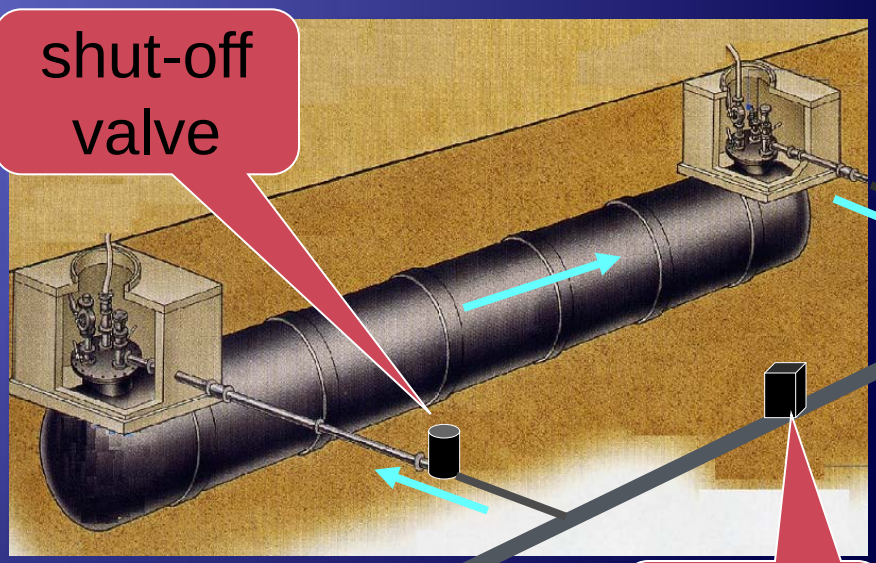


3.Pipe-form and Concrete Storage Tanks (1/2)

(1)Pipe-Form Storage Tank

This is large diameter pipeline buried under park or greens. TWD plans to install 3 pipe-form emergency water storage tanks

- Length : 15 – 30 m
- Diameter : 1.5 m to 2.4 m
- Capacity : Mostly 50 -100 m^3
- shut-off valves installed to distribution pipes



3.Pipe-form and Concrete Storage Tanks (2/2)

(2)Reinforced Concrete Emergency Storage Tank

The reinforced concrete emergency storage tank is just like the normal tank but connected with shut-off valve. In normal days, it is used as distribution tank in supplying water to users. At occurrence of sizable earthquake, the emergency shut-off valve will shut automatically and keep the water inside the storage tank.

- Capacity : Mostly above 500 m^3

4 reinforced concrete emergency storage tanks in 4 shelter parks.

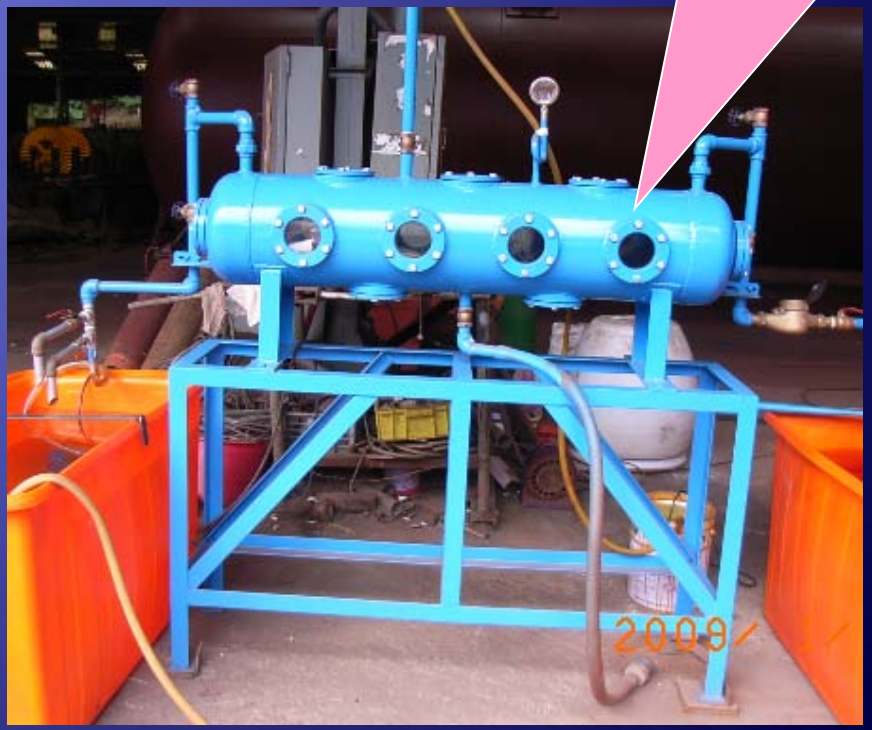
PIPE-FORM EMERGENCY STORAGE TANK

Principle of design

- open-cut method
- enclosed pipe-form storage tank
- Material : ductile cast iron or steel
- Specification : quake-resisting, water tight, water retention ability and fall-off resistance
- Normal days: a part of the distribution pipeline
  Earthquake: shut-off valve works and preserves water
- Storage room : manual pumping facility, emergency water supply equipment (water supply rack and hose).

Pipe-Form Model Experiment (1/5)

- In order to ensure the safety of water quality inside the tank and to prevent pollution due to the idled water, TWD made a 1/10 storage tank model to simulate the flowing of water in the tank.



Model Experiment (2/5)

- Method :colorimetric method

- STEP 1 :

  Store pigmented water in the model.

Model Experiment (3/5)

- STEP 2 :

  Introduce clean water into model.

Model Experiment (4/5)

- STEP 3 :

Observe the color of water from the window. The pigmented water in the model must be repelled before the replacing rate exceeds 6.

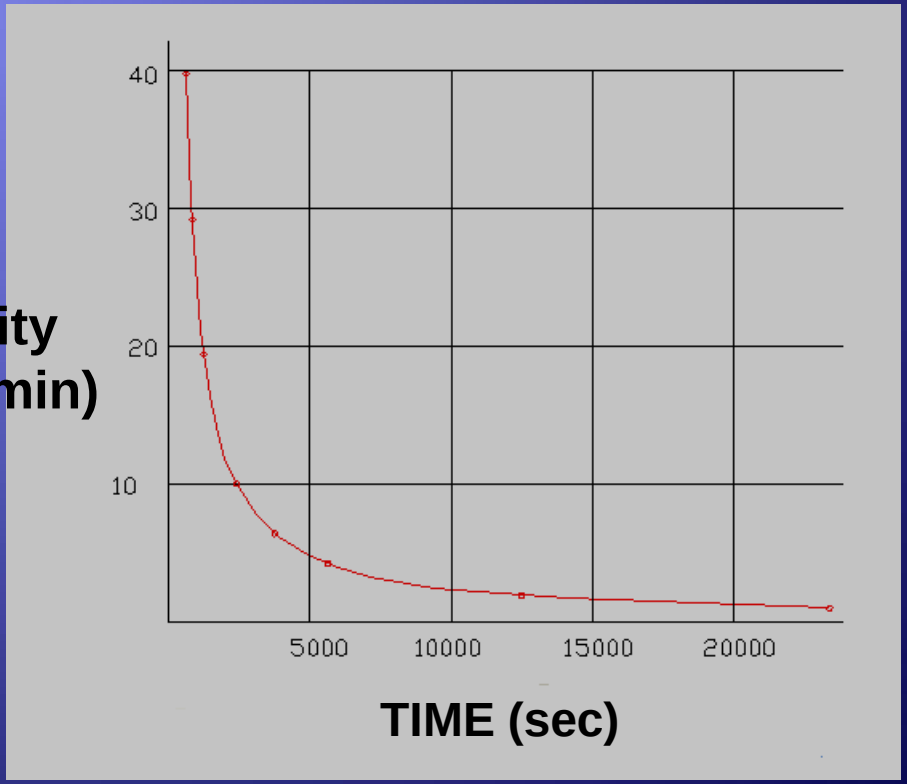
$$replacing \quad rate = \frac{\text{inflow volume}}{\text{storage tank capacity}}$$

before

after

Model Experiment (5/5)

After 6 tests of different velocity, the finding is – “when the velocity is fast, the replacing time is short. “But all the replacing rates did not exceed 6.



Construction Case (1/3)

- Take Jing-hua Park project as an example

Find sufficient space , and determine the type and capacity of tank .

Retaining wall must be made properly .

Construction Case (2/3)

Manufacture and inspect the tank in factory.

Move it to the construction site and pay attention to the traffic and citizens.

Construction Case (3/3)

Hang the tank under ground

Fix it properly

Construction Case (4/4)

Recover the pavement

Set up the storage room

Conclusion

TWD has completed 11 water drawing stations beside the distribution tanks and 19 on the transmission mains. Besides, we planned to set up 12 new storage tanks in the shelter parks and 2 have been completed. When a disaster happens, we can provide water to refugees at the water drawing stations.

Prospect

The Taipei area emergency water supply plan is based on the existing water supply system and the emergency water drawing stations are located according to the distribution tanks , available transmission mains or shelter parks. Due to the restriction, they could not be located very evenly. In the future, We might find other feasible places for establishing more emergency water supply stations, so that the system may be as perfect as possible.

Thank You

TAIPEI

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Construction Steps and Case

The inspection items of storage tank are:

(1) Appearance and dimensions
(2) Coating
(3) Non-Destructive Testing : Welding channels of storage tank must be X-Ray inspected.
(4) Material test : Tolerable stress of material and radioactive-free inspection.
(5) Water Quality Safety : Sampling at site shall meet the standard.
(6) Pressure and Leak Test: Pressure test must be tested to 7.5 kg/cm2 and last for 30 minutes .