How to reduce water leaks
In case of TOKYO

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Keynote session2.1 Water Loss & Leak Detection

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Theatre1, Level 1

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Overview of Tokyo Waterworks

(2017 FY)

Water Supply Area	**1,239.27 km^2**
Households Supplied	**7,550,000**
Coverage	**100.0 %**
Distribution Pipe Total Length	**27,125 km**
Annual Water Distribution Volume	**1,541,705,000 m^3**
Annual Leak Repairs	**7,977**
Material of Distribution Pipes	**Ductile Cast Iron Pipes**
Material of Supply Pipes	**Stainless Steel Pipes**
The number of Staff	**3,824**

(Ward Area and 26 cities in the Tama Area)

2017: 27,125 km

2/3 circumference of the Earth

1

Which is the correct leakage rate in Tokyo?

A: 10%

B: 5％

C: 3％

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Initiatives

Trends in water leaks in Tokyo

1945:80%
(End of WWⅡ)

1949:30%

1963:20.3%

1992:10.2%

2017:3.5%

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Initiatives

Water Leak Countermeasures

Early detection and repair of leaks

◆Mobile Work: Immediate repair of water leaks
◆Planned Work: Systematic detection and repair of underground water leaks

Systematic replacement of water pipes and improvement of pipe materials

◆Adopt ductile cast iron pipe as distribution pipe
◆Adopt stainless steel pipe as service pipe

Securing advanced water leak prevention skill

◆Human resource development

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Initiatives : Planned Work

Planned Work

●Observation survey works

 →Early detection and repair of underground leaks

➢**Survey with acoustic bar**

 Checking leaks from service pipe with acoustic bar

➢**Surveys with electronic detector**

 Specify the location of leaks from Distribution pipe with electronic detector
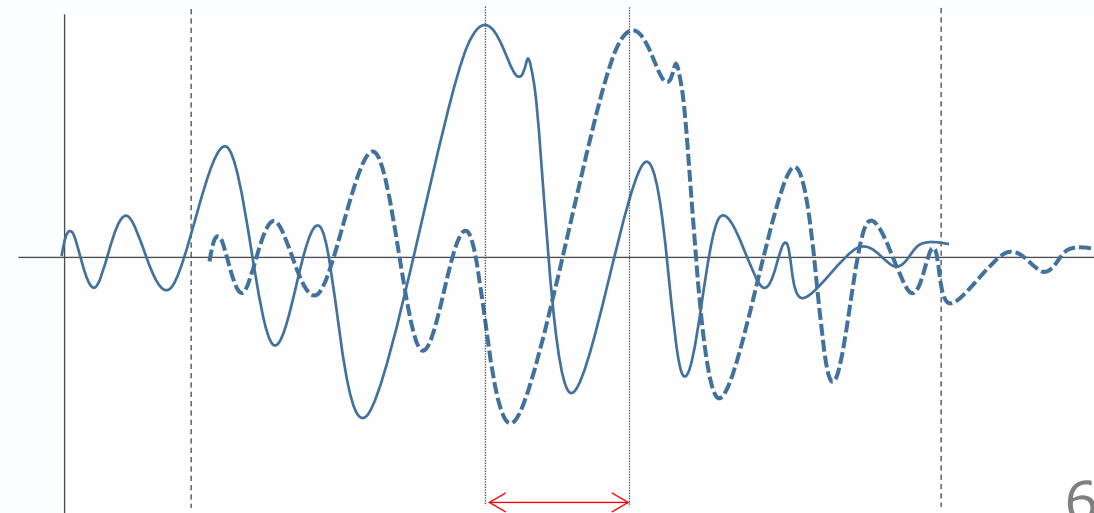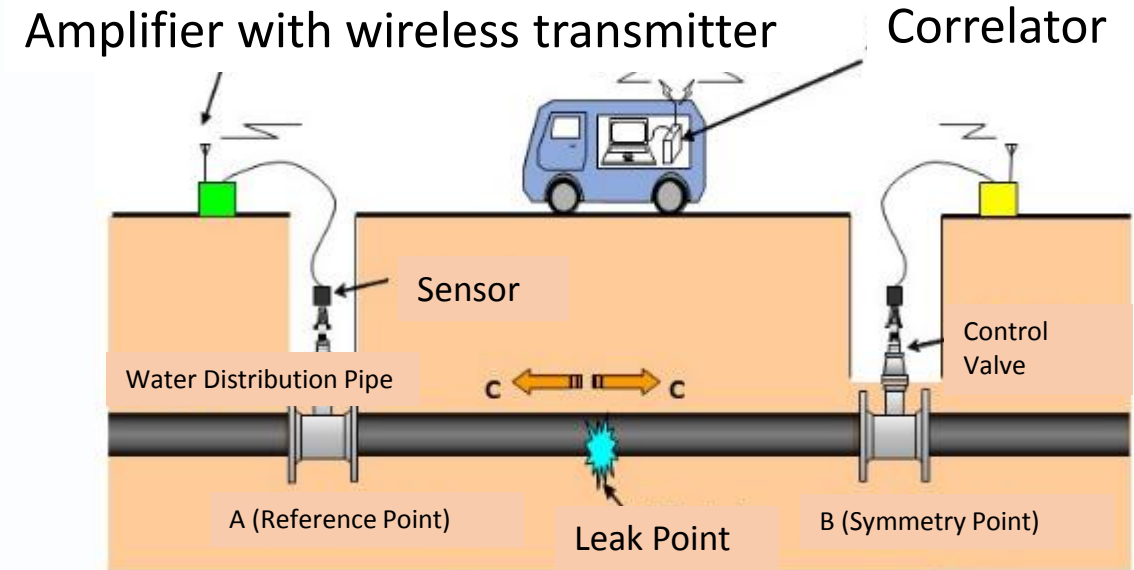

▲Survey with electronic detector

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Initiatives : Planned Work

●Correlation Leak Detector

First Adopted: 1984

<POINT>

- Identifies the location of a leak by taking time gap to reach 2 points.

Amplifier with wireless transmitter   Correlator

Sensor

Control Valve

Water Distribution Pipe

C ← → C

A (Reference Point)   Leak Point   B (Symmetry Point)

Initiatives : Improving Pipe Quality

Improving water supply pipe material

Replacing lead pipes with stainless steel pipes from distribution pipe outlets to the meter

Saddle Tap

Public Road Part

Corrugated Stainless Steel Pipe

Private Home Part

Distribution Pipe

Supply Pipe

Water Meter

Gate Valve B-SSP
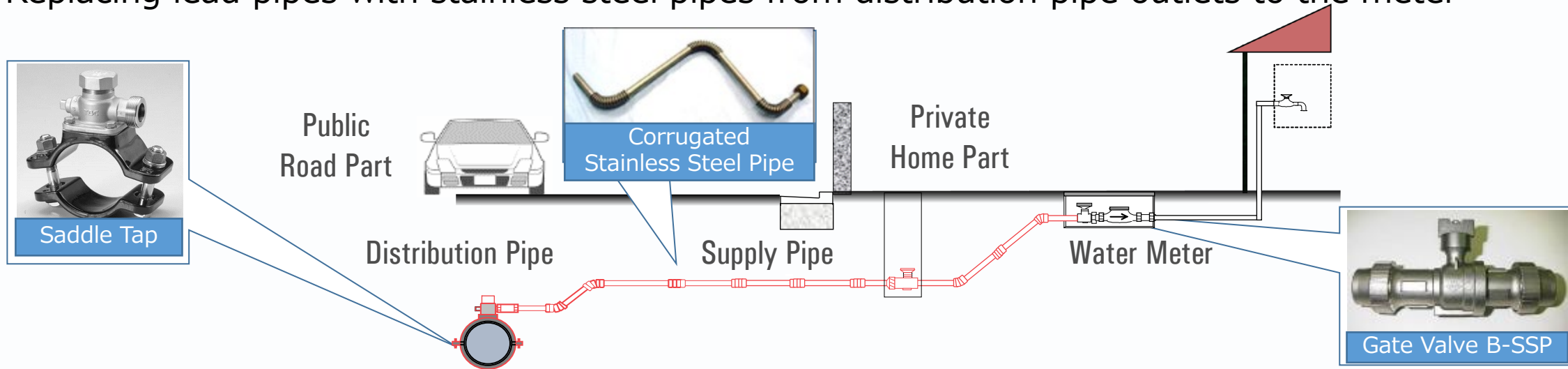
Improving water distribution pipe material

Replacing weak cast iron pipes with ductile cast iron pipes, preventing corrosion with poly sleeves

Poly Sleeve

Water Distribution Pipe

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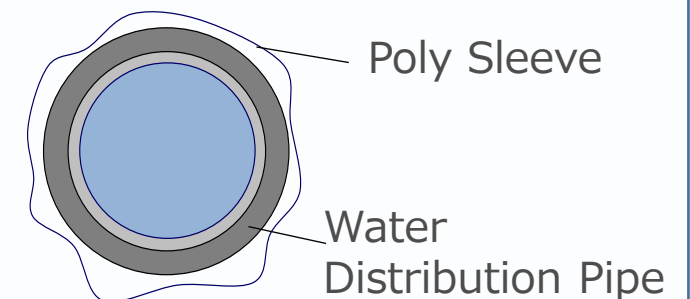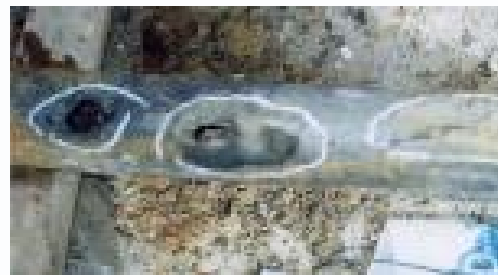
Initiatives : Employee training
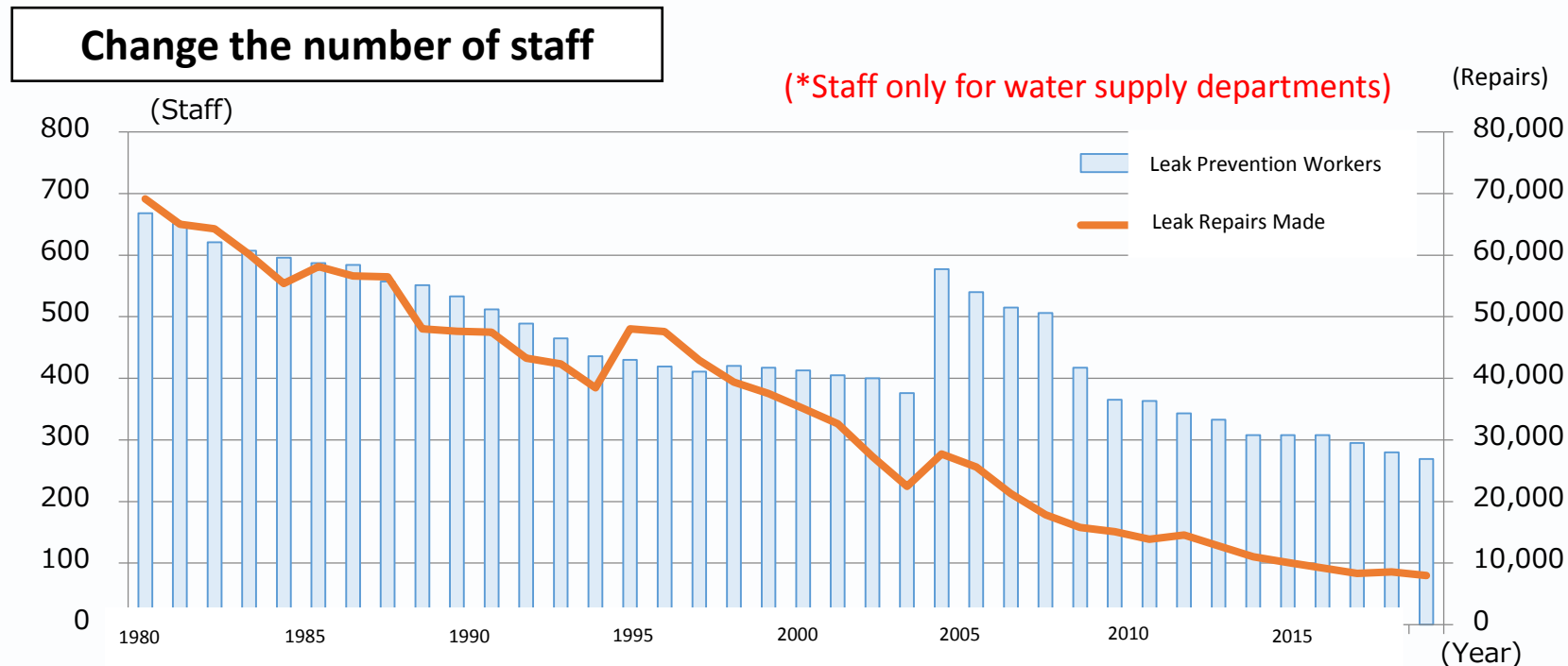
●**Current Issues**

- Maintaining low leak rate
- Number of staff falls with decreasing repairs
- Many experienced staff retire

➡ Train employee and use new and effective water leak methods to take effective and reliable water leak prevention measures

Change the number of staff

(*Staff only for water supply departments)

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Initiatives : Employee training

●**Training and Development Center**

➢Works on technology transfer, improving staff capabilities, and developing devices

➢Other domestic and overseas engineer staff also use here for training

●**Tokyo Waterworks Expert System**

➢Highly skilled and experienced staff are recognized to promote effective employee training and technology transfer

●**Knowledge Bank**

➢Skills developed in the field are made into videos and uploaded to a shared network

➢All staff can view them, and that enables the transfer of knowledge and skills

技術伝承アーカイブス
漏水音の識別 6/7
・漏水の擬似音

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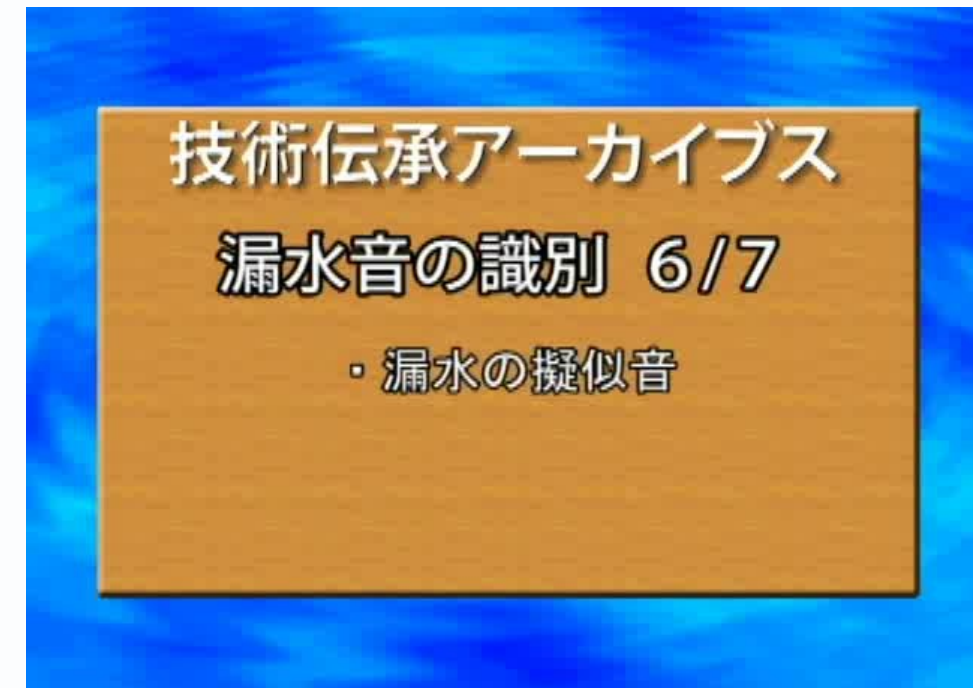
Leak countermeasures using ICT devices

● In addition to the 6,000 unit model project in Harumi area, we have also made a <u>trial project</u> to introduce smart meters to 100,000 units by 2025

Harumi 5-chome area Model Project

Trial Project

➢ In Harumi area, where the Olympic Village will be renovated into housing after the Tokyo 2020 Games, we will implement a smart meter model project in cooperation with TEPCO.
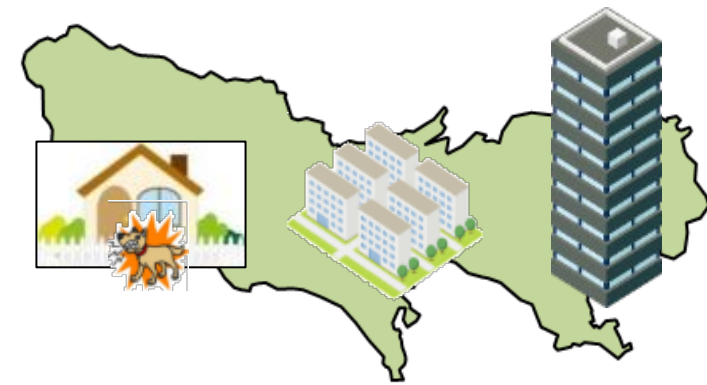
➢ By 2025, we will introduce 100,000 smart meters in various areas of Tokyo to promote technological development and cost reduction.

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Leak countermeasures using ICT devices

● We conducted demonstration experiments using data from smart meters installed in multiple areas -pilot areas- in Tokyo for maintenance and management of pipelines.

Image of demonstration experiment

Emergency Medical Institutions

Smart Meters at Each Building and Housing

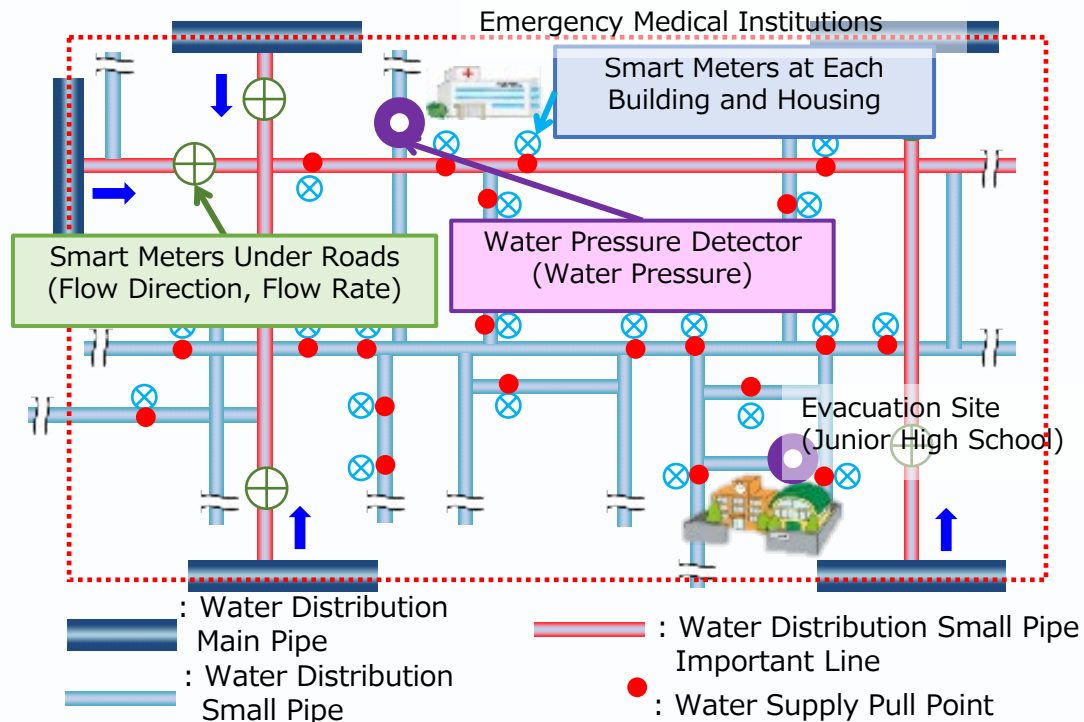Smart Meters Under Roads (Flow Direction, Flow Rate)

Water Pressure Detector (Water Pressure)

Evacuation Site (Junior High School)

: Water Distribution Main Pipe

: Water Distribution Small Pipe

: Water Distribution Small Pipe Important Line

: Water Supply Pull Point

Purposes

Quantitative understanding of water flow rate, flow direction, and pressure to…

- Efficiently maintain and manage pipelines
- Reduce range of turbid water during accidents
- Accelerate accident response with early detection of water leaks
- Reduce maintenance costs and renewal costs for pipelines

Locations

Set areas where water usage is different

- ・Core capital areas
- ・Residential areas
- ・Industrial areas
- ・Commercial areas

Use data from smart meters not only for automatic meter reading, but also for bureau projects, in order to refine and streamline, and see from new perspectives to create cost-effective results.

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Leak countermeasures using ICT devices

- In order to improve the efficiency of water leak investigation and early detection of pipe abnormalities, we will introduce a water leak investigation method using multipoint correlation water leak detectors.

Stage 1: Collect data in the field for wide range survey of water leaks

Collect and analyze data in the field

- Point A — Point B
  A＞leak 30 m
- Point A — Point C
  A＞leak 30 m
- Point A – Point D
  A＞leak 30 m
- Point A – Point E
  A＞no leak
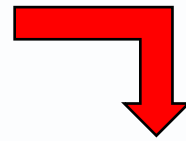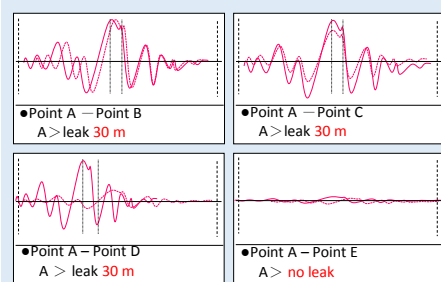
Stage 2: Collect data in the cloud for continuous monitoring of leaks on maps

Cloud

Office

Base Station /Relay Station

Leak Point
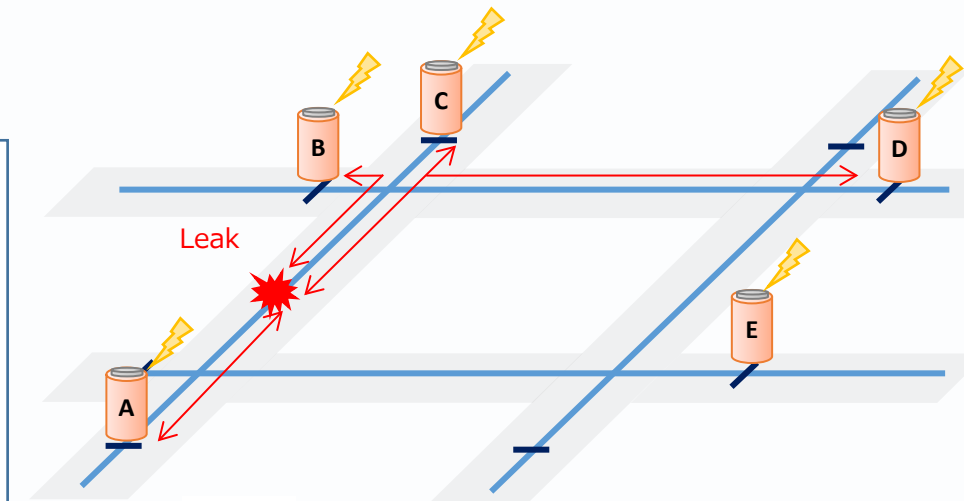
Leak

Key

— : Distribution Pipe

| : Control Valve

: Loga Sensor

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Future prospects for water leak reduction

Issues related to the maintenance and management of pipelines

Data acquired through pipeline diagnosis work
- Difficulty of site environment
- Degree of aging of ancillary equipment
- Past accident rate

Data separately controlled

GIS system
- Searching and outputting of various drawings related to pipelines
- Simulation of area that would be affected by water suspension
- Compilation of data on pipeline lengths
- Searching of detailed information including pipe diameters, types and installation years

Not reflected yet

Pipeline reconstruction plan

Pipelines of approximately 5,000km will be made earthquake-resistant in 10 years

2025:Installation rates of earthquake-resistant joints =61%

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Future prospects for water leak reduction

The data from pipeline diagnostic work

Type	Tokyo's 23 wards	Tama area	Total
Gate valve	248,605	137,227	385,832
Air valve	9,435	6,475	15,910
Drain valve	7,595	3,291	10,886
Fire hydrant	90,379	42,237	132,616
Vertical shaft	241	75	316
Telemeter	260	55	315
Aqueduct bridge	24	69	93
Total length of aqueduct bridges（m）	535	1,269	1,804

GIS System

Main functions of GIS system

Mapping function　　　Filing function

Suspension and turbidity simulation function　　　Totalization function

Dedicated terminals
Web mapping system

➡ Build a comprehensive pipeline maintenance system
(Makes it possible to grasp weak areas of the pipe network by correlating with more detailed regional pipe health and accidents)

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Future prospects for water leak reduction

Plan

Developing a reconstruction plan

Pipeline diagnosis work plan

- Developing the next reconstruction plan and pipeline diagnosis plan according to verification

ICT

Do

Implementation of projects

On-site response

- Implementing projects such as pipeline reconstruction facility replacement according to pipeline reconstruction plan
- Implementing pipeline diagnosis and function investigation
- On-site response to accidents

Works by human power

Action

Analysis and verification by the system

- Analysis of accident-related factors
- Efficient analysis of big data
- Multifaceted analysis using new insights
- Verification according to analysis

Check

Progress managementUtilizing data in the system

- Managing the progress of projects such as pipeline reconstruction diagnosis and investigation
- Inputting data on the statuses of pipeline reconstruction and diagnosis outcomes into the GIS System

１５

Future prospects for water leak reduction
– Information management system for the next generation –

All information will be collected, which enable us to analyze various data and develop plan.

Sensors in pipes, valves and smart meters transmit data to the head office.

In case of leakage accidents, this system shows which valves should be operated.

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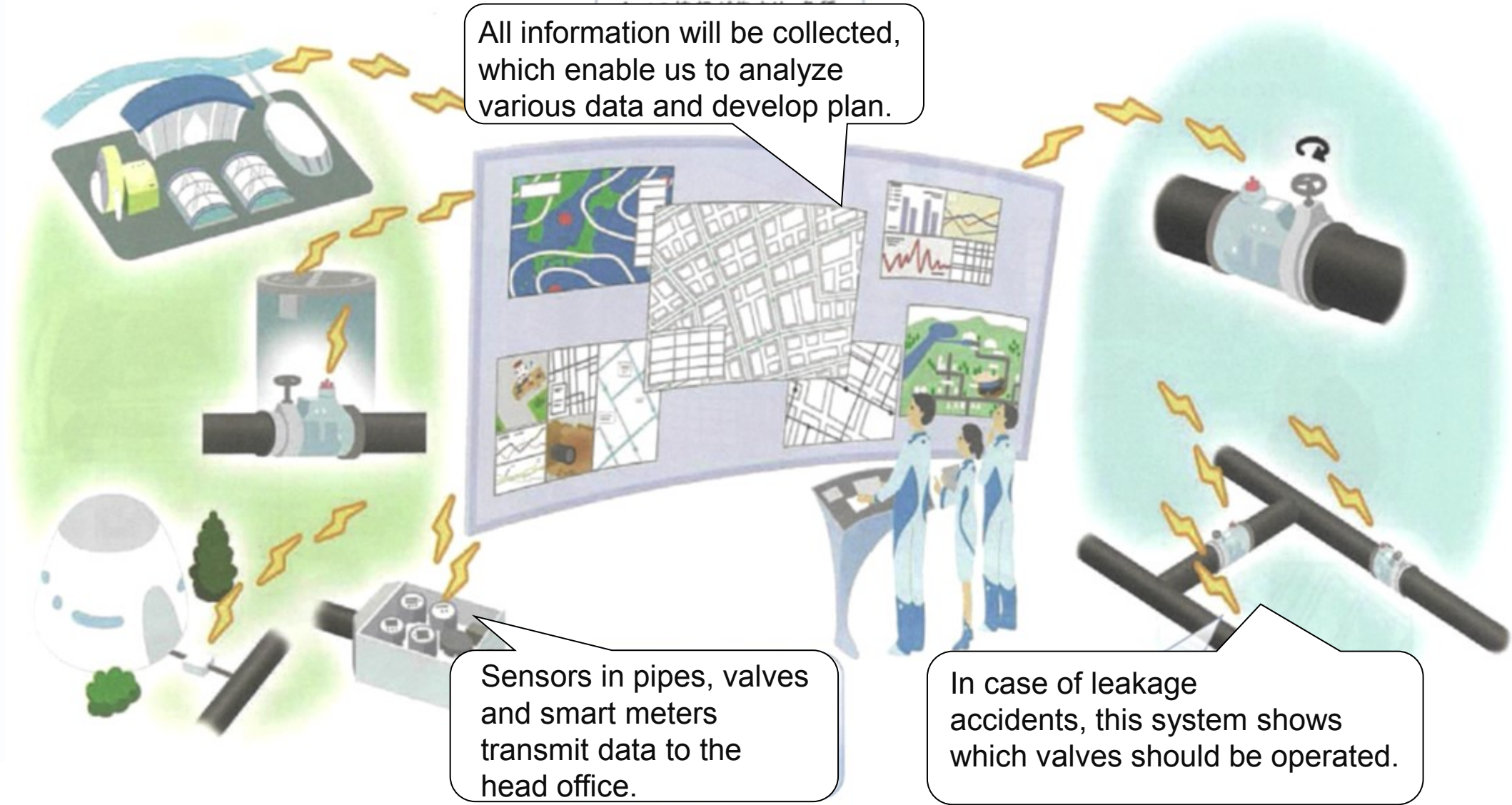
Initiatives For The Olympic And Paralympic Games

	The 32nd Olympic Games	2020 Tokyo Paralympic Games
Period	July 24th – August 9th, 2020	August 25th – September 6th, 2020

Just 9 months to go !

Initiatives For The Olympic And Paralympic Games

- **Conclusion of "Bureau of Waterworks, Tokyo Metropolitan Government Terrorism Countermeasures Partnership"**
  ➢ Local residents watch over basic water supply facilities such as water purification plants

- **Terrorism Countermeasures**
  ➢ We conduct counterterrorism drills

- **Machining of iron lids**
  ➢ Changed to a structure that can be opened only with special keys

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Initiatives For The Olympic And Paralympic Games

Night Listening Surveys

Patrol Surveys

Vicinity of Event Venues

STATION

- **<u>Investigation of water leaks around stadiums</u>**

➢ Conduct patrol work in the vicinity of event venues

➢ Conduct night listening survey work on spectator transportation routes

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Thank you for listening!