

Seismic Measures for Gas Pipelines

Measures in Shizuoka Gas

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Shizuoka Gas Company

Production & Supply Department

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The Greater Gas Safety METI's Study Group -

“The Greater Gas Safety Study Group Report” (March 1998)

Basic policy for enhancing gas safety:

Establish safety systems based on new concept by 2010, reduce fatal accidents to minimal level and create a society where citizens can use city gas with peace of mind.

Main direction of discussions for rationalizing safety measures:

- ◆ Rationalization of gas safety measures based on principle of self-responsibility
 - In principle, gas suppliers and appliance manufacturers should be responsible for safety.
 - ✓ **Obligation to submit, observe and disclose the safety regulations**
 - ✓ **Obligation to ensure that all gas facilities comply with technical standards**
 - Minimization of the Government's involvement
 - Mobile and effective use of *ex post facto* regulations
 - Ensuring information disclosure

Two approaches to city gas safety: technical standards & safety regulations

Regulations under the Gas Business Act

Regulations on gas facilities

Regulations on gas utilities

Obligation to conform to technical standards

Obligation to submit and observe the safety regulations

Applicable to the construction, maintenance and operation of gas facilities

Safety-related functional requirements applicable to the construction, maintenance and operation of gas facilities

Two approaches to city gas safety: technical standards & safety regulations

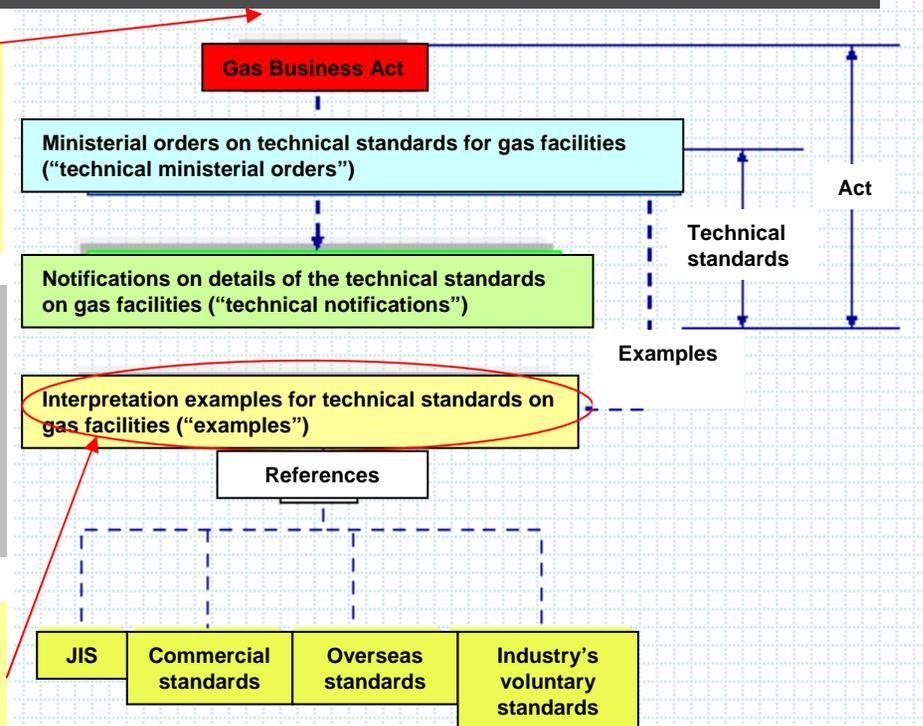
Obligation to conform to technical standards

To promote voluntary efforts to improve safety and quickly incorporate new technological findings, technical standards are formulated as a set of performance requirements for ensuring safety.

Article 28 of the Gas Business Act requires gas utilities to ensure their gas facilities comply with the technical standards established by ministerial orders.

An interpretation example is an example of technical specifications that are expected to result in a performance level required by the technical standards. These examples are useful when choosing actual technical specifications from available choices.

The seismic performance of gas pipelines is addressed by the interpretation examples provided for technical ministerial orders.



Two approaches to city gas safety: technical standards & safety regulations

Obligation to submit and observe the safety regulations

Gas utilities' obligation to submit and observe the safety regulations

Responsibilities and organization of the persons who supervise safety-related tasks

Persons who may act on behalf of the chief gas engineer

Education on safety

Patrols and inspections for gas safety

Operation and adjustment of gas facilities

Gas pipeline installation and maintenance methods

Supervision arrangements for ensuring safety at gas pipeline construction/maintenance sites

Maintenance of gas pipelines in contexts other than the construction and maintenance of gas installations

Measures to emergencies including disaster

Gas safety-related record-keeping

Penalties for violating the safety regulations

Other gas safety-related provisions

Two approaches to city gas safety: technical standards & safety regulations

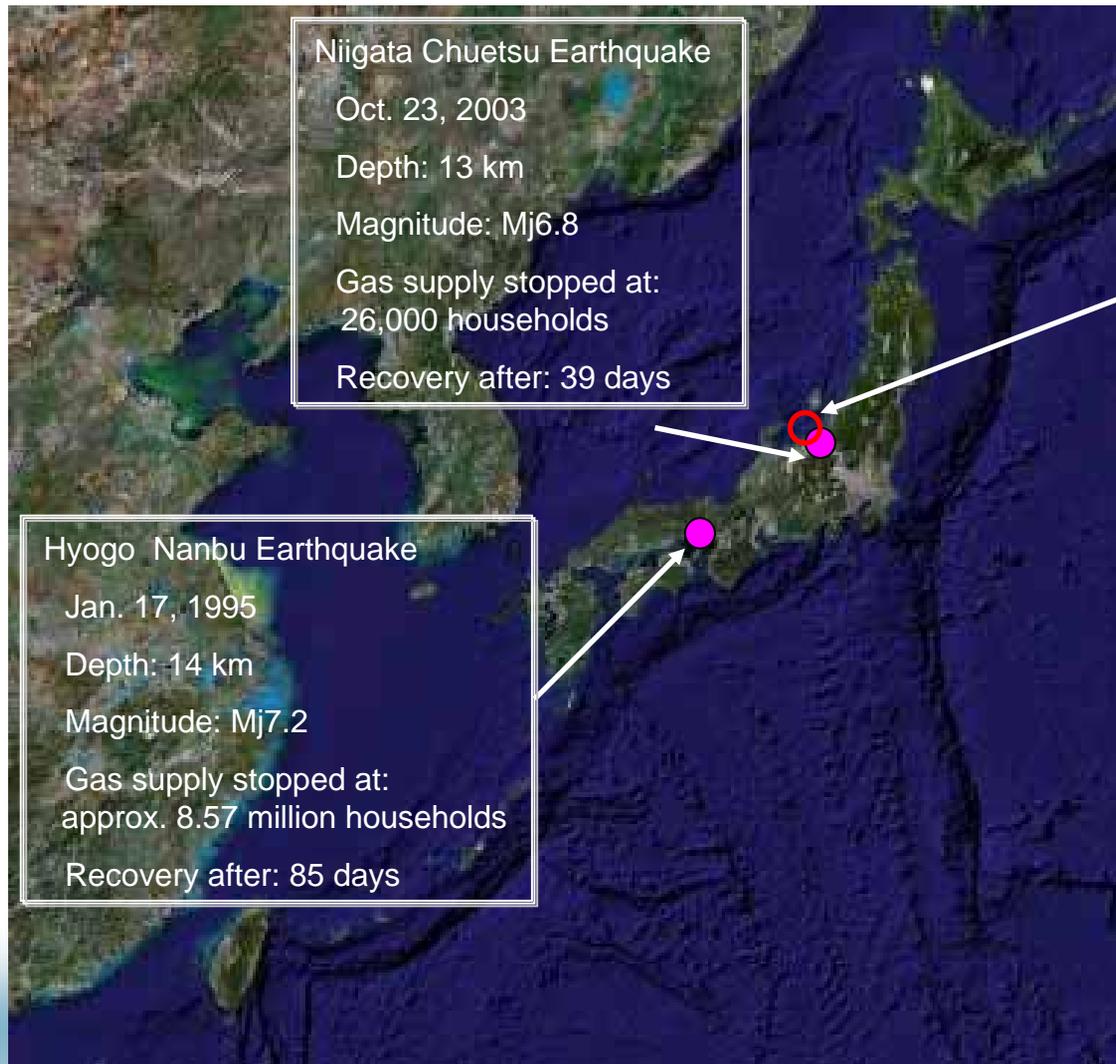
Obligation to submit and observe the safety regulations

Safety regulations: “measures to emergencies including disaster”

Measures to emergencies including disaster:

- ◆ Establishing an organizational framework for disaster prevention
- ◆ Communication with counter-disaster organizations
- ◆ Public relations
- ◆ Education and training
- ◆ Decision-making about shutting off the supply in case of earthquake
- ◆ Request for rescue and support in case of emergency or disaster . . . etc.

Recent earthquake damages in Japan



Niigata Chuetsu Earthquake

Oct. 23, 2003

Depth: 13 km

Magnitude: Mj6.8

Gas supply stopped at:
26,000 households

Recovery after: 39 days

Hyogo Nanbu Earthquake

Jan. 17, 1995

Depth: 14 km

Magnitude: Mj7.2

Gas supply stopped at:
approx. 8.57 million households

Recovery after: 85 days

(Reference)

Niigata Chuetsu-oki
earthquake

July 18, 2007

Depth: 17 km

Magnitude: Mj6.8

METI's The Study Group Report on seismic measures for city gas

Improvement of seismic measures in the gas industry by gathering new findings, identifying challenges and discussing possible measures

Evaluation of the effectiveness of seismic measures for city gas after major recent earthquakes such as the Hyogo-ken Nanbu Earthquake

- ◆ The Study Group Report on seismic measures for city gas
 - published in January 1996 after the Hyogo Nanbu Earthquake
- ◆ The Study Group Report on seismic measures for city gas in the Niigata Chuetsu Earthquake
 - published in July 2005 after the Niigata Chuetsu Earthquake

• In October 2007, The Study Group regarding City Gas Industry and City Gas facilities was established after the Niigata Chuetsu-oki Earthquake.

The Japan Gas Association guidelines: the Earthquake Disaster Prevention Guidelines, etc.

Earthquake Disaster Prevention Guidelines (revised in March 2007)

A guideline for gas utilities to plan and review their seismic measures

Revised to incorporate
recommendations
from the Chuetsu
Earthquake report

Earthquake Disaster Prevention Guidelines

Seismic engineering
guidelines

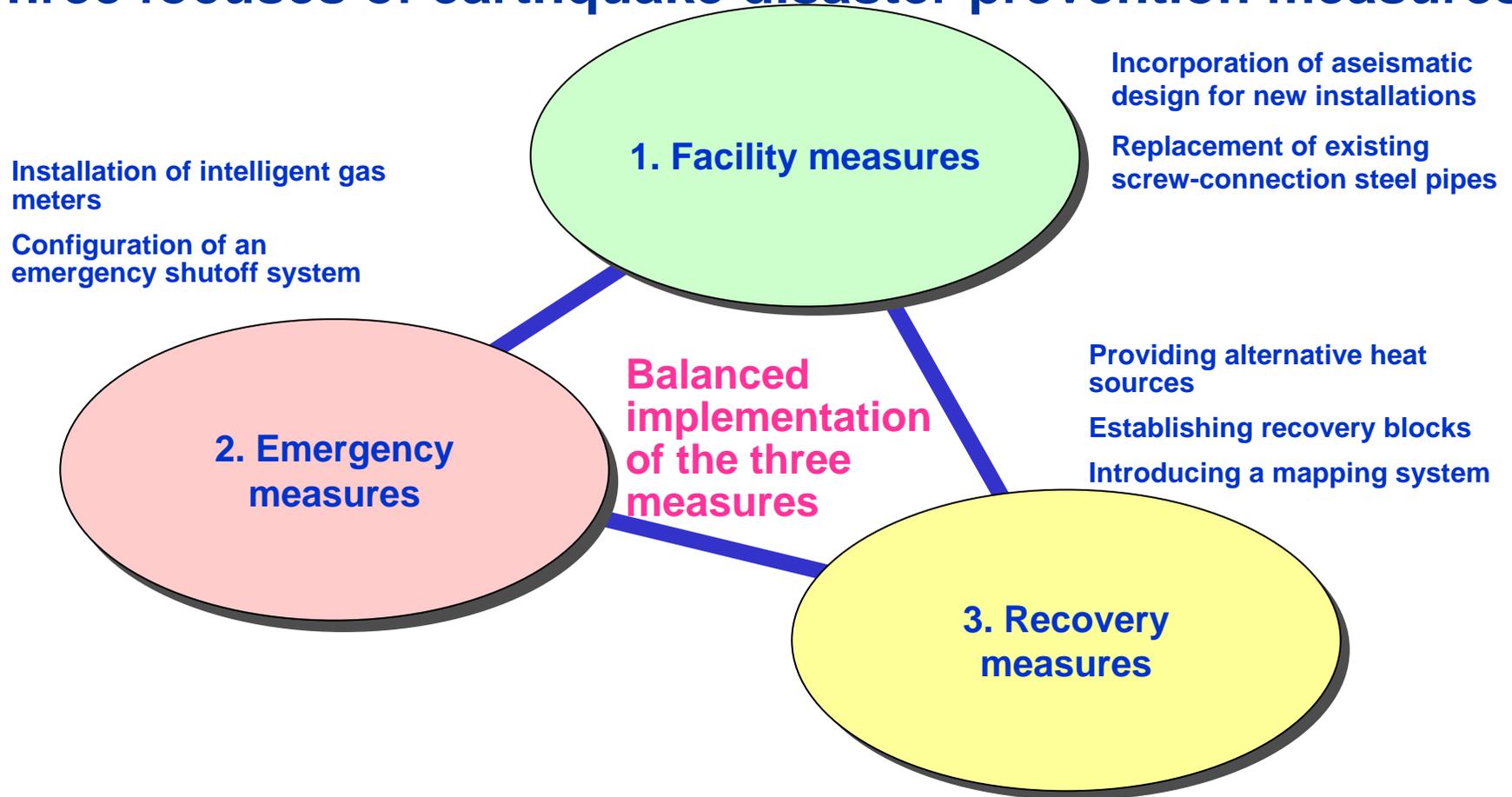
Aseismatic design guidelines provided
as interpretation examples

Guidelines for Emergency Measures
for Gas Pipelines in Case of Earthquake

Guidelines for the Recovery of
Gas Pipelines after an Earthquake

Seismic Measures in Shizuoka Gas

Three focuses of earthquake disaster prevention measures



Seismic Measures in Shizuoka Gas

Shizuoka gas supply area



Company profile:

Established: April 16, 1910

Number of customers: 317,441
(end of September, 2007)

Total gas pipeline length: 3,728 km

High-pressure: 94 km

Medium-pressure: 648 km

Low-pressure: 2,986 km

Seismic Measures in Shizuoka Gas

1. Facility measures

- ◆ Earthquake-proof polyethylene pipes are used for many low-pressure main pipelines.
 - Reached 37% by the end of 2006.
- ◆ All high- and medium-pressure conduit pipes are weld-jointed steel pipes.
- ◆ Existing screw-connection steel pipes without a coating layer are gradually being replaced.
 - We replaced 18.7 km of such pipes in FY2006.



A polyethylene pipe that can follow even a large ground displacement



Weld-joining of steel pipes

* Pressure designation

Low: less than 0.1 MPa
Medium: 0.1 to 1.0 MPa
High: 1.0 MPa and higher

Seismic Measures in Shizuoka Gas

2. Emergency measures

- ◆ Installation of intelligent gas meters
 - Installed at 99.6% of customers (the end of June 2007)
- ◆ The supply area is divided into six emergency shutoff blocks.
- ◆ If seismic motions of 60 kinas (SI unit) or more are detected in any of the blocks, the supply to that block is shut off by remote operation.
- ◆ Seismometers are installed at 39 locations.

In the safety regulations



Remote monitoring and control by dedicated communication lines and satellite radio



Remote shutoff valve

Seismic Measures in Shizuoka Gas

2. Emergency measures – Installation of intelligent gas meters

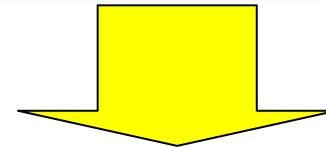


If the seismic sensor detected an earthquake; or

an abnormally large amount of gas has leaked out; or

gas is used over an abnormally long period; or

gas pressure decreased:



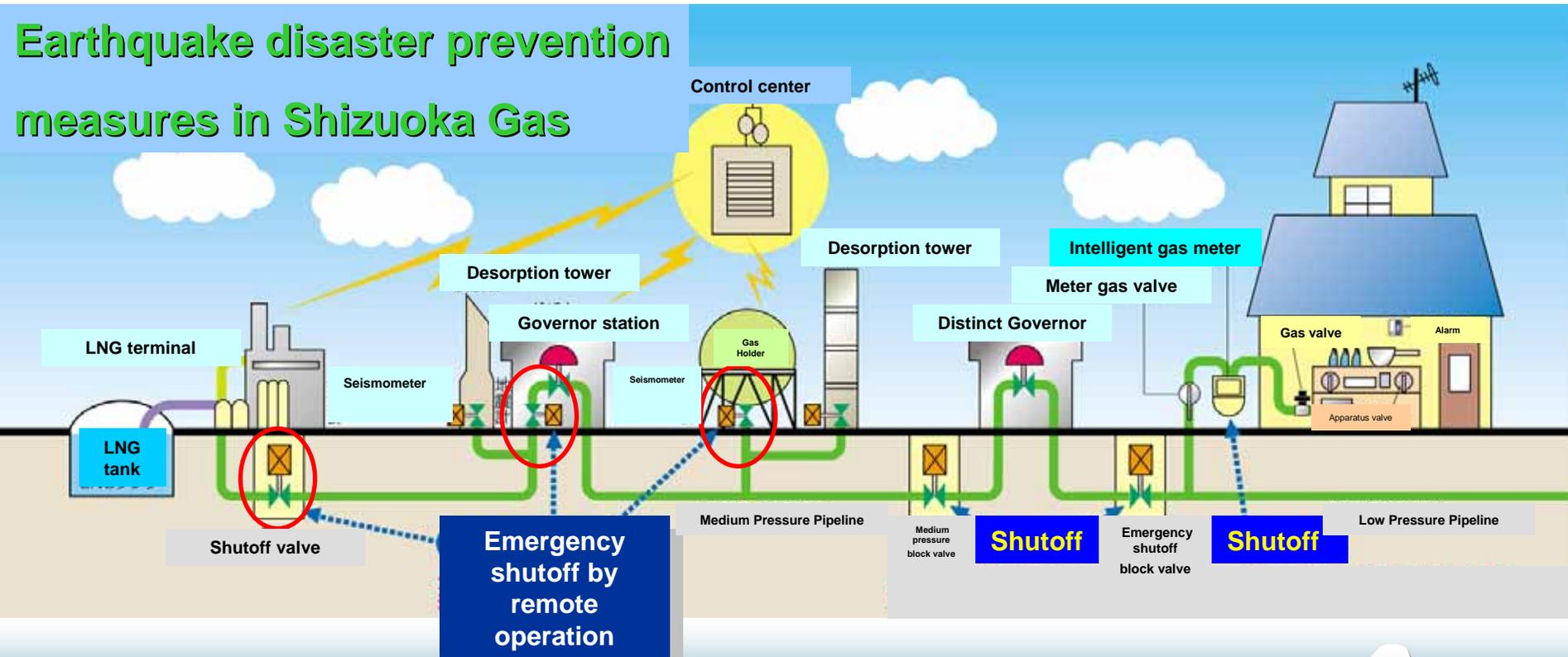
Gas is shut off automatically.

Seismic Measures in Shizuoka Gas

2. Emergency measures – Emergency shutoff system

When there is a major earthquake, Shizuoka Gas shuts off the gas supply by remote operation at high-pressure governor stations and at gas holders.

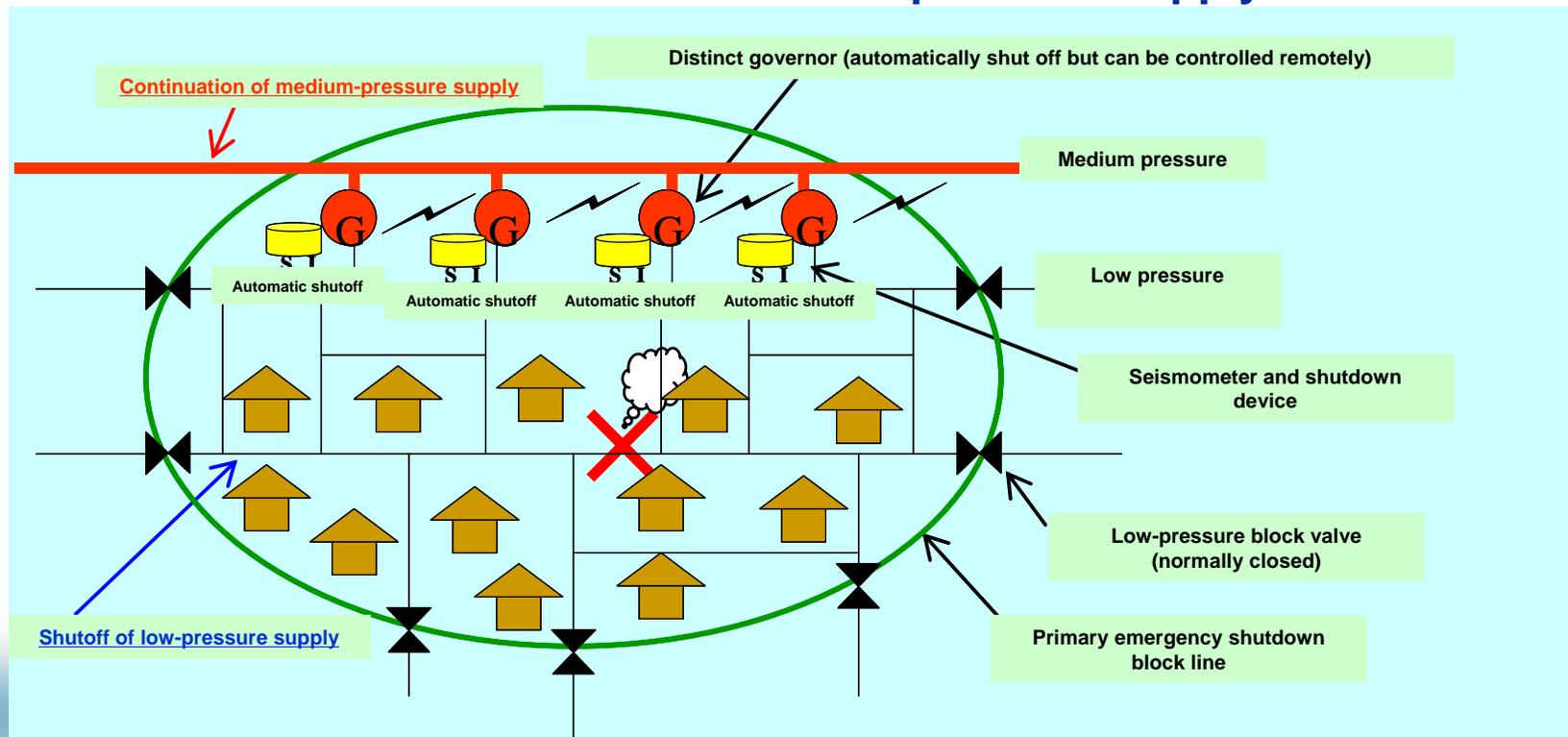
Earthquake disaster prevention measures in Shizuoka Gas



Seismic Measures in Shizuoka Gas

2. Emergency measures – Configuration of a new emergency shutoff system

- Shutoff of supply only to affected areas
- Quick and reliable shutoff method
- Continuation of medium-pressure supply



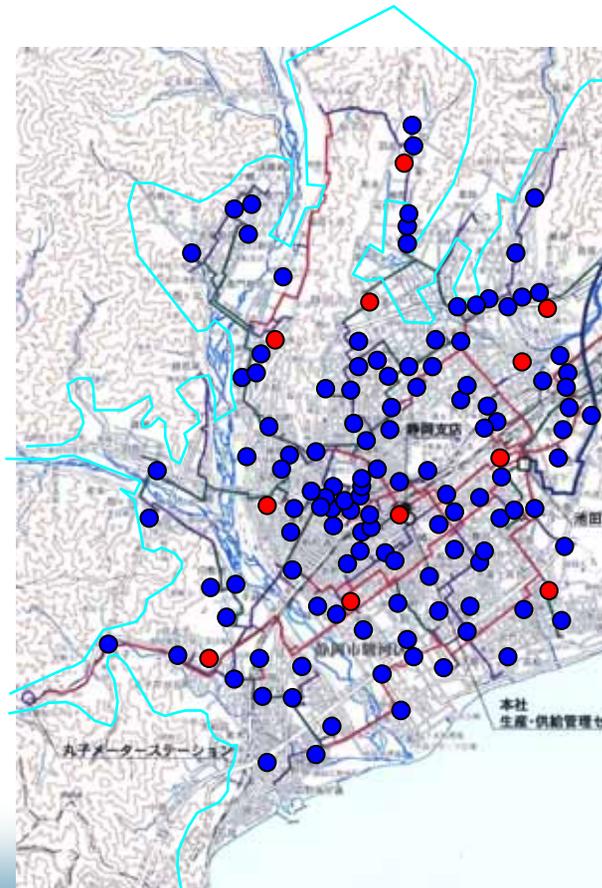
Seismic Measures in Shizuoka Gas (2. Emergency measures)

Configuration of a new emergency shutoff system – Installation of seismometers

Installation of seismometers at 479 locations (at all low-pressure governors) in the Shizuoka Gas supply area

Each seismometer automatically shuts off the supply when it has detected seismic motions of a preset intensity level or higher.

Shutoff by remote operation is also possible.



- Proposed locations for seismometer installation (127)
- Existing seismometer locations (11)



The Japan Metrological Agency has installed seismometers (including seismic intensity monitors) at 25 locations in Shizuoka Prefecture.

Example:
Shizuoka block (Number of customer is 134,293)

Seismic Measures in Shizuoka Gas

3. Recovery measures

- ◆ Provision of alternative heat sources
 - For important facilities that should recover quickly from disaster
- ◆ Establishment of recovery blocks
 - Dividing the total of about 300,000 customer sites into 620 blocks
- ◆ Introduction of a mapping system
 - Prompt supply of gas pipelines information to rescue JGA and gas utilities

Seismic Measures in Shizuoka Gas

3. Recovery measures – Portable gas production units

Identifying emergency hospitals and other customer sites that are important to society

Quickly offering a means for emergency gas supply such as portable gas production units

Propane and air type units: 22 units are available.



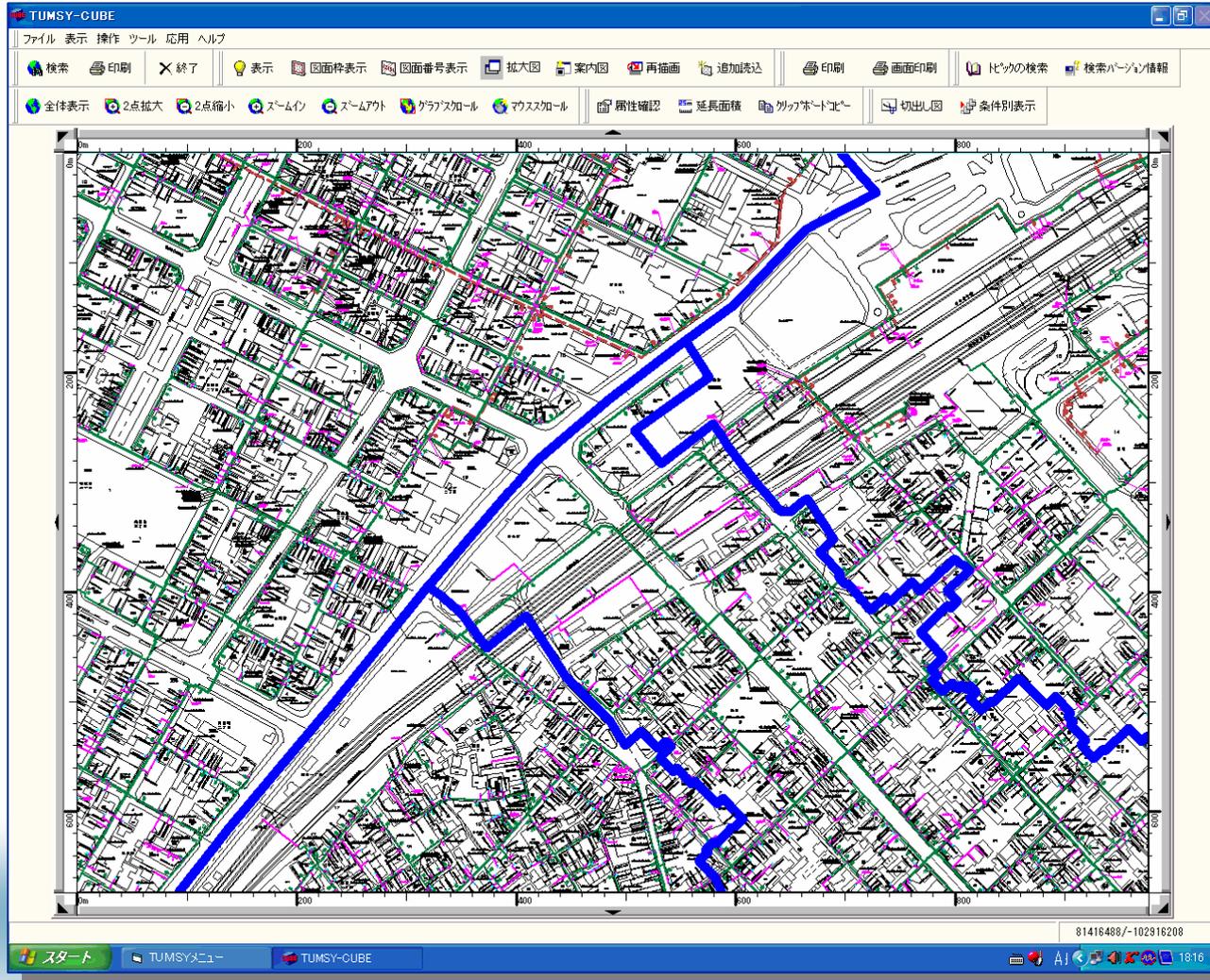
Compressed natural gas type units: 7 units are available.

Portable stoves: 1,200 units are available.



Seismic Measures in Shizuoka Gas

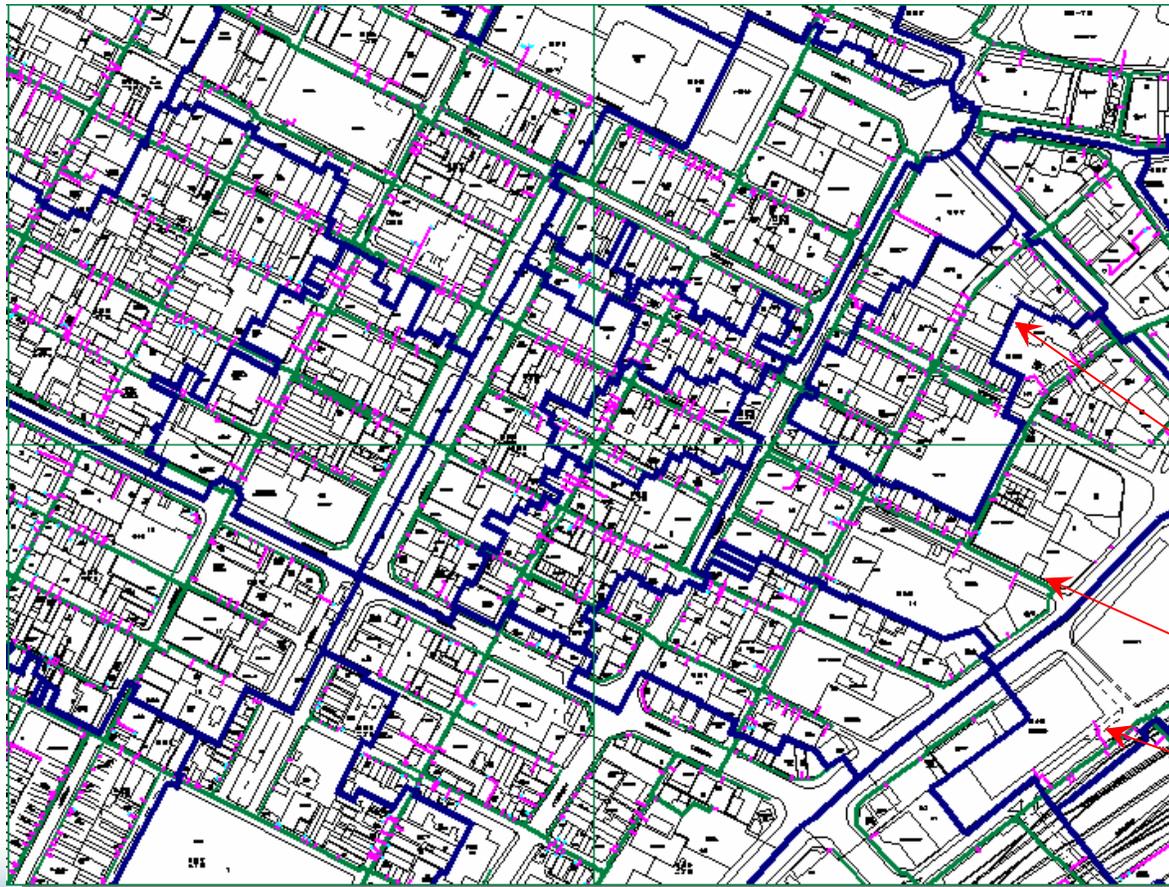
3. Recovery measures – Introduction and maintenance of a mapping system



- Pressure
- Pipe type
- Aperture
- Joining method
- Buried pipe location
- Earthquake control block boundaries
- Image data of detailed drawings

Seismic Measures in Shizuoka Gas

3. Recovery measures – Establishment of recovery blocks



- ◆ Portioning of low-pressure pipeline networks
- ◆ Registration of recovery block boundaries
- ◆ A system for creating and updating lists of customers by recovery blocks

Recovery block lines

Low-pressure mains and branches

Service pipe and house pipe

Thank you for your attention.

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