Maintenance of House Pipes in Japan’s City Gas Industry: Regulations and Voluntary Initiatives by Gas Utilities

October 2015
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- Priority Ranking of Countermeasures Based on Risk Management Approach
- Issues and Changes in Remaining Pipes over Time

#### III-2: Countermeasures for Damage from Third Party Construction on User Property
- Accident Incidence Conditions
- Accident Prevention Initiatives
## I. Overview of Customer’s Gas Facilities (House Pipes): Types of Pipe

- General gas utilities in Japan: 206 utilities
- No. of general gas utility users (no. of installed meters): approx. 29 million
- No. of laid gas pipes: approx. 14 million

### Main types of pipe used for gas pipes

<table>
<thead>
<tr>
<th>Type of Pipe</th>
<th>Photo</th>
<th>Joining Method</th>
<th>Main Areas of Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyethylene pipe</td>
<td><img src="image" alt="Polyethylene Pipe" /></td>
<td>Fusion joint, Mechanical joint</td>
<td>Underground buried sections</td>
</tr>
<tr>
<td>Polyethylene-coated pipe</td>
<td><img src="image" alt="Polyethylene-Coated Pipe" /></td>
<td>Mechanical joint, Welded joint</td>
<td>Underground buried sections, Exposed sections in corrosive atmospheres</td>
</tr>
<tr>
<td>PVC-coated steel pipe</td>
<td><img src="image" alt="PVC-Coated Steel Pipe" /></td>
<td>Screwed joint, Mechanical joint</td>
<td>Buried sections/outdoor exposed sections, Exposed sections in corrosive atmospheres</td>
</tr>
<tr>
<td>Galvanized steel pipe</td>
<td><img src="image" alt="Galvanized Steel Pipe" /></td>
<td>Screwed joint</td>
<td>Indoor exposed sections (including concealed sections) (also used for buried sections until the 1980s)</td>
</tr>
<tr>
<td>Stainless steel flexible pipe</td>
<td><img src="image" alt="Stainless Steel Flexible Pipe" /></td>
<td>Mechanical joint, Screwed joint</td>
<td>Internal gas pipes (sheathed pipe is used if buried)</td>
</tr>
</tbody>
</table>
1. Outline of customer’s gas Facilities (house pipe) <division of duty>

- **Service pipe**
  - External gas pipe
  - Meter gas valve

- **House pipe**
  - Internal gas pipe
  - Gas meter

- **Gas appliances**
  - Gas outlet

- **Public roads**
  - District main

**Assets classification**
- **Gas utility**
- **Customer**
  - *Gas meter is utility’s asset*

**Duty to Conform to Technical Standards**
- **Construction classification**
  - Construction request from customer

**Construction request from customer**
- **Customer**
  - **Gas utility**
  - **Customer**
I. Overview of Customer’s Gas Facilities (House Pipes): Maintenance

House pipes are maintained through the installation of safety equipment/facilities and leak detection tests based on regulations and voluntary initiatives by gas utilities.

I. House Pipe Maintenance-Related Regulations

- **Installation of safety equipment**
  Intelligent meters, various gas shut-off devices, etc. (including equipment not stipulated by regulations)
- **Leak detection tests**
  Leak detection tests based on stipulated frequency and method

II. Voluntary Initiatives by Gas Utilities

The following are two essential issues relating to house pipe maintenance in Japan:

- **Countermeasures for aged buried house pipes**
  Promoting improvement of pipelines at risk of corrosion on user property
- **Countermeasures to prevent damage from third party construction on user property**
  Preventing damage to gas pipes due to construction work, etc., by companies other than gas utilities on user property
II. Legislation concerning pipeline maintenance

Gas Business Act

Ministerial Ordinance Providing Technical Standards for Gas Facilities (“Technical Standards Ordinance”)


Sample Interpretations of the Gas Facility Technical Standards

Reference

JIS
Private-sector standards
Foreign standards
Voluntary industry standards

Laws and regulations
Technical standards
Interpretation
II. House Pipe Maintenance-Related Regulations: Building Classification

Safety measures are implemented based on user characteristics (building purpose, type of gas usage, etc.), and for the purpose of ensuring safety, buildings that use gas are divided into 11 Classifications.

<table>
<thead>
<tr>
<th>Building Classification</th>
<th>Overview</th>
<th>Safety Priority Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Specified underground mall</td>
<td>Large-scale underground malls, semi-underground malls, etc. (basement areas only)</td>
<td>1</td>
</tr>
<tr>
<td>2 Specified basement</td>
<td>Large-scale basement, etc. (basement areas only)</td>
<td>2</td>
</tr>
<tr>
<td>3 Skyscraper</td>
<td>Building exceeding 60 m in height (including residential skyscrapers)</td>
<td>3</td>
</tr>
<tr>
<td>4 High-rise building</td>
<td>Building exceeding 31 m in height (including residential high-rise buildings)</td>
<td>5</td>
</tr>
<tr>
<td>5 Specified large building</td>
<td>Building used for specific business purposes with converted total Qmax gas meter reading of 180 m³/h or more</td>
<td>4</td>
</tr>
<tr>
<td>6 Specified medium building</td>
<td>Building used for specific business purposes with converted total Qmax gas meter reading of 30 m³/h or more</td>
<td>6</td>
</tr>
<tr>
<td>7 Specified public building</td>
<td>Building used for specific public purposes with converted total Qmax gas meter reading of 30 m³/h or more</td>
<td>7</td>
</tr>
<tr>
<td>8 Industrial building</td>
<td>Building used for industrial purposes with converted total Qmax gas meter reading of 90 m³/h or more</td>
<td>8</td>
</tr>
<tr>
<td>9 General commercial building</td>
<td>Building used for business purposes with gas meter</td>
<td>9</td>
</tr>
<tr>
<td>10 General housing complex</td>
<td>Building used for residential purposes only with 2 or more gas users</td>
<td>10</td>
</tr>
<tr>
<td>11 General housing</td>
<td>Building used for residential purposes only with 1 gas user</td>
<td>11</td>
</tr>
</tbody>
</table>
II. House Pipe Maintenance-Related Regulations: Safety Equipment

- Installation of safety equipment based on the building category is mandatory.

<table>
<thead>
<tr>
<th>Building Classification</th>
<th>Micon meter</th>
<th>Service pipe gas shut-off device</th>
<th>Emergency gas shut-off device</th>
<th>Gas alarm, etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Specified underground mall</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>2 Specified basement</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>3 Skyscraper</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>4 High-rise building</td>
<td>O</td>
<td>O</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>5 Specified large building</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>6 Specified medium building</td>
<td>O</td>
<td></td>
<td>–</td>
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</tr>
<tr>
<td>7 Specified public building</td>
<td>O</td>
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<td>–</td>
</tr>
<tr>
<td>8 Industrial building</td>
<td>O</td>
<td></td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>9 General commercial building</td>
<td>O</td>
<td>(Service pipe with aperture of 70 mm or more, pipe supplying underground room, etc.)</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>10 General housing complex</td>
<td>O</td>
<td></td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>11 General housing</td>
<td>O</td>
<td></td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>
Main Functions of Intelligent Meters (for Reference)

Installation became compulsory in 1997. 100% installation rate for low-pressure users (excluding some special cases).

1. Gas shut-off functions

- **Excess flow rate shut-off function** (Designated by law)
  - Shuts off the gas if excess flow due to a damaged gas pipe or the like is detected

- **Seismic shut-off function** (Designated by law)
  - Shuts off the gas if an earthquake with an intensity equivalent to a strong 5 (approx. 200 gal+) or more is detected

- **Pressure reduction shut-off function** (Designated by law)
  - Shuts off the gas if an abnormal gas pressure reduction (approx. 300 Pa or less) is detected

- **Continued usage shut-off function**
  - Shuts off the gas if it detects that gas is being used continuously for an abnormally long time with no variation in flow rate

2. Warning functions

- **Gas leak warning function**
  - If gas continues to flow for 30 days in a row, this function will deem that there is a risk of a gas leak and a display light will flash.

3. Other safety functions

- **Safety restoration function**
  - Customers may easily restore micon meters for which the above cut-off functions were activated by pressing the restore button. At this time, it will take about 2 minutes to check whether there is a gas leak, whether the indoor gas valve has been left open, etc.
Service Pipe Gas Shut-Off Devices and Emergency Gas Shut-Off Devices (for Reference)

Service pipe gas shut-off device

Emergency gas shut-off device

Diagram showing the layout of service pipe gas shut-off devices and emergency gas shut-off devices in relation to a building, street, and sidewalk. The diagram includes control boards and disaster prevention centers.

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II. House Pipe Maintenance-Related Regulations: Leak Detection Tests

It is obligatory to check pipelines (house pipes) laid from pipelines buried under roads to gas valves for leaks at the following frequencies, using an appropriate method, starting from the day they are laid.

<table>
<thead>
<tr>
<th>Category</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 1 buildings (Specified underground mall)</td>
<td>At least once per 14 months</td>
</tr>
<tr>
<td>Class 2 buildings (Specified basement)</td>
<td>At least once per 40 months</td>
</tr>
<tr>
<td>Other than the above</td>
<td></td>
</tr>
</tbody>
</table>

◆ **Stipulated leak detection tests include using a gas detector, boring, and pressure retention.**

◆ **The main methods used in practice are pressure retention or a gas detector (semi-conductor type)**

*Leak detection test does not apply in the following circumstances:

- Areas within the range of an appropriate leak detector (intelligent meter)
- If entry is refused by the owner or occupant
- Sections where polyethylene pipe is used
- Outdoor sections that are not buried
From the 1950s through the 1980s, many gas utilities used “Galvanized steel pipes” for buried sections.

In the 1990s, the possibility of serious accidents due to leaks from corroded galvanized steel pipes became apparent and received significant attention as a social issue.

◆ In 1996, the use of white gas pipes for buried sections was prohibited.

This is a key safety-related issue in the city gas industry, and countermeasures for aged buried gas pipes supplying high-risk buildings are underway with the aim of completing implementation by the end of fiscal 2015.
Ill-1. Countermeasures for Aged Buried House Pipes: Risk Management

- There is a huge number of buried Galvanized steel pipes (approx. 3 million)
- The corrosion environment and degree of impact in the event of an accident vary depending on the building

Necessary to carry out improvement work effectively for reasonable cost

Important to prioritize pipelines for action

As the degree of corrosion varies widely according to the underground environment, improvement work needs to be targeted at pipes that have deteriorated more or whose failure would have a greater impact.
III-1. Countermeasures for Aged Buried House Pipes: Basic Approach to Assigning Priority Rankings

For house pipes for which countermeasures will be implemented, the order of priority and implementation timeline are determined by considering the frequency of gas leak accidents and impact of accidents.

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**Approach to risk of accident**

(Risk of accident) = (Frequency of accident by gas leak) × (Impact of accident)

Buildings in Class 1 to 7, schools, and reinforced steel-structure buildings in Class 8 to 10 are considered high-risk buildings for which safety is essential, and efforts are being made to address them. Issues include improving users’ understanding of the asset classification of gas facilities and improving the upgrade cost burden borne by users.

<table>
<thead>
<tr>
<th>Building Category</th>
<th>Reinforced steel-structure buildings</th>
<th>Wooden-structure buildings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>High-risk buildings</td>
<td></td>
</tr>
<tr>
<td>2-7</td>
<td></td>
<td></td>
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<tr>
<td>8</td>
<td>*Includes wooden-structure schools, etc.</td>
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<td>9</td>
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<td>10</td>
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<tr>
<td>11</td>
<td></td>
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</tbody>
</table>

**Issues**

**Gas pipes are a user asset**

- Low recognition of the asset classification of gas facilities.
- PR relating to gas pipe asset classification via various business opportunities.

**To make improvements, users’ understanding and co-operation (sharing upgrade cost burden) is vital**

- The cost burden is an impediment that stops users agreeing to improvements.
- Encouraging improvement based on national subsidy program.
- Proposing methods that minimize the cost to users (e.g., rehabilitation and repair method)

**Example of rehabilitation and repair method**
Changes in National Subsidy Program (for Reference)

In 2003, a national subsidy program was introduced to cover upgrading work costs for aged buried house pipes, and it has gradually increased in scope. Utilities encourage customers to make improvements using these subsidies.

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</tr>
</thead>
<tbody>
<tr>
<td>Class 1-5</td>
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<tr>
<td>Class 7</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Class 6, Schools</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Class 8-10 Piping under floor</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Class 8-9 Qmax gas meter reading of 6 m3/h or more</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Class 8-10 Reinforced steel-structure buildings other than the above</td>
<td></td>
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</tr>
</tbody>
</table>

**Subsidy for 1/2 of all work expenses**

**Subsidy for 1/4 of all work expenses**
III-1. Countermeasures for Aged Buried House Pipes: Changes in Remaining Amount

Issues include improving users’ understanding of the asset classification of gas structures and improving the upgrade cost burden borne by users.

- The aim is to upgrade as many buildings as possible by the end of fiscal 2015.
- For buildings where users’ understanding and co-operation in upgrades has not been obtained, utilities will conduct appropriate maintenance with a view to proactive prevention of accidents while continuing to take advantage of various business opportunities to pursue publicity and PR activities.
In recent years, incidence of gas pipe damage due to work by companies other than city gas utilities on user property has remained at the same level. These projects are of various kinds.

- Looking at the past 5 years, the ratio of damage-causing accidents where there was no advance inquiry/discussion with the gas utility is high.

- In addition to implementing preventive countermeasures when laying gas pipes, it is necessary to encourage construction contractors and the like to make inquiries to gas utilities in advance and implement visible countermeasures that promote awareness of gas pipes in the field.
III-2: Countermeasures for Damage from Third Party Construction on User Property: Accident Prevention Initiatives—Preventive Countermeasures

- Laying of marking sheets directly above PE pipes in order to prevent damage during excavation work, etc.
- Laying of protective metal plates/pipes in places where flex pipe is liable to be damaged by nailing

Marker sheet (PE pipeline)

- Laying of marking sheets directly above PE pipes in order to prevent damage during excavation work, etc.

Protective plate/pipe (flex pipe)

- Laying of protective metal plates/pipes in places where flex pipe is liable to be damaged by nailing.
III-2: Countermeasures for Damage from Third Party Construction on User Property: Accident Prevention Initiatives—Encouraging Inquiries/Clearly Marking Gas Pipes

Utilities are proceeding with a combination of invisible countermeasures (encouraging inquiries before work, collecting information about projects by other companies) and visible countermeasures (promoting awareness of gas pipes in the field).

**Initiatives to encourage inquiries**

- Asking construction contractors and organizations to make inquiries in advance
- Asking customers to inform us about planned large-scale renovation work, etc.
- Proactively identifying construction projects for which no inquiries have been made

**Visible countermeasures to promote awareness of gas pipes in the field**

- Gas pipe indicator tape (in areas where gas pipes and other facilities are crowded together, etc.)
- Installing marking stakes, marking pins, marking plates, marking stickers, etc.

In future, utilities will continue to make diligent efforts.
Conclusion

**Countermeasures for aged buried house pipes**

- The aim is to upgrade as many buildings as possible by the end of fiscal 2015.
- For buildings where users’ understanding and co-operation in upgrades has not been obtained, utilities will conduct appropriate maintenance with a view to proactive prevention of accidents while continuing to pursue publicity and PR activities.

**Countermeasures to prevent damage from third party construction on user property**

- Utilities will continue to make diligent efforts to prevent house pipe damage.
Thank you for your attention.

October 2015

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The following pages are reference materials.
Example of Factors Considered in Priority Ranking (for Reference)

Indicators are divided into three categories: “possibility of corrosion-induced leak,” “possibility of accident after leak,” and “extent of impact if an accident occurs.”

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Likelihood of accident occurring</td>
<td>No. of years buried underground</td>
</tr>
<tr>
<td></td>
<td>Type of Pipe</td>
</tr>
<tr>
<td></td>
<td>Accident (corrosion-induced leak) history</td>
</tr>
<tr>
<td></td>
<td>Burial environment</td>
</tr>
<tr>
<td></td>
<td>Macrolell corrosion diagnostics result (categorization based on maximum corrosion depth and original thickness of pipe)</td>
</tr>
<tr>
<td>Possibility of accident after leak</td>
<td>Likelihood of leaked gas build-up (high priority for pipes buried under buildings)</td>
</tr>
<tr>
<td></td>
<td>Likelihood of leaked gas build-up (high priority for highly air-tight reinforced concrete-structure buildings)</td>
</tr>
<tr>
<td>Extent of impact if an accident occurs</td>
<td>Building Classification</td>
</tr>
<tr>
<td></td>
<td>Building use</td>
</tr>
<tr>
<td></td>
<td>No. of meters</td>
</tr>
</tbody>
</table>

★ Approach to accident risk

(Accident risk) = (Likelihood of accident occurring) × (extent of impact if accident occurs)
Establishing priority ranking by focusing on building classification, building use, building structure, and conditions of pipe buried under building

- Building classification: 1-5
- Building use: highly frequented public building
- Building structure: highly airtight reinforced concrete building
- Building where leaked gas is likely to build up with pipes buried under it

<table>
<thead>
<tr>
<th>Building Class</th>
<th>Pipes buried under building</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Building Class 1-5</td>
<td>Priority ranking = I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2) Building used as school or hospital in building class 6-10</td>
<td>Priority ranking = III</td>
<td>Priority ranking = II</td>
<td></td>
</tr>
<tr>
<td>(3) Reinforced concrete building in building class 6-10, excluding (2)</td>
<td>Priority ranking = IV</td>
<td>Priority ranking = III</td>
<td></td>
</tr>
<tr>
<td>(4) Other than the above</td>
<td>Priority ranking = VI</td>
<td>Priority ranking = V</td>
<td></td>
</tr>
</tbody>
</table>
Inter-ministry collaboration

Submission of written requests via the Ministry of Health, Labour and Welfare and the Ministry of Land, Infrastructure, Transport and Tourism to relevant industry groups asking them to help prevent gas pipe damage.

Gas safety information PR activities

Running newspaper, magazine, radio, and Internet advertisements aimed at gas users, etc., and providing education relating to city gas safety in order to reduce gas accidents.

Along with this, utilities analyze past accidents and aim to promote further understanding through timely, appropriate dissemination of safety information to users with respect to initiatives by the government and gas utilities (e.g., gas supply/restoration conditions in the event of a disaster).


Ministry of Economy, Trade and Industry “Gas Safety Review Team” website (for reference)
Prevention of Damage from Third party construction on User Property: Example of Initiatives by Gas Utilities (for Reference)

Initiatives to encourage inquiries before work

- Asking contractors and organizations to make inquiries in advance
  - Distribution of notification stickers and holding of damage prevention education sessions aimed at construction sector and demolition companies
  - In-person visits to relevant companies for damage prevention education sessions immediately after damage occurs
  - Requesting that condominium management associations, education committees, etc., make inquiries in advance of undertaking work

Requests to customers

- Notices sent via direct mail to educational facilities before long vacation periods explaining the need to contact gas utilities in advance of work
- Similar notices via direct mail to buildings where large numbers of people come and go

Proactively identifying construction projects for which no notification has been received

- Patrolling areas where an accident would have a major impact
- Collecting information via various business opportunities (sales opportunities, etc.)

Flyers and posters

Safety education DVD