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TECHNOLOGICAL AND ECOLOGICAL NORMS REQUIRED FOR THE DESIGN AND OPERATION OF GAS DISTRIBUTION NETWORKS

Draft consolidated report, prepared by the delegation of the Russian Federation

Practices with regard to the design of gas distribution networks in a variety of European countries have been analysed. Gas distribution enterprises from the following 11 UN-ECE member countries sent in replies to the questionnaire prepared by the Russian Federation: Bosnia and Herzegovina, Croatia, Czech Republic, Hungary, Poland, Romania, Russian Federation, Slovakia, Spain, Turkey and Ukraine.

The results of that analysis are set out below, in five sections.

1. Design of Gas Distribution Networks

Which documents stipulate the norms for technological design of the gas distribution networks?

All the countries have a national regulatory framework for technological design which lays down the principles and conditions for the design and construction of gas distribution networks. Croatia uses the German regulatory framework for technological design in addition to its own normative instruments.

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How are pipelines in the gas supply system divided up according to the pressure of the gas transported?

All the countries classify gas distribution lines according to pressure level as high-, medium- or low-pressure lines. (The exception is Turkey, which in its answer indicated the pressure levels for use of steel and polyethylene lines.) The classification criteria vary from country to country. Ukraine and the Russian Federation use an identical classification system based on the regulatory framework of the former USSR.

How do you calculate the annual gas consumption for each type of consumer?

To calculate annual consumption, countries use the normative indicators established in the normative framework (Russian Federation, Ukraine) or the annual load on the equipment (Czech Republic). Some countries did not fully understand the question and reported on the method of calculating the volume of gas supplied to consumers with a permanent connection to gas distribution organizations.

What is the actual load on distribution lines in summertime?

The load on gas lines falls in summer. The load is spread most evenly in Spain; there the summertime load is 75 per cent of the wintertime load, whereas elsewhere the proportion is between 70 and 25 per cent. The determining factors are climatic conditions and the pattern of gas use by consumers. Bosnia and Herzegovina and Croatia cited absolute values for summertime consumption.

Design requirements for outside (external) gas distribution lines

The design of outside (external) gas distribution lines is specified by the relevant normative instruments. In Turkey outside (external) lines are not laid.

What methods do you use in constructing external steel or polyethylene lines?

In accordance with national normative instruments, polyethylene lines are laid in trenches, whereas steel lines may be laid above or below ground. Steel lines are welded. Polyethylene lines are electrically welded or butt-welded.

Criteria for the use of steel or polyethylene tubes and fittings in gas distribution networks

Pressure restrictions on polyethylene pipes: 0.6 MPa in the Russian Federation and Ukraine, 0.4 MPa in Poland, Slovakia, Spain, Turkey, and 1 MPa in Hungary. In most countries polyethylene pipes are used only in low- and medium-pressure lines.

Requirements and design solutions with regard to the inlets to buildings

Requirements for the inlets to buildings are specified in the relevant normative instruments and only a few countries went into more detail on this question:

Romania: Inlets to buildings for low-pressure systems only (max. 0.05 bar); all communal inlets to buildings are pressure-tight.

Bosnia and Herzegovina: For inlet pressures of 100-200 millibars, polyethylene pipes are laid to a distance of 1 metre from the entrance to the building and steel lines thereafter.

Croatia: Maximum inlet pressure to the building is 100 millibars; incoming steel pipes start at a distance of 1 metre from the frontage.

Czech Republic: The JMP Company (the gas supplier in southern Moravia) tries to avoid running inlets into buildings by ensuring that its equipment ends in public-access areas. The gas equipment that enters the building is the property of the consumer.

Methods used in water-crossings. Special requirements for steel and polyethylene lines

Great care is needed when laying lines across water obstacles.

Methods used for water-crossings are: under-water, above-water, and beneath river beds by horizontal directional drilling. The pipes normally used are steel with individually checked seams. In the Russian Federation and Ukraine the use of polyethylene pipes under water and beneath river beds is permitted for crossings no more than 25 metres long. In some countries (Hungary, Spain, Turkey) polyethylene pipes are not used in water-crossings. In Poland, above-water polyethylene pipes must be thermally insulated.

Road and rail crossings

Special care is required when laying gas lines across roads and railways.

In the Russian Federation and Ukraine, polyethylene lines are laid underground only. Steel lines may be laid underground or above ground. For underground pipes, open trenches and covered methods (thermal drilling, drilling) are used.

Spain takes special precautions against stray currents for steel lines. Large-diameter protective outer pipes are used when laying both steel and polyethylene gas lines. Depth 1 metre.

In Turkey, open and perforated sleeves are used.

In Poland, polyethylene pipes are laid underground only; steel pipes may be laid underground or above ground. Casing is used on crossings underneath railways, if the roadbed is unable to withstand the temporary loads. The edges of the casings are pressure-tightened.

In Romania, casings are used both for steel and for polyethylene lines. Lines passing under a railway or a road are fitted with two valves, one each at the entry and exit points.

In the Czech Republic, gas pipes crossing a road or railway are, to the extent possible, installed at right angles to their centreline. The possibility of using a protective sleeve is decided on a case-by-case basis by agreement with the owners of the equipment and taking account of local conditions. Preference is given to trenchless technologies. High pressure: gas lines are housed in protective sleeves when crossing highways, class I and class II roads, and main and branch rail lines. In the case of railway lines, the protective sleeves must protrude 1 metre above the top of the trench or be positioned at least 2 metres above the foot of the railway embankment. If the sleeve is more than 10 metres long, it must have inspection apertures on each side. Across roads, provided the highway operator agrees, the protective sleeve may be replaced by pipes with a protective covering of fibre-reinforced concrete.

Croatia uses directional drilling beneath the foundations of roads and railways; in special cases the requirements are specified by the road- and railway-inspection authorities; protective pipes and rental terms.

Requirements for the positioning of preventer (cut-off) equipment

These are regulated by relevant normative instruments.

Turkey: Squeeze tools are used for polyethylene pipes.

Poland: Each gas distribution system is fitted with valves positioned so as to minimize the cut-off time of the section in an emergency. The position of the valves depends on the working pressure, the size of the main and the physical characteristics of the terrain.

Bosnia and Herzegovina: Devices for preventing increases and decreases in pressure are an integral component of regional regulating stations and pressure regulators in buildings.

Czech Republic: In areas of possible seismic activity and areas prone to erosion (primarily the basement areas of historic towns), networks are fitted with preventer shutoff valves to disconnect the gas supply in the event of a malfunction on a service pipe.

Methods used for connecting pipes and fitting branch-pipes (steel and polyethylene lines)

For steel pipes, gas and electric-arc welding; for polyethylene pipes, butt welding, sleeve welding by surface heating, grooved seam welding.

Slovakia: Mechanical connection, mainly polyethylene pipes.

Romania: Polyethylene pipes: arc welding for pipes up to 75 mm in diameter, butt-welding for pipes over 75 mm in diameter.

Czech Republic: Polyethylene pipes are arc welded or butt-welded (pipe wall thickness at least 3 mm); steel pipes are butt-welded. Branch-pipes: polyethylene pipes - arc-welded T joint with drilling (grooved weld); steel pipes: T joint using gas bags and blocking devices. High pressure: connections of high-pressure pipes are welded. Flanged connections are permitted on measuring lines, armatures, pressure-tight flanged joints and bolted filter joints outside regulating stations and under similar conditions. Branches are attached using screw joints.

Methods used for laying underground gas distribution lines (depth and width of trench)

Methods of laying gas lines are specified in the relevant normative documents.

Russian Federation and Ukraine: Steel - welding of individual tubes 6-12 metres long. Maximum depth 0.8 m from pipe surface. Width of trench - diameter of pipe (D) + 300 mm. Polyethylene - welding of individual pipes 6-12 m long and of bundles (of pipes) up to 400 mm depending on diameter. Depth - maximum 1.0 m. Width of trench - D + 300 mm.

Spain: Minimum depth: diameter of pipe + 0.8 m. Width sufficient to lay the pipe.

Turkey: Width: diameter of pipe + 40 cm; depth: diameter of pipe + 100 cm.

Slovakia: Covering for pipes 0.8-1.2 m. Thickness of cover should not exceed 1.5 m.

Poland: Minimum depth from pipe surface 0.8 m. Width: sufficient to lay the pipe.

Romania: Covering of pipe - 0.90 m (0.2 bar p 4.0 bars); 0.6 m (0.05 bar p 0.2 bar). Width: d + 200 mm.

How wide is the provisional right of way for the laying of gas distribution lines between settlements?

The width of the right of way depends on what the gas line is made of and the level of pressure in the pipe. A selection of values appears below.

Russian Federation and Ukraine: 28 m when laying lines in agricultural land, 20 m when laying lines in land unsuitable for farming.

Spain: Normally 10 m.

Turkey: At least 0.5 m when laying polyethylene lines. Steel lines: 7 m when pressure is lower than 20 bars, 9 m for lines with pressure of 20-40 bars, 14 m for lines with pressure of more than 40 bars.

Slovakia: For underground lines at less than 5 kPa, minimum width 1 m from the foundations of a building; for lines between 5 kPa and 400 kPa, 2 m from the foundations of a building.

Bosnia and Herzegovina: At least 8 m for high-pressure steel lines. Exceptions are possible, up to a maximum of 5 m (a special request for an expert study and assessment must be made to the authorities). Medium pressure - 3.5 m. Low pressure - 2 m, including allowable deviation of not more than 1 m.

Czech Republic: For low- and medium-pressure gas lines, the right of way is 1 m on either side. For high-pressure lines, the width of the right of way is specified by Law No. 458/2000 Coll. The safety zone is 4 m wide on either side; no activity that might compromise the reliability and safety of the equipment is permitted in this zone. The safety zone is established to prevent and minimize the consequences of possible equipment failure, and also to protect the life, health and property of the population. For lines up to DN100, the safety zone is 15 m; for DN250 lines - 20 m, and for DN250 lines - 40 m. No activity or construction work may be undertaken in the safety zone without the consent of the operator of the high-pressure equipment.

Requirements with regard to design and location schemes of gas distribution regulating units and equipment

The requirements are specified in the relevant normative instruments. A selection of requirements appears below.

Russian Federation and Ukraine: In cubicles, self-contained units or free-standing brick buildings. Single-line with bypass or dual-line.

Turkey: Self-contained units or free-standing brick buildings on working, reserve and bypass lines.

Poland: Self-contained units or free-standing buildings. In some cases, regulators may be buried underground.

Romania: Regulating stations are sited above ground on the boundary with consumers' property; the distance between buildings and the above-ground plant must be at least 10 m.

Gas distribution networks in settlements. Use of combined regulators. What pressure is used for gas distribution lines in settlements?

There are restrictions on the pressure in gas distribution networks in towns.

Russian Federation and Ukraine: Single-stage (low pressure), two-stage (medium and low pressure, with use of regulator), combined (see the classification of pressure levels above).

Spain: Pressure level in towns is below 0.5 MPa.

Turkey: From 4 bars to 300 millibars or 21 millibars, depending on the gas appliances used.

Slovakia: Up to 400 kPa in built-up areas, adjusted to low pressure by gas-regulating stations.

Poland: Below 0.4 MPa.

Romania: Regulators for medium and adjusted pressure for major consumers only; adjusted pressure lines in settlements.

Bosnia and Herzegovina: Steel pipes (working pressure 8 (14.5) bars) supply gas to working stations at a pressure of 3 (4) bars, 0.1 (0.2) bars with a direct connection to major consumers. Polyethylene pipes with a working pressure of 3 (4) bars supply gas to working stations at a pressure of 3 (4) bars, 0.1 (0.2) bars and to major consumers. Other polyethylene pipes at a pressure of 0.1 (0.2) bars are used to connect smaller consumers.

Croatia: 100 millibars in low-pressure gas lines (town grid); 4 bars before the inlet to buildings and in rural areas.

Czech Republic: Low-pressure gas networks with pressure up to 5 kPa are used in settlements; medium-pressure lines with a pressure of between 5 and 400 kPa are laid in built-up areas.

What gas pressure is used in household gas appliances?

There are restrictions on the gas pressure used in household appliances.

Russian Federation and Ukraine: Maximum 0.003 MPa (0.0015-0.002 MPa).

Turkey: Greater than 21 millibars but less than 300 millibars.

Slovakia: Up to 3 kPa.

Poland: Normally around 2.5 kPa, 2.0 = +/-10% kPa.

Hungary: Natural gas: 25-85 millibars depending on the type of appliance; liquefied natural gas: 30 or 50 millibars.

Bosnia and Herzegovina, Croatia: 25 millibars.

Czech Republic: 1.7-2.1 kPa.

Environmental regulations applicable to the design of gas distribution networks

The relevant normative instruments contain environmental regulations, and designs for gas distribution networks must include an environmental impact study.

Special pipeline-design requirements for specific areas (seismic areas, areas prone to frost-heaving, subsidence, swelling or flooding)

Design in these conditions is regulated by normative instruments.

Hungary: An increased safety factor is mandatory. The minimum safety factor is 2; the use of polyethylene pipes is prohibited.

Czech Republic: In areas of possible seismic activity and areas prone to erosion (primarily the basement areas of historic towns), networks are fitted with preventer shutoff valves to disconnect the gas supply in the event of a malfunction on a service pipe. High pressure: in accordance with Law No. 458/2000 Coll, the Ministry may decide to establish a protective zone for gas equipment up to 200 wide in certain cases (proximity to mines, hydropower plants and other major installations that might affect the siting of the gas equipment). In conditions of anticipated soil subsidence, as, for example, when laying a main across ground with varying physical and mechanical characteristics and bearing capacity, the line could be at risk of deformation. In these circumstances the necessary statistical safety factor is built into the design on the basis of an engineering and geodesy survey. Backfilling of the trench requires close attention. When a line passes through an area prone to erosion, the requirements of standard CSN730039 must be met. If the gas line is being laid through a mining area where there may be blasting, it must be laid at a safe distance as prescribed by standard CSN386410, taking account of the seismic effect of the explosions.

What criteria do you use to choose the type of gas pipes in each particular case?

Diameter is determined according to the results of a hydraulic strength analysis, taking account of the product range in accordance with national standards.

The pipe material depends on the pressure, site and construction cost.

Slovakia: The thickness of pipe walls is calculated in relation to the internal gauge pressure, which must not be taken to be less than 2.5 MPa.

Poland: Safety and cost-effectiveness are the criteria for choosing pipe diameters and materials.

Czech Republic: Local distribution networks are comprised almost entirely of polyethylene pipes; depending on corrosion monitoring data, high-pressure lines use steel pipes with industrial insulation, concrete-coated steel pipes or fibreglass-reinforced pipes (in particularly unfavourable conditions, e.g. strong stray currents).

Do you use reinforced polyethylene lines for gas distribution? If so, what kind of fittings do you use?

Neither the Russian Federation, Ukraine, the Czech Republic, Poland, Romania, Slovakia nor Turkey uses reinforced polyethylene pipes.

Hungary uses them only rarely and joins them by welding.

Methods of gas distribution line testing

Testing is carried out in accordance with national normative instruments.

Russian Federation, Ukraine: Underground lines in all pressure categories and low- and medium-pressure surface lines are air-tested for strength and leaks. Above-ground high-pressure lines are water-tested for strength and leaks, but air testing is also permitted.

Slovakia: Pressure-testing using air or inert gas (gauge pressure of tested medium 600 kPa); pressure-testing using gas (all joints and valves checked, application of foaming emulsion or use of detector).

Hungary: Pressure checks, checks for leakage, radiographic analysis (isotope-based X-ray, UV).

Quality control methods for welded and sleeved joints on steel and polyethylene lines.

Russian Federation and Ukraine: The number of joints to be tested is specified in normative instruments. Steel pipes undergo X-ray, ultrasound and mechanical testing; polyethylene pipes undergo ultrasound and mechanical testing.

Spain: Selective radiographic checking of welded seams (up to 100% testing for certain sections and pressures). All welded seams are inspected visually.

Slovakia: Detector or foaming emulsion.

Poland: Visual inspection.

Hungary: Regular checks, annual operational checks, detector checking for leakage, factory testing certificates required.

Czech Republic: Documentation on polyethylene and steel fittings is checked upon delivery of the fittings and prior to pipeline commissioning. Pipes are visually inspected during pipeline assembly.

Economic criteria applied in deciding whether to provide settlements with a piped natural-gas supply

Russian Federation and Ukraine: The project must pay for itself in 5-7 years.

Spain: The usual internal rate of return over 10-20 years.

Turkey: The cost of the investment and consumers' capacity to pay.

Slovakia: Anticipated gas consumption, return on investment, environment.

Poland: Payback within 10-20 years.

Hungary: Number of potential consumers, volume of consumption, distance from the transmission main, cumulative expenditures and expected volume of gas sales (similar criteria used in Romania and the former republics of Yugoslavia).

Czech Republic: Payback period of 10 years; internal rate of return, net present value.

2. Determination of optimum types and sizes of gas distribution lines

How do you determine the internal diameter of pipelines? What criteria do you use?

The internal diameter of pipelines is determined according to gas flow formulae contained in normative instruments. The diameter will depend on the length of the pipeline, the initial pressure, the flow rate and constraints on maximum pressure at the end of the pipeline, the allowable level of pressure drop and the allowable gas flow rate. The flow rate is calculated in accordance with the maximum level of consumption.

Which coefficient (factor) of the roughness of steel and polyethylene pipes do you apply in hydraulic calculations?

Different roughness values are used in calculations for steel and for polyethylene lines.

Russian Federation and Ukraine: Steel pipes = 0.01, polyethylene pipes = 0.002.

Spain: The elasticity limit (range 0.40-0.72), not the coefficient of roughness, is used in calculations.

Turkey: 1,350 microns.

Slovakia: Steel pipes: s = 0.25 mm; polyethylene pipes: s = 0.05 mm.

Poland: Steel pipes 0.01, polyethylene pipes 0.002.

Romania: Steel pipes: K = 0.05 cm; polyethylene pipes: K = 0.007 cm.

Hungary: Steel pipes 0.1; polyethylene pipes 0.05.

Bosnia and Herzegovina: Steel pipes: K = 0.2; polyethylene pipes: K = 0.05-0.1.

Croatia: Median roughness factor K (mm): steel pipes 0.1-0.2; polyethylene pipes 0.025 mm.

Czech Republic: The following coefficients of roughness are used in hydraulic calculations for steel pipes: 0.1 mm for new pipes; 1.0 mm for pipes more than five years old; 5.0 mm for pipes more than 25 years old (i.e. the original pipes used to distribute town gas). The coefficient of roughness of polyethylene pipes is taken as 0.001 mm for calculation purposes.

What relative roughness values are used in designing gas pipelines, and do the values differ for pipes of different grades of polyethylene (PE63, PE80, PE100, PE125)?

Russian Federation, Ukraine, Slovakia, Poland, Romania, Croatia: The same coefficient is used for all types of polyethylene pipe.

Hungary: PE80 is generally used, design value = 0.012. This answer is inconsistent with the response to the previous question.

Bosnia and Herzegovina: Depending on the category of polyethylene line, relative roughness is used in determining the coefficient and limits: (2.06-2.8) x 10^{-2} for medium pressures, i.e. 3 (4) bars, and (1.73-2.3) x 10^{-6} for low pressures of 100 (200) millibars.

Czech Republic: At the design phase the supplier of the pipes is still unknown, so it is impossible to determine roughness accurately on the basis of quality criteria. Differences in roughness are insignificant in determining flow and pressure parameters in the network. Relative roughness is the ratio between the standard value referred to above and the internal diameter of the pipe (e.g. 0.00002 for PE63 pipes).

Is the rate of gas flow in the pipe set in the formula for determining the pressure drop for medium- and high-pressure pipelines or is it determined for each individual pipeline section?

Russian Federation, Ukraine, Spain, Slovakia, Poland: Determined for each section.

Romania: Set in the design formula.

Bosnia and Herzegovina: Gas flow is determined according to the formula for medium- and high-pressure pipelines using the Hardy-Cross method.

Croatia: Gas flow is set in the formula; formulae vary according to pressure levels.

Czech Republic: Both. The principle of the consumption programme is that the gas flow is set in the formula for determining the pressure drop for each individual pipeline section and then, using the continuity requirement (e.g. the sum of the directional head losses in a closed loop equals zero), the gas flow correction is determined. This method (the Hardy-Cross method) is repeated until the correction value in each of the loops drops below the required accuracy values (normally 1 m^3/h).

How is gas flow along the pipe determined? By adding together the hourly maximums or by solving a non-steady-state problem in which the gas flow is not constant over time?

Russian Federation, Ukraine, Poland: Sum of the hourly maximums.

Romania: Sum of the hourly maximums, corrected for the coefficient of simultaneity.

Hungary: Steady-state model used. The Hardy-Cross method is used for low and medium pressures and the Hardy-Cross method or a transition model for high pressures.

Bosnia and Herzegovina: Steady-state problem. Hourly maximums subject to the coefficient of simultaneity.

Croatia: Steady-state calculation; pre-set maximum values.

Czech Republic: The network must be designed so as to ensure that the gas pressure and flow rate are consistent with the required values at maximum load. Calculations therefore use the hourly maximums for large and small consumers; for domestic consumers who use gas for heating, the coefficient of simultaneity is taken to be equal to 1, since the probability of overlapping gas consumption maximums (during periods of intense cold) is very high.

What is the ratio between maximum and minimum annual gas consumption throughout the year?

Russian Federation and Ukraine: There may be a difference of several hundred per cent, depending on the region and the pattern of consumption.

Spain: 17/11, i.e. the minimum monthly volume of consumption (August) is 65 per cent.

Turkey: 90 per cent in winter, 10 per cent in summer.

Poland: Significant variation: from approximately 19 million cubic metres a day in summer to 45 million cubic metres during the winter maximum (data seems to apply to the whole country).

Hungary: 4/1 (monthly data).

Bosnia and Herzegovina: Minimum 200 cm^3/h in summer; maximum 50,000 cm^3/hour in winter.

Croatia: Hourly ratio min/max 29.5 (in 2000).

Czech Republic: Ratio of summertime/wintertime gas consumption varies between 1 and 6-8.

3. Research work applied in gas distribution projects

(Slovakia did not submit replies to questions in this section.)

In your country/company, what is your estimate of the percentage of the use of archive data in research and engineering?

Countries fall into two groups according to their replies:

Group I: Spain (20%), Romania (20%), Hungary (30%)

The low level of use of archive data could mean either that such data are lacking, or that they are expensive to obtain.

Group II: Russian Federation, Ukraine, Turkey, Poland, Bosnia and Herzegovina, Croatia, Czech Republic (40-50%)

In these countries archive data are readily available, but may be rarely updated. Consequently it is necessary to verify their reliability.

What percentage would you consider as an optimum one?

Spain and Romania: 30 per cent.

Ukraine, Poland and Hungary: 50 per cent.

Russian Federation: At least 60 per cent.

Turkey, Croatia: 70 per cent.

Bosnia and Herzegovina: 80 per cent.

Which of the survey methods (engineering and geodesy) listed below would you consider the most efficient?

All the countries use surface survey methods. Except for the Russian Federation, only Ukraine and Spain use advanced modern methods - Ukraine because significant areas of its territory border the Russian Federation, the scientific leader in this sector, and Spain owing to the influence of the developed European context. The other countries that responded to the questionnaire do not appear to be undertaking large-scale projects where such methods can be profitably employed.

The Russian Federation provided the following explanatory notes on the use of other survey methods:

Surface: Yes, at the stage of draft projects, guidelines and the preparation of executive documents.

Aerial: Yes, for large areas (city, district) when there is no updated topographical data.

Satellite (remote): Yes, for various types of monitoring and as small-scale planning material.

Laser scanning: Yes, for large areas or extensive facilities in an enclosed space, and also in combination with general updates of topographical data.

Do you think it reasonable and necessary to conduct engineering and geological surveys using new geophysical methods and other techniques?

All the countries except Spain (probably because it has been thoroughly geologically surveyed) think it reasonable to use geophysical methods to conduct engineering and geophysical surveys.

Same, but without well drilling

Russian Federation and Hungary: Yes, provided reliable geological reference data is available.

Croatia: Yes, but cost criteria must be taken into consideration.

Other countries: No.

4. Operation of Gas Distribution Networks

Who is responsible for gas distribution networks operations?

This varies from country to country. Direct gas transportation enterprise in Turkey, Slovakia and Romania; in other countries, a specially established gas distribution enterprise.

What kind of organization is it?

In Romania, Turkey and Bosnia and Herzegovina, a State enterprise. In Spain and Hungary, a private company. In the other countries, another form of ownership.

Which types of documents regulate gas distribution?

In most countries a unified normative and technical document, containing instructions and guidelines concerning methods of work, etc., on the basis of compliance with which the gas distributor is licensed to operate. In Poland and the Czech Republic, however, operations are regulated by separate norms, rules and standards specifying the requirements for each function performed by the organization. The situation in Bosnia and Herzegovina is interesting: in particular cases and upon special request, operations may be regulated by separate norms, rules and standards specifying the requirements for each function performed by the organization. In Hungary operations are regulated by statutes, Government decisions, standards and quality certificates.

Which of the following are the responsibility of the gas-supply system operator?

Surveillance and technical maintenance, scheduled repair work (routine and major) and emergency repair works in all countries, and disconnecting defective gas equipment everywhere except Hungary.

What parameters of the gas supply system are used to operators' structure and manpower and equipment requirements?

In most countries, the total length of the gas distribution network, the type of pipeline and the pressure, and the number and category of consumers.

Spain: Each private gas distribution company is free to set the number of its employees based on its requirements.

Croatia: In-house service instructions; prescribed operating limits.

Czech Republic: Remoteness and quantity of gas equipment, man-hours (technical standards of the organization), frequency of operational functions (as per TPG standards).

What is the level of service beyond which it is considered worthwhile establishing a repair and operating unit in any given locality?

Only the following countries answered this question:

Ukraine: Minimum of 300 km and at least 30,000 domestic consumers.

Russian Federation: The numbers, standards of equipment and location of emergency dispatching units are dictated by the requirement that an emergency team must arrive at the scene of an accident within 40 minutes.

Is the gas distribution organization fully equipped to ensure the normal operation of gas supply installations, or does it use the services of other specialized and appropriately licensed firms?

For the majority of countries the answer is yes, but outside organizations are brought in to perform certain specialized tasks.

Turkey and Slovakia: The gas distribution enterprise carries out all work.

Romania, Croatia: The services of outside (licensed) organizations are used to carry out repair work (the consumer pays the bill).

Does the gas distribution organization have its own emergency and dispatching units for locating and fixing faults and maintaining normal gas supply, or does it use the services of other specialized professional teams, firms or organizations?

The Russian Federation and Bosnia and Herzegovina provided almost identical answers to this question: for the most part the company carries out this work on its own, resorting when necessary to the services of specialized firms.

What is the time limit for emergency services to reach the scene of an emergency?

All the countries have their own requirements as regards arrival at the scene of an incident.

Romania: Immediately after report of a gas leak by the consumer or a special unit.

Turkey: 20 minutes to the remotest part of the network.

Slovakia: Depends on the distance (approximately 30 minutes).

Russian Federation, Ukraine: An emergency team should arrive at the accident scene within 40 minutes. When an explosion, fire, or gas leak in premises is reported, an emergency team must be dispatched within 5 minutes.

Croatia: One hour (internal regulations).

Hungary, Bosnia and Herzegovina: 1-2 hours after receipt of report.

Spain, Czech Republic: No norm specified. Work performed as quickly as possible.

What type of system monitoring do you employ?

Automatic/remote monitoring giving permanent coverage of entire distribution system

Optimal combination of automatic and visual (regular on-site inspection) checking of the system

The "optimal combination" method is used for permanent monitoring in all countries except Spain.

How often do you perform fault detection on pipelines?

In most countries, checks are carried out during scheduled work:

Turkey: Every month.

Romania: Every month in towns, every other month in rural areas.

Croatia: Regular checks are carried out throughout the year. Over a 12-month period, the entire high-pressure network is checked.

Slovakia: Low-pressure steel pipes (up to 5 kPa) are checked once every three years; medium-pressure pipes up to 0.4 MPa once every three years.

Spain: Comprehensive check of the entire network for leakage every 2-4 years.

Russian Federation: At least once every five years; lines needing major repairs or scheduled for replacement (relaying) are checked using instruments at least once a year.

Hungary: Frequency of fault detection varies depending on the GDC and depends on pipes' age, material and pressure level.

Czech Republic: In accordance with authorized rules in TPG 913 01.

In the event of forced replacement of pipelines, would you prefer replacement of steel pipes by steel pipes, replacement of steel pipes by polyethylene pipes, or pull-through methods ("Phoenix", "U-Liner" technologies)?

The determining factor is cost. The countries surveyed prefer replacement of steel pipes by polyethylene pipes, and steel pipes in high-pressure lines. Pull-through methods ("Phoenix", "U-Liner") are occasionally used.

To what extent do you use mobile fault detection?

Mobile fault detection is not used in Turkey or Ukraine. The Russian Federation and Poland use it as necessary. The other countries use mobile fault detection.

Do you install portable gas leakage detectors in residential buildings?

Most countries do not install such detectors. Turkey and Poland install them at the consumer's request.

Do you use acoustic methods of fault detection in your gas services? If so, how effective are they in comparison with other methods?

Most countries do not use acoustic methods.

Czech Republic: Not used because their range is considered too narrow.

Spain: Magnetic and electric methods preferred.

Hungary: Acoustic methods used as well as other methods.

Turkey: Acoustic methods are more effective than others.

There is therefore no consensus about the effectiveness of this method.

Do you use any special equipment for pipeline operation in high-risk areas (e.g. seismic or subsidence-prone areas, etc.)?

Most countries do not use special equipment; for some countries, no data is available. Special rules have been drawn up in the Russian Federation, Hungary and the Czech Republic.

Do you have an emergency stock of polyethylene pipes? If so, do you store them in a special area and what is the time limit for storage?

The majority of countries have an emergency stock of polyethylene pipes. These are stored in a special area for 2 years, whereupon the stock is renewed. Only Ukraine does not have special areas. The pipes are buried.

For employee training, certification and refresher training, do you use your own centres or existing institutions within your country or abroad? Do you screen potential employees according to any particular criteria?

Turkey, Romania, Ukraine, the Russian Federation, Bosnia and Herzegovina and Croatia have their own training centres.

The Russian Federation, Poland, Hungary and the Czech Republic have specialized training centres. The services of international specialized training and refresher training centres are used by agreement.

What rights and powers does the gas distribution organization have in the event of: consumers' breach of contractual obligations regarding the upkeep of gas equipment or payment for gas; repeated safety violations?

Most countries have an appropriate settlement law. Disconnection in the event of non-payment is an option in the Russian Federation, Ukraine, Bosnia and Herzegovina and Croatia.

Are gas distribution facilities guarded? If so, who is responsible for protecting them?

There is no special service in Ukraine or Turkey.

Russian Federation: In-house technical inspection department with help of special services.

Slovakia: SPP personnel.

Poland: The gas network operator is responsible for the security of gas distribution equipment.

Romania: Specialized units of the gas company are responsible for the security of the equipment.

Hungary: The GDC can be reached by phone 24 hours a day.

Bosnia and Herzegovina: There is a special security service in the form of teams that work on the pipeline route. Information is received at a dispatching centre.

Croatia: In-house technical inspection department.

Czech Republic: JPM has a permanent centralized service for monitoring high-pressure lines; the duty emergency teams monitor individual district branch mains.

Which types of activity regarding industrial safety are carried out by your organization?

Most of the countries had difficulty in answering this question. Those that did respond gave the following answers:

Poland: Training; only certified products and materials used for gas lines.

Hungary: Prevention of fires and leaks, safety precautions for staff.

Russian Federation, Ukraine, Romania: Industrial safety is achieved through planning and preparation for accident and incident location and repair, in-service monitoring of compliance with industrial safety requirements, and technical investigations into the causes of accidents and incidents.

Only the Russian Federation and Ukraine record gas supply accidents.

No country makes provision for industrial safety assessments or mandatory liability insurance for damage resulting from operation of gas supply networks.

Which means of communication do you use during the operation of gas supply networks: telephone, radio or technological communication?

Telephones are used everywhere except in Turkey (radio). Technological communication is used in the Russian Federation, Ukraine, Turkey and Romania. The Czech Republic uses satellite communication.

5. Gas Appliances and Installations

The Czech Republic and Slovakia provided no information under this section (explaining that these questions are outside the competence of the gas distribution companies).

Technical description of household gas installations

Type of appliance:

Cookers: The rated heat output of cookers used in these countries is in the range 2-15 kW (average 7 kW). Cookers in Turkey have the highest rated heat output.

Instantaneous water heaters: The rated heat output of instantaneous water heaters used in these countries is in the range 10-30 kW. Instantaneous water heaters in Turkey, the Russian Federation, Hungary and Ukraine have the highest rated heat output; heaters in Bosnia and Herzegovina have the lowest (10 kW).

Storage water heaters: The rated heat output of storage water heaters used in these countries is in the range 6-34 kW. Storage water heaters in Poland have the lowest rated heat output (6 kW); heaters in Bosnia and Herzegovina have the highest (34 kW).

Combined boilers: The rated heat output of combined boilers used in these countries is in the range 10-60 kW. Combined boilers in Hungary have the highest rated heat output (60 kW); Romania did not submit any information about this type of appliance.

Central heating boilers: The rated heat output of central heating boilers used in these countries (except for Spain) is in the range 7-60 kW. Spain cited data for its appliances in the range 118-1,641 Mcal/hr.

Condensing central heating boilers: Several countries do not use this kind of boiler. Only Croatia, Hungary and Turkey provided data on appliances in the range 25-60 kW.

State the efficiency of each type of household gas appliance

Cookers: Efficiency range 55-80%. Least efficient - Spain (55%); most efficient - Turkey (80%).

Instantaneous water heaters: Efficiency range 75-95%. Least efficient - Spain (75%), most efficient - Turkey (95%).

Storage water heaters: Efficiency range 80-95%. Least efficient - Spain (80%), most efficient - Turkey (95%). Bosnia and Herzegovina and Croatia did not provide data about this type of appliance.

Combined boilers: Efficiency range 78-95%. Least efficient - Spain (78%), most efficient - Turkey (95%).

Central heating boilers: Efficiency range 80-95%. Least efficient - Spain (80%), most efficient - Turkey (95%). Poland, Bosnia and Herzegovina and Croatia did not provide data about this type of appliance.

Condensing central heating boilers: Efficiency range 85-95%. Least efficient - Ukraine (85%), most efficient - Turkey (95%). Poland and Croatia did not provide data about this type of appliance.

Thermal performance testing and standards. List the normative instruments that regulate testing of the thermal performance of household gas appliances.

All the countries have relevant normative instruments except for Bosnia and Herzegovina, which is in the process of drafting them. Croatia uses the German standard in addition to its own normative instruments. In the Russian Federation, for example, this matter is dealt with by four State standards (GOST) and one technical directive.

Describe the basics of the thermal testing and of the measurement of environmental performance

Bosnia and Herzegovina provided no indication. In the other countries, gas appliances are measured against rated standards and performance levels. In Hungary, testing is carried out by independent organizations in line with national standards.

List the standard parameters employed in testing

Tests are usually carried out to measure CO, CO_2, No_x, CH_x, etc.

Name the organizations that carry out official testing and authorize the series production of gas appliances

Turkey: manufacturers. Hungary: certifying company. Poland: institute of oil and gas. Croatia: national laboratory. Ukraine: national centre for certification testing. Russian Federation: specialized certification centres. Spain: more than 30 authorized laboratories. In Bosnia and Herzegovina there are no such organizations.

Technical and environmental performance standards. Give the absolute values of the present and proposed future technical and environmental performance standards applicable to household appliances

Spain and Bosnia and Herzegovina did not cite these values. Relevant documents are being prepared in Croatia. Poland is planning to migrate to European standards. Hungary uses standards adopted in Hungary and Europe. Ukraine provided the fullest details.

Verification of the thermal efficiency of appliances. Indicate how and by whom the thermal efficiency of appliances is checked and emission concentrations are measured in service conditions, and whether there are any standards or rules for those activities

No information received from Bosnia and Herzegovina. In Croatia, tests are carried out by manufacturers. In Hungary, these matters are dealt with by an institute at the request of consumers. In Romania, a national inspectorate conducts tests at the request of consumers. In Poland, inspections are carried out by experts from the institute of oil and gas. In Spain, testing is carried out by authorized laboratories using measurement methods specified by Spanish and European standards. In the Russian Federation and Ukraine, current legislation does not provide for checks of this kind, but a series of efficiency checks is carried out during routine servicing of appliances.

Conclusions

Analysis and comparison of the answers to the questionnaire from 11 European countries (the Russian Federation, Ukraine, Spain, Turkey, Slovakia, Poland, Romania, Hungary, Bosnia and Herzegovina, Croatia and the Czech Republic) allows the following conclusions to be drawn:

1. Only a few European countries sent in answers to the questionnaire. With the exception of Turkey and Spain, they were mainly countries from the former “socialist bloc”.

2. The major Western European countries did not take part in the survey. It may be that the normative corpus on gas distribution is being elaborated at the EU level. However, it would certainly have been interesting to hear about relevant practices in Germany, France, the United Kingdom, etc.

3. In the light of 1. and 2. above, the conclusions about practices in European countries cannot be considered comprehensive.

4. Each country has its own normative framework regulating the planning and operation of gas distribution systems. This normative framework is shaped by the country's experience of planning and operating gas distribution systems, the characteristics and state of development of the national gas distribution sector, and regional climatic conditions. Croatia is the sole exception because it also uses the German normative framework for technological design.

5. Considering the future integration of the European economic area, it would be useful to elaborate unified normative instruments for gas distribution.

6. The Russian Federation is currently at the stage of reforming and improving its normative framework for gas distribution. Under the auspices of the Russian Ministry for the Power Industry, a special commission has been established to review and improve the normative framework for gas distribution and bring it into line with international and European practice. The Promgaz open joint-stock company is the scientific powerhouse for the distribution and use of gas, and it actively cooperates with this commission.

7. From the point of view of possible use by other European countries, it would be extremely useful to receive information about progress in drafting a normative framework concerning gas distribution for the countries in the European Union.
