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General Status

Strict and Meticulous Water Quality Management

Supply Water without Interruption

Sustainable Management and Overseas Business

Efforts to Improve Citizen Service and Awareness
Organization and Personnel
Office of Waterworks Seoul Metropolitan Government

Organization
- 1 headquarters (5 bureaus, 1 division), 8 water supply offices, 7 centers (6 water purification centers, 1 waterworks equipment management center), 1 research institute

Personnel
- (1,874 people)
- Headquarters (223), water supply offices (1,084), water purification centers (441), Waterworks Research Institute (93), waterworks equipment management center (33)

Headquarters
- Management & Administration Bureau (6 departments)
- Revenue Management Bureau (4 departments)
- Production Bureau (4 departments)
- Water Supply Bureau (4 departments)
- Water Facility Safety Bureau (4 departments)
- Safety Management Division (1 division)

Offices
- Water supply office (8)
- Arisu water purification center (6)
- Waterworks equipment management center

Waterworks Research Institute
- Water Quality Analysis Bureau (5 departments)
- Waterworks Research Bureau (4 departments)
- Future Strategy Research Center (2 departments)
As of December 31, 2018

- Liabilities: 157.5 billion KRW
- Total assets: 5.2491 trillion KRW

2019 revenues and expenditures

- Government subsidies: 0 KRW
- Budget: 835 billion KRW

Office Of Waterworks Seoul Metropolitan Government
Production and Water Supply Facilities

Office Of Waterworks Seoul Metropolitan Government

- 1908, Dduk-do purification plant
- Start supplying tap water for 125,000 people

Production facilities:
- Production capacity: 4,800,000 tons/day
  (6 purification centers, 4 water intakes)
- Average production: 3,200,000 tons/day

Population served:
- 10,049,000 people (2018.12.31)
- 4,264,000 households, distribution rate 100%

Water supply facilities:
- Length of water pipes: 13,571km
- Water reservoirs: 100 locations (2.42 million tons)
- Booster stations: 212 places
- Hydrants: 2,205,000 shatt
Arisu Recognized Worldwide
Office Of Waterworks Seoul Metropolitan Government

- **2000**
  - ISO14001 (Environmental Management)
  - Environment-friendly management to minimize environmental pollution

- **2009**
  - UN Public Administration Service Water Awards

- **2010**
  - IWA (International Water Association) Global Water Industry Project Innovation Awards

- **2010**
  - International Business Awards

- **2016**
  - Effective management harmful elements in the entire ISO22000 (Food Safety Management) production and manufacturing process
Seoul’s tap water Arisu that citizens trust and drink

Production of clean, mineral-rich Arisu

Supply Water Without interruption

Strengthening Capacity for Sustainable growth

Improve Social and Psychological Awareness Of Arisu

Improve Citizen Service

- Preemptive water Quality management From a water source To a faucet
- Optimal management Of faucet disinfection Condition
- Maintaining The ISO22000

- Water supply pipe Which is vulnerable To rust maintenance
- Expansion of reservoir To stable water supply
- Even in a leak accident Uninterrupted water Supply pipe network
- Improve GIS accuracy

- World’s best revenue Water rate management
- Construction of Intelligent Water management system
- Expansion of renewable Energy equipment
- Promote international Status as an advanced City for water supply Facilities

- Support for water Pipe replacement costs
- Converting to Direct-connection Water supply system For high-rise apartments
- Installing Arisu drinking fountain
- Improved awareness About Arisu through the right information Delivery

- Arisu Quality Checking System
- Provide information of Home water quality And supply path
- Water rate notification service
General Status

Strict and Meticulous Water Quality Management

Supply Water without Interruption

Sustainable Management and Overseas Business

Efforts to Improve Citizen Service and Awareness
01 Strict Management of Water Quality
Office Of Waterworks Seoul Metropolitan Government

- 33 branch water quality inspection, Automatic monitoring of source water quality, Biological warning system
- 60 water quality standards + 111 self-monitoring standards, Total 171 items water quality inspection
- Water quality inspection on faucets at 450 different location through Arisu quality checking system

Water source
24-hour real time
Monitoring of water quality

Purification water
Above WHO standards
171 items

Tap water
450 locations
Tap water quality examination at 220,000 households
24-Hour monitoring of water source

Use the surface water of the Han River as source water.

Installation of automated water quality measuring equipment at water intake plants to detect the presence of algae and phenols 24 hours a day.

Reinforcement of monitoring of new microbial elements and secure safe source water.

Operation of Biological-Warning System using the Food Chain Index.

Microorganisms, algae, fish.
Seoul Water-Now System
Office Of Waterworks Seoul Metropolitan Government

- Publication real-time water quality from Source water to faucet: 208 spots
- Water quality information available on Seoul City atmospheric environment electronic bulletin board: 12 locations

Seoul Water-Now System screen page on website

Mapo-gu Arisu water quality residual chlorine: 0.28 mg/L (criteria 0.1–4.0)
Healthy and tasty Arisu
Advanced Water Purification System

04
Office Of Waterworks Seoul Metropolitan Government

Process

- Ozone and Granular Activated Carbon particle treatments added to process

Production of healthy and tasty tap water

Installation and Operation

- all Water Purification plants (3,570,000 tons/day)

Water intake
Coagulation/ Sedimentation
Filtering
Advanced water purification

Active carbon on adhesion
Ozone oxidation

Faucet
**Effect**: Advanced water treatment

**Safe from green algae**
- **Completely remove** odor causing substances such as soil (geosmin) and mold (2-MIB) caused by algae.

**Safe from pesticides**
- Eight insecticide components detected in eggs **were not Detected in Arisu**.

**Safe from micro-plastics**
- **Microplastic was not detected in Arisu**.

**Safe from radioactive material**
- **Total of 12 Management Items**: Artificial radioactive elements (5), natural radioactive element (6), radiation (1).
- Provision of radioactive element removal plan during water purification & creation of response manual.
  - I-131: 100% remove, Cs-134, Cs-137: 80% remove.
Chlorine Disperse Injection System
Office Of Waterworks Seoul Metropolitan Government

05

Residual chlorine equalization across the entire area
the amount of residual chlorine in water at the faucet

Water purification center
Chlorine injection

Reservoir
Chlorine re-injection

Households

Past
Chlorine injection limited to center

Local chlorine odor complaints
Long-distance residual chlorine targets not met

Now
Decentralized injections in water purification center and reservoir

Reduction of chlorine odor
Supply of tasty water (0.1–0.3mg/l of chlorine)

Construction of Chlorine Disperse injection System

15 reservoirs (Nakseongdae, Daebang and others)
Maintaining ISO22000 International Certification
Office Of Waterworks Seoul Metropolitan Government

Certification date  2016.10.27.

Certification scope  6 water purification center systems from water intake to faucet (including bottled tap water)

Certification agency  BSI (British Standards Institution)

Introducing a hygiene concept and Managing a facility (Hazard Analysis and Critical Control Points)
Set up safety goals and operation plans (6 goals and 15 tasks)

Establishing a safe tap water production system (2 manual and 17 procedures)

Effective management of harmful elements in production and manufacturing process

Strengthening hygiene management for all visitors
Repairing weak, old water pipes to create an environment to supply safe, clean tap water

**Business scope**
- 13,571 km (13,396 km repaired, 98.7% completed)

**Business period**
- 1984~present

**Total business expenses**
- 3,512.3 billion KRW (invested cost from 1984 to 2018: 3,338.4 billion KRW)

- **Built before 1983**
  - Rust often generates

- **Replacement of corrosion resistance pipes**

- **Stainless steel pipes**

- **Ductile cast iron pipes**

- **Gray cast iron pipes**

- **Galvanized steel pipes**
Expanding reservoir for establishment of a stable water supply system
Office Of Waterworks Seoul Metropolitan Government

Newly construct or expand reservoir to establish a stable water supply system without a shutoff even during waterworks construction, leakage accidents, etc.

- Newly construct or expand reservoirs
- Reservoirs status: total 100 locations, 2.42 million tons, 2018.12.31
- Business period: 2015 – 2030
- Total business expenses: 108.2 billion KRW

Water supply by natural flow type
Build a systems that can supply tap water under any circumstances (2018~2030)

01 Establishment of supply system between Arisu water purification centers

02 Stable supply of tap water through Double line of main water line

03 Establishment of efficient block system

04 The main valve of the water supply pipe was electronicized for remote control
Close examination of facilities’ location, depth and data and construction of tap water GIS database

- **Project objective**
  - Establish Construction of water pipeline (9.647km / more than 80mm diameter)

- **Progress report**
  - Completed 72.6% (7,003km) as of December 2018

- **Project period**
  - 2005 – 2022 (Cost: 87.8 billion KRW)

- **Project detail**
  - Close examination of facilities’ location and specifications
  - Measurement of coordinates using state-of-the-art equipment such as Global Navigation Satellite System (GNSS) & editing of database

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- **Tap water facilities research and inspection**
- **Precise (Coordinate) measurement**
- **Modification/editing of database**
World’s best revenue water rate management

Office Of Waterworks Seoul Metropolitan Government

Replacement of old facilities
- Systematic management of waterworks facilities
- Removal of disused pipes, Preemptive leak detection

Scientific management of water supply quantity
- Water intake and flow meter management, booster area management, flow management block by block

Producing savings
500 million tons per year

Revenue water rate
95.1% (2018)

Trend in revenue water rate changes

Comparison to major cities in developed countries(2017)

Paris
New York
London
LA
Tokyo
Osaka
Seoul

39.9% increase from 1989 to 2018
Information on the supply and distribution of tap water is collected in real time via the Smart Water Grid and holistically managed in order to improve management efficiency and ensure a prompt response in the event of an emergency.

**What is the Smart Water Grid?**

A next generation water control system combined with state-of-the-art IT technology in order to enhance management efficiency of water resources, supply and drainage.

- **Intelligent Purification Plant**:
  - Integrated automated operation of the entire process
  - Estimate demand / Create plan

- **Intelligent Main Water Pipe Network**:
  - Create optimized GIS-based block system
  - Implement main valve remote control system

- **Water gauge remote monitoring**:
  - Create ICT-based remote monitoring system
  - Implement trial run of remote monitoring system
Environmental Friendly Energy, Recycling Facilities
Office Of Waterworks Seoul Metropolitan Government

Production of renewable energy
- Solar power
- Geothermal
- Small hydro

- Produced 18,448 mwh/year, reduced manufacturing cost of 640 million KRW (2018)

Environmentally friendly usage of sludge originating from water purification process
- Construction using prototype water-permeable soil concrete and water-permeable blocks at 3 water purification centers to reduce the waste processing cost

Reduction of the cost of generating tap water, reduction of waste management fees, improvement of productivity

Solar power
Geothermal
Small hydro
04 Lowest Water Fees in the World
Office Of Waterworks Seoul Metropolitan Government

Minimizing fees through sensible management

Comparison of tap water fees

- Korea Seoul: 0.49
- U.K. London: 2.17
- Denmark Copenhagen: 2.77
- U.S. New York: 3.13

Tap water fees (USD/m³)
Applied exchange rate: 1066.30 KRW / USD

*City of Seoul froze the cost after an increase in March 2012

Water usage costs in Seoul are 5.7 and 6.4 times lower than Copenhagen and New York respectively (as of January 2018)
05 Pursuit of international expansion of waterworks project
Office Of Waterworks Seoul Metropolitan Government

- Participated in infrastructure development consulting project of PMB Island, Brunei
  - Dispatch supervising personnel, 2016.04 – 2020.04

- Pursuit of waterworks system improvement project in Chanchamayo city, Peru
  - San Ramon, La merced, Pichanaki(2012 ~ 2018, 2.5billion KRW)

- Completed water facility improvement project for regions in Vietnam
  - Huế, Vietnam, 2016.01 – 2016.02

- Conduct training for representatives from target capital cities (2~3 times per year)
  - Dispatch professional personnel (Ninh Binh and Hai Duong, Vietnam)

- Operate private–government council for overseas advancement of waterworks
  - Operation of subcommittee for consulting, design, construction, water quality, and equipment
International Waterworks Project

ODA for the International Waterworks Project

- ODA for improving the intake & water treatment facilities and water supply system in Chanchamayo city, Peru from 2013 to 2018

Bidding as a Private and Public Consortium for the International Waterworks Project

- Contracted an infrastructure consulting service of PMB Island, Brunei (2016. 4.~ 2020. 4.)
Supporting policy for the International Waterworks Project
Office Of Waterworks Seoul Metropolitan Government

MOU for Promoting the Cooperation Projects of Waterworks with Foreign Cities
- 11 cities and institution in Brazil, Thailand, Papua New Guinea and others

Training Camp for Foreign Waterworks High Officials
- Instructed 40 high level officials each year from ASEAN and Latin America
- 223 people from 34 countries participated in 18 events held from 2012 to 2018
General Status
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Supporting replacement of old indoor water pipes
Office Of Waterworks Seoul Metropolitan Government

Since old indoor pipes become a reason for deteriorated water quality, replacement construction cost is supported to prevent the release of rust and improve the water quality.

Implementation performance

565,000 households, 255 billion KRW (2007 – 2022)

Details

389,000 households, 147 billion KRW (69%)
(Supporting up to 80% of the cost within the upper limit for each housing type)

<table>
<thead>
<tr>
<th>Classification</th>
<th>Social welfare facilities and beneficiary of basic livelihood security aid</th>
<th>Single house</th>
<th>Multi-household house</th>
<th>Apartment houses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replacement construction : within 80%</td>
<td>Entire construction cost</td>
<td>1,500,000 KRW max</td>
<td>2,500,000 KRW max</td>
<td>1,200,000 KRW max (400,000 KRW common water pipes)</td>
</tr>
</tbody>
</table>
Improved from water tank supply method to pressurized direct-connection water supply method, supplying clean Arisu to faucets to improve the drinking rate

- Existing apartments converting to direct-connection water supply method
  - For: 1,325 complexes (39% of 3,359 apartment complexes that have 6 floors or more)
  - Results: 443 complexes completed from 2014 to 2018

- Assigned conditions for direct-connection water supply after agreeing on water supply of new apartments with construction permission (178 complexes completed)
Arisu Quality Checking System
Office Of Waterworks Seoul Metropolitan Government

Water quality testing service provided for water faucets in every household

**Testing items**  Residual chlorine, Turbidity, pH, iron, copper

**Objective**  300,000 households each year (220,000 households from 2019)

**Methods**  Immediate inspection at faucet

When inadequate, an additional seven items are thoroughly checked and an improvement plan is formulated

**Testing items**  Typical germs, Total E. coli groups, E. coli, Ammoniacal nitrogen, Chlorine ion, Zinc, Manganese

Diagnosis of general condition of in-house water pipe and tank performed free of charge
Creating an environment where drinking water can be enjoyed by Installing Arisu drinking fountain at places where there are many citizens, Such as schools, kindergartens.

**Policy Information**
- Elementary School and Middle School 1,353(1,290 School 20,400 units completed)
- Installing Arisu drinking fountain in Park, Circumference, National and Public kindergarten

**Expense**
- 86.6 billion KRW

**Maintenance**
- Outsourcing

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**Elementary School**

**Kindergarten**
Confirmation service of our home supply path

Office Of Waterworks Seoul Metropolitan Government

Information of home water quality, Secure tap water through real-time confirmation

Policy Information

- Tight monitoring system by installing an automatic water quality meter
- Map-based verification of household Arisu supply route & water quality per route
[Thank you]
Office of Waterworks
Seoul Metropolitan Government

Healthy and tasty
Globally expanding Arisu