

INTERNATIONAL QUALITY STANDARD PRINCIPLES DEVELOPMENT AND APPLICATION FOR PRACTICAL TECHNICAL REGULATION OF THE INDUSTRIAL SAFETY CONDITIONS OF GAS DISTRIBUTION SYSTEMS CREATED UNDER RUSSIAN PROJECTS

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Annotation

This report deals with the conceptual approaches of technical rules for operational processes, maintenance and management of service life of gas energy systems and facilities, which are created according to the Russian projects. The contents of the report is the basic principle of the International Organization for Standardization 9000: 2000, which we have developed and use in the operation of gas distribution networks, in the practice of regional gas supply and we use this principle for quality management processes, maintenance and repairs, reduction of the risk of exploitation and reasonable management for safe and reliable service of the major components of gas systems and complexes, including gas pipelines. Also this report shows the results of implementation of quality management regulation for full control of the quality parameters of technical devices and measuring information systems for objects of gas energy and industry. The report proposes a method to achieve important missions on industrial safety of technical rules for the operation of gas systems and complexes, which are based on the standards of the International Organization for Standardization 9000: 2000 and on international standards and recommendations on the functional safety of complex technical systems of the International Electrotechnical Commission (IEC).

Foreword

This report shows the results of the study of the quality of the justification for the industrial and environmental safety for gas distribution systems for objects that are created and operated according to the Russian projects. At the beginning we note particularly that the package of new federal laws of the Russian Federation in the field of culture of the safe operation of complex technical systems, including gas energy systems and gas industrial facilities during the licensing of dangerous production equipment facilities of these systems, defines the main principle of functional requirements, system reliability, security and environmental sustainability for the future operation period. This principle determines the importance of the implementation of quality management actions to solve the national problem of development of gas energy systems and facilities, as well as for the successful implementation of creative approaches and innovative projects in this sector of the economy of the gas industry and energy. In accordance with the fundamental conceptual statements on development direction of the Russian gas energy sector during the period up to 2015 and subsequent years, special and continuous attention should be given to the problem of detecting quality problems solution in designing, production and ensuring reliability, industrial safety of gas systems and objects of gas energy. It is clear that at the stage of designing and technological preparation and operation of new commercial gas energy systems, important aspects and functional safety factors that will affect the reliability, usability and viability of these objects must be taken into account. We have adopted the following principles for control methods and a culture of safety in gas energy systems:

- quality risk signs at any time of operation shall not exceed the acceptable social value of the designated security indicators;

- to get the greatest benefit from the operation of the industrial gas industry and energy facilities;
- commercial operation of gas industry and energy facilities should be as long as possible;
- full commercial use of the advantages of quality management of the gas industry and energy facilities and the possibility of applications for a variety of services for gas equipment, systems.

Implementation of these guidelines requires a transfer from the ageing idea of the planned management of production processes, diagnostic and maintenance, repair and/or replacement of equipment, reconstruction of pipelines or systems to the modern notion of resource-efficient service and/or completing the commercial operation of gas energy systems and facilities taking into account their actual technical conditions and risks for the further operation. However we must take into account all available justifications for further safe operation. While carrying out the practical tasks of technical regulations, we must choose new policies and programmes of operation, maintenance and repair of gas power systems, necessarily considering the technical and financial results of findings in the areas of safety, reliability, efficiency and profits during the operation of gas energy systems and facilities. Consequently, a new challenge arises: to redefine the content of the basic principles of quality management, underlying the families of standards ISO series 9000-2000. These standards are the foundation of the methodology of quality assurance services for the design, construction and operation of gas distribution installations and can form the basis of criteria to justify energy safety, system reliability and environmental acceptability of the risk to the consumers of natural gas, including the change of their preferences in terms of volume of consumed natural gas. In our case this task is being solved when we study the issues of security and system operation of various technological components and linear sections of the distribution gas pipelines, which will include different operating modes and which are subject to external influences from negative factors. Primarily, this will be the factors that lead to the degradation of the service properties, damage and even accidental destruction of portions of the gas pipelines of energy systems and facilities.

The main objective of our work is to optimize costs for diagnosis of industrial safety and maintenance of gas energy systems facilities, based on the main strategies of operation:

- termination of the industrial use of the facilities of gas systems and complexes right before the expiry of the projected service life;
- termination of the industrial use of the facilities of gas systems and complexes right before failure,
- termination of the industrial use of the facilities of gas systems and complexes in accordance with the requirements of international and national safety rules.

Considering global trends of ensuring quality and the culture of the safe operation of gas energy systems and facilities JSC "Gazprom promgaz" performs this task in the surrounding world of gas power engineering. JSC "Gazprom promgaz" continuously improves the quality management systems (QMS) for technical regulations of the whole cycle of works on the operation of gas power supply systems, management of service life and risks during the operation of the gas systems facilities. International Organization for standardization and its standards of series 9000: 2000 offer quality management and basic principles for ensuring safety during operation of gas energy systems and facilities. This lays the groundwork for QMS, namely,

- a systematic approach to the management of the industrial safety and risk management during operation of gas energy systems;
- compliance with regulations and technical regulations;
- formation of decisions on gas facilities security based on the experience, knowledge and facts;
- leadership of the manager in assurances of security, system reliability and environmental acceptability of future operation of gas energy systems,
- continuous improvement of QMS;

- belonging of employees to meeting the challenges of ensuring security for the gas systems and complexes;
- mutually advantageous relations with the outside world.

The essence and scope of quality system for technical regulation of conditions of industrial safety in gas distribution systems, created according to the Russian projects are illustrated in Figure 1. It should be noted that the principles of ISO apply in this system together with a certain hierarchically organized priorities of design process technical regulation, development and operation of gas distribution engineering systems constructed and operated in Russia.

Method – integration of operation method of gas energy systems and facilities through a system of quality support based on information platform of security distribution by QMS Technologies

Historically, to support the safe operation of gas energy systems and facilities by QMS Technologies, equipment, while basic gas facilities (pipelines, equipment, gas units, etc.) are susceptible to degradation and aging, was the integration of safety thought advances in such academic disciplines as gas engineering, engineering mechanics, instrument making, management. This integration in technical disciplines is important to support the basic idea of the QMS and target it (Figure. 2) to the analysis of industrial safety and risk management operation for gas energy systems and facilities. The integration is carried out with constant assessment and dynamic control of technical safety state of gas systems. Important step of this integration is a continuing process of diagnosis of what is the mechanism of damage of separate objects of gas energy systems. Knowing the mechanism of damage of separate objects of gas energy systems, and knowing the mechanism of damage spreading you can build models of industrial safety management. Then you can prevent accidents, death or injury to person or damage resulting from the operation of gas facilities. Normally by modeling different the most likely scenarios of the operation of the gas objects, you can predict useful conditions to support the safe remaining lifecycle of the gas facility (Fig. 3). The essence of why academic technical disciplines must be united in the analysis of industrial safety for gas systems based on the platform of QMS Technologies, lies in a practical opportunity to design the aging processes of equipment, pipelines or systems of gas installations in the future, and, thus, to support informative knowledge base for correct decision-making. The best quality and reliability of analysis of safety gas systems on the platform of QMS Technologies could be achieved through implementation of probabilistic safety analysis to support confidence in the future value of the expected damage to gas installations. This will ensure the implementation of quality management under conditions of optimizing maintenance and repair at all stages of the life cycle of gas facilities, will improve the construction of gas power systems, increase the efficiency of the production process. Now, for the operational stage of gas energy systems and facilities among many problematic tasks of industrial safety, a problem of development of quality management in maintenance became particularly important. For this reason, in recent years, investigations of possible risk factors and the operation of gas installations risks for different strategies and scenarios of operation has been seriously and systematically identified in relation to improvement of the quality of service management for processes and procedures. The platform for these studies was determined by standards of the International Organization for Standardization 9000: 2000 and standards IEC/TC 45. To achieve the desired results and to optimally control the processes of operation of gas energy systems and facilities a methodological algorithm was proposed (Figure. 4). This algorithm provides a processed system of actions to ensure industrial safety for the facilities of gas energy systems through specific documented quality management system processes on gas installations.

Results

In the case of solution of the problems of industrial safety, system reliability and environmental acceptability of future commercial operation of gas energy systems and facilities, it has been found out that the processes of the gas installation life cycle are

common for overall quality management system. First of all the following processes should be named:

- steering by activities' competitiveness while complying with the socially justified standards in industrial safety;
- instrumenting industrial safety activity provided socially sustainable level of performance of industrial operation of the gas facility;
- development and implementation of measures on maintenance, repairs, labor protection, etc.

The structure of these processes, especially in the field of modernization of quality management system model of industrial security systems, gas distribution, created according to the Russian designs, is presented in Figure 5.

Conclusion

Gas energy systems and facilities are the technological product of decades of hard work and enormous investments, the efforts of many people. Taking into account the trends of development of gas distribution systems and services for the design and operation at JSC "Gazprom promgaz" the development and application of the principles of international quality standards for the technical regulation of conditions of industrial security systems, gas distribution, created according to the Russian designs, has been carried out in an environment of constantly evolving quality management system (QMS) of technical regulation processes of lifecycle for engineering systems distribution, created according to the Russian projects. At the heart of this QMS are the basic principles of quality management ISO international standards 9000:2000, namely, customer orientation; system approach to management; process approach to regulatory and technical regulation; decisions based on the experience, knowledge and facts; leadership of the executive; continuous improvement of QMS; the involvement of employees; mutually beneficial relations with suppliers and consumers in the gas distribution system. Knowing when and where the limited resources of the service and support processes to ensure industrial safety for gas energy systems and facilities must be spent to fight ageing of gas installations and prevent accidents and damage, including health of personnel, requires the integration of risk analysis methodologies of design and implementation of technical, financial and other decisions. Considering the challenge of improving the safety, reliability and environmental acceptability of gas energy systems and complexes in the format of time of their project operation requires a broader optimization of the criteria of effectiveness of the conditions of maintenance and repair. This can provide a way to integrate the resources of the service on the platform of constantly developed QMS through practices of operation and technical regulation of the conditions of industrial safety gas distribution systems, created according to the Russian designs. In all steps of planning, design, and implementation of this QMS through integral processes of operation of gas facilities, the system should match the capabilities of gas energy facilities; carefully supporting their soundness to ensure energy security for the regions. Management of life of plants should be based on this understanding. At all stages of this QMS you should consistently provide monitoring, controlling compliance with industrial safety norms based on the platform of QMS Technologies. Using the features and benefits of QMS through practices of operation and technical regulation of the conditions of industrial safety gas distribution systems, created according to the Russian designs, it becomes possible to maximize the net cost of service, while remaining within budgetary constraints and keeping gas energy systems safety at the highest level.

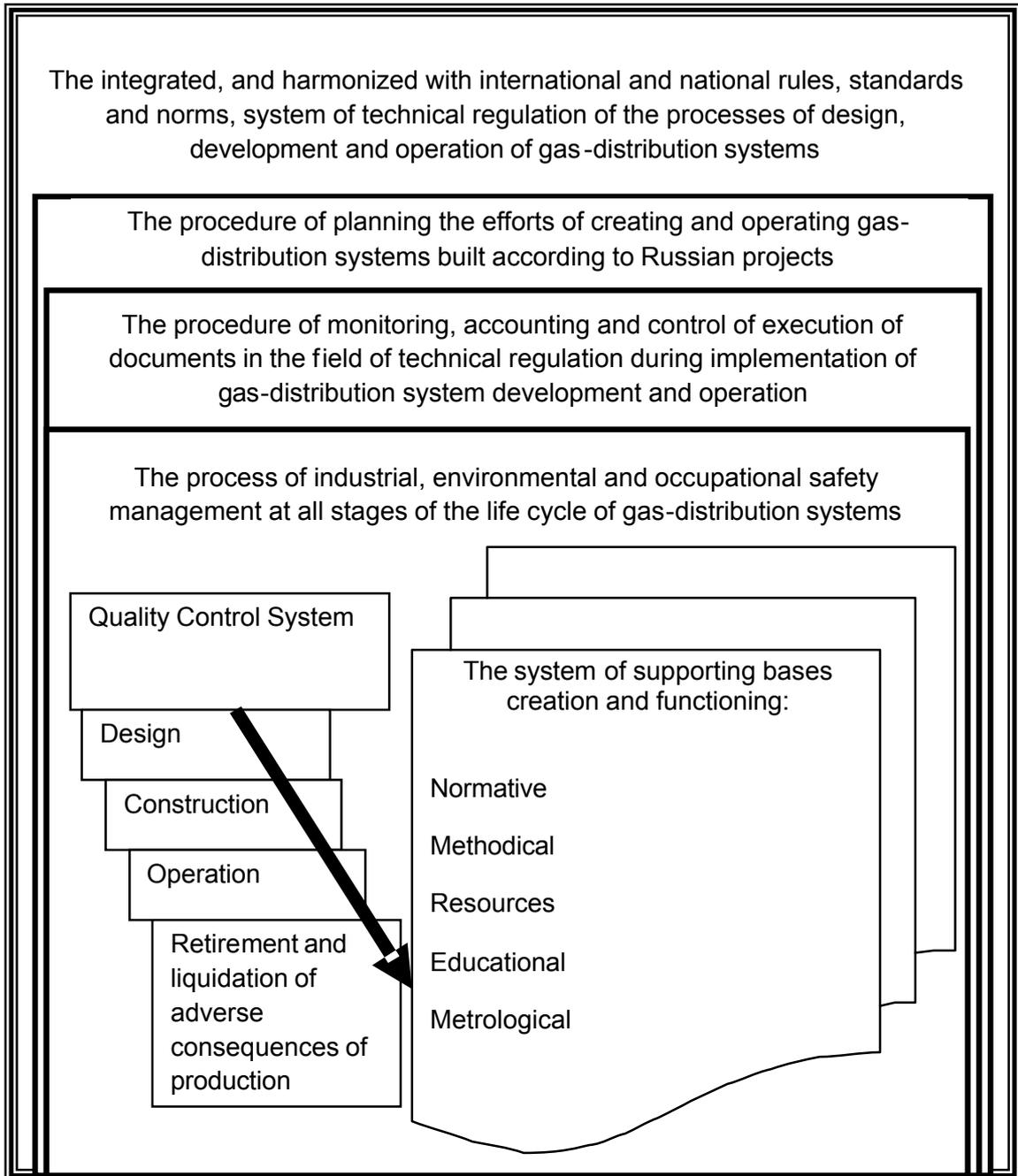


Fig.1

Improvements of the quality of services and production in implementing projects of constituting both equipment operation and data measuring system of gas installations

Basic kinds of rendered services

1. Assessment of enterprises capabilities and conditions to carry out activities in the field of gas energy utilization in line with requirements of regulatory documents
2. Supervision of compliance with requirements of regulatory documents, as well as with other Customer's requirements in developing design documentation for gas energy utilization facilities
3. Arrangement and implementation of:
 - Safety analysis documents for gas energy utilization facilities
 - Technical documents on equipment for gas energy utilization facilities
 - Consulting in the field of gas energy utilization facilities
 - Examination of organization preparedness to manufacturing equipment or rendering services
 - Review of inspection and testing schedules (quality plans, etc.)
 - Development of supervision schedules
 - Exercising supervision in control points (according to inspection and testing schedules), including acceptance inspections
 - Products and services suppliers' QAPs audits

Fig. 2. Main idea and aim for application of ISO principles for regulatory practices and safety culture of gas installations

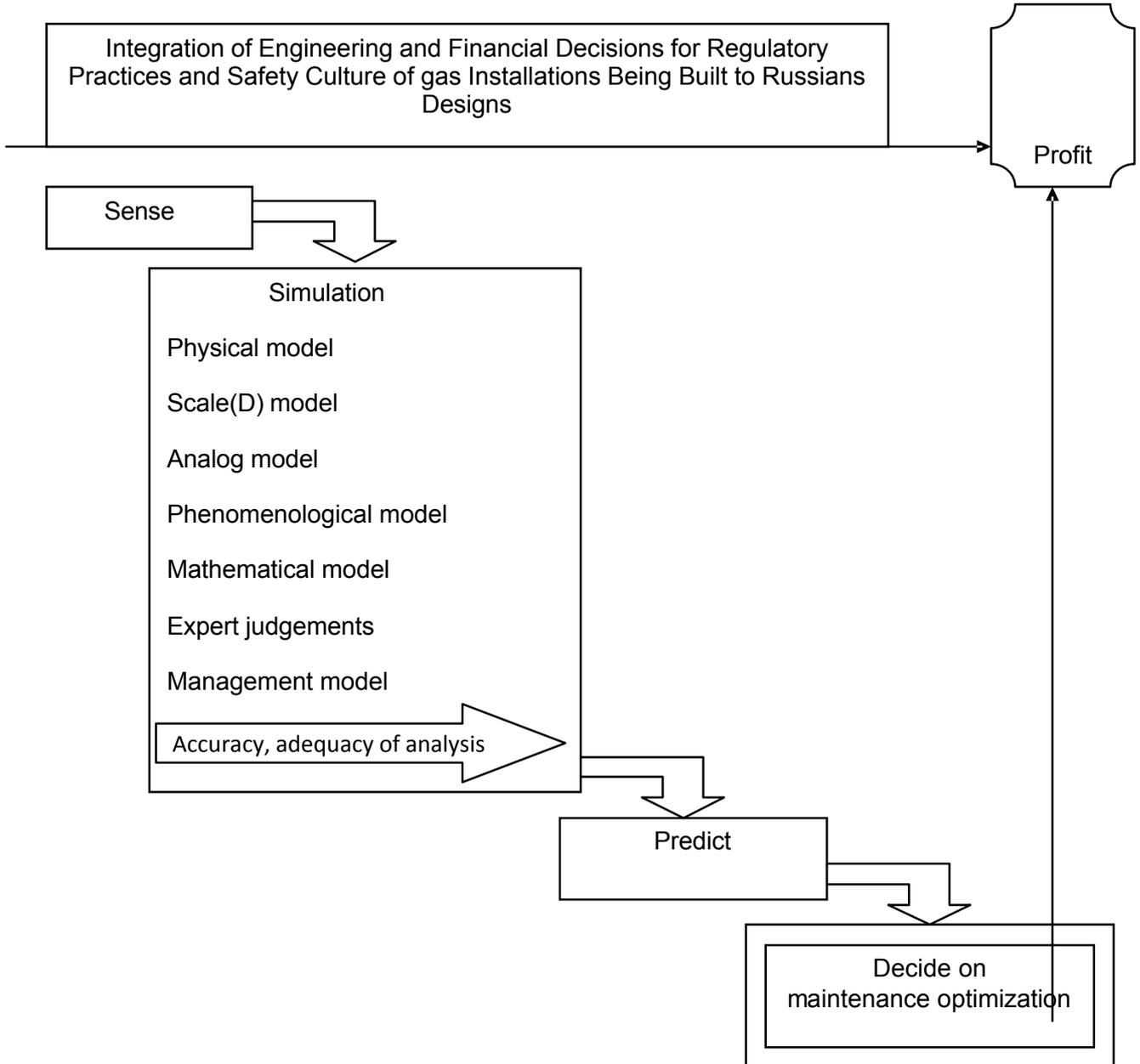


Fig. 3. Classification System Imitating Model for Assessment Priority Industrial and Safety

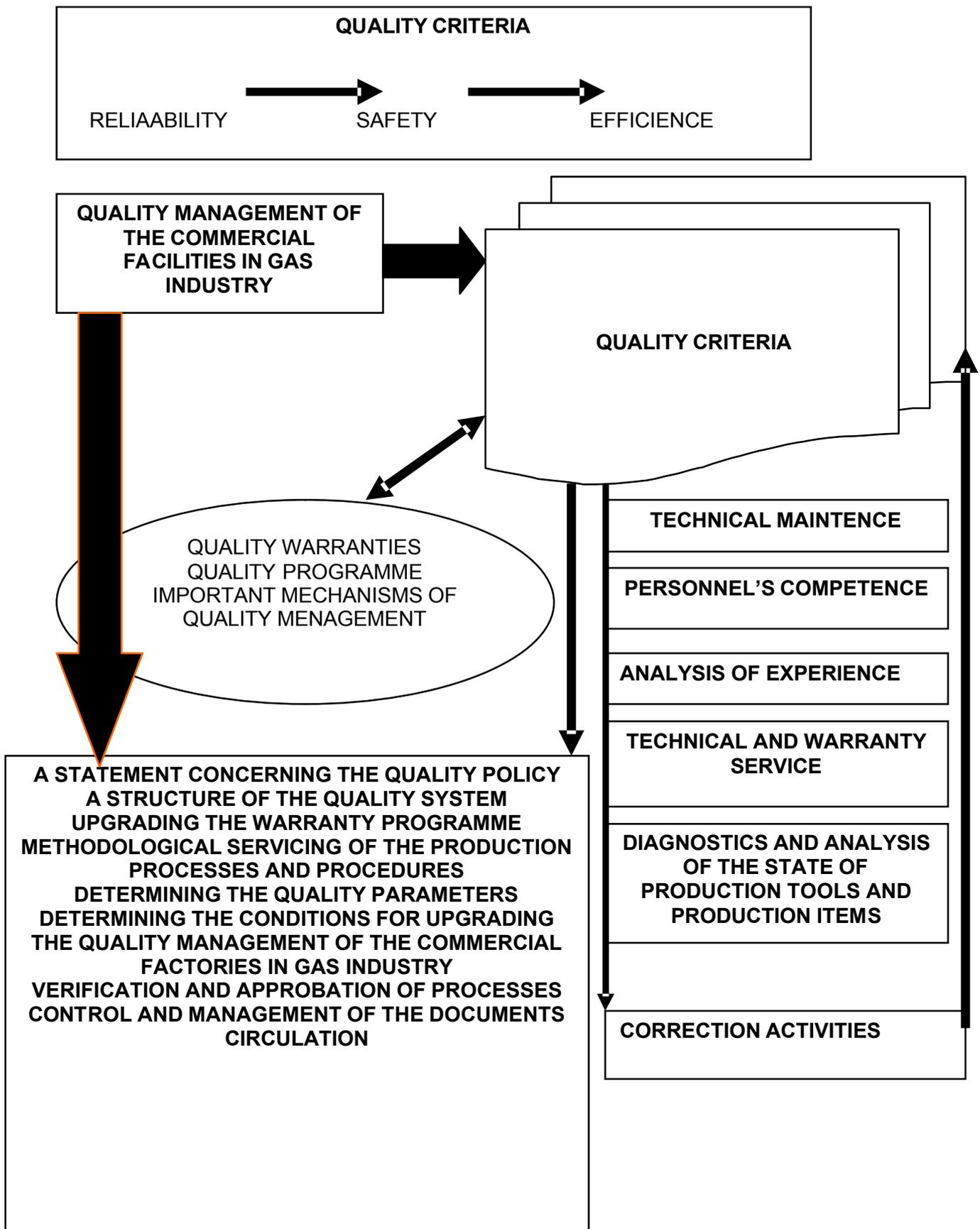


Fig. 4. Algorithm of system production item quality management at gas enterprises

Fig. 5. Methodology for improving properties the system quality management for regulatory practices and safety culture of gas installations built to Russian designs.