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Economically Sound Methods of Designing Water Supply and Distribution Systems

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Abstract: Is proved in article decisions on development of a water handling half-scientists only on the basis of an extensive and reliable data about technical condition of separate elements of these systems and parameters of the modes of their work, i.e. on data of redesigns researches.

Keywords: water taps, uneven pressure, internal water supply and sewerage of buildings, utilities, pressure instability, pump, tanks, pressure, network failure, internal water supply systems, frequency converter, water supply and distribution systems.

Reasonable decisions on the development of water supply systems can only be obtained on the basis of extensive and reliable data on the technical condition of individual elements of these systems and the parameters of their operating modes, i.e. based on pre-project survey data. However, in many cases it is not enough to use only the documentation available in operating organizations that characterizes the parameters of individual elements and equipment. This is due to the fact that during operation there is a continuous and regular change in the technical parameters of the structure, and the actual operating modes of the water supply and distribution systems (WDS) differ significantly from the calculated ones regulated by previously developed projects.

The collection of information on the actual state of the PRV systems is a rather complex technical task, the solution of which is not always possible by the forces of design organizations. At the same time, the work carried out by some organizations indicates that by obtaining extensive information about the water supply and distribution system (WDP), it is possible to obtain a significant economic effect and improve consumer provision. So the Academy of Public Utilities named after. K.D. Pamfilov [1, 3] developed a set of methodological techniques, in which decisions on managing the development and reconstruction of WDP systems are prepared on the basis of special surveys of WDP systems and equivalent calculation schemes.

The first stage in the construction of equivalent design schemes (models), which, in terms of the main parameters (pressure at network nodes, pressure at pumping stations, water flow through water conduits and the most important network lines, hydraulic resistance of pipeline sections) with sufficient accuracy, corresponds to real conditions, consists in determining water consumption values for various subscribers, in the analysis of a complete map of the water supply network and its simplification. The difficulty of simplifying the complete network diagram is due to the fact that the hydraulic calculation of complex ring networks, even with the use of modern computer technology, is not an easy task. In practice, the number of rings in networks that can be calculated using widely used computers does not exceed 200-300, while real networks of large cities can have 1500-2000 rings. Therefore, it is recommended to leave in the design scheme only the main trunk lines with the highest load, excluding almost the entire distribution network and dead-end lines. In many cases, the number of design scheme elements is reduced by combining several network lines into one scheme element with equivalent hydraulic resistance.

Data on the average water consumption in the WDP system is obtained from the materials of subscriber departments or control measurements. This requires special care, because due to the imperfection of the instruments for recording the amount of water consumed, data on water consumption do not have high accuracy. It is recommended to experimentally determine the water consumption at pumping stations and for the largest consumers (with a flow rate of more than 1-2% of the total water consumption). Data on water consumption is systematized and applied to the calculation scheme in the form of nodal selections. One of the most important stages of work on constructing an equivalent model of the WDP system is carrying out field surveys, determining the actual hydraulic resistance of existing pipelines and the flow-pressure characteristics of pumping units [2].

Manometric survey data during characteristic periods of relatively stable water consumption (from 11 am to 3 pm and from 1 am to 5 am on weekdays) is the basis for assessing the equivalence of the design scheme of the WDP system to real operating conditions. Gauge survey, i.e. pressure measurement, is carried out in a sufficiently large number of nodes (main intersections of highways), the number of which should be at least 70% of the total number of network nodes. For large networks, measurements are carried out over several days, while the stability of water consumption regimes must be confirmed by the data of the dispatching service, which should prevent a sharp change in the operating modes of the main structures (pumping stations, tanks, etc.) during the period of manometric survey.

Manometric survey data are the basis for constructing the movement of water. Already a preliminary analysis of the manometric survey data makes it possible to identify sections of the network with abnormally high pressure losses (due to closed valves, blockages, freezing, etc.), and the elimination of these anomalies leads to an improvement in the water supply of some local areas of the water supply network.

The most important type of natural testing is the work to determine the actual hydraulic resistance of pipelines. It is known that as a result of corrosion and hydraulic fouling, the operating conditions of long-term pipelines can differ significantly from the conditions of new pipes. In addition, poor-quality construction of pipelines also leads to an increase in hydraulic resistance. The pattern of fouling on the inner surface of pipelines can be analyzed by inspection, but obtaining quantitative characteristics is possible only through experimental studies. The most reliable and practically accessible method of such studies is the determination of the hydraulic resistance of pipelines according to the measurement data of pressure tubes of the velocities of water at various points in the section, including on the axis of the pipe.

As a result of a number of studies, dependencies were obtained for calculating the values of the coefficients of hydraulic resistance according to the measured speeds [3]. These studies are the most time-consuming and cannot be performed on all sections of the network. Nevertheless, it is recommended to cover sections of pipelines made of different materials, different years of construction, different diameters in order to fairly reasonably extrapolate the results of a limited number of measurements to the entire network.

Other methods for measuring hydraulic resistance are also used, which are based on determining the pressure difference in the initial and end sections of pipelines, the water flow rates for which are determined using water meters.

During field surveys of WDP systems, it is recommended to determine the flow-pressure characteristics of pumping units, since during operation, due to wear and tear of equipment, these characteristics are quite different from the passport data. It should be noted that it is the stage of field surveys that is the most difficult for design organizations, but only the mandatory performance of the work of this stage by specialized survey departments of design institutes, commissioning organizations or operational services can guarantee the receipt of a sufficient amount of initial information about the operating conditions of the WDP system.

The absence of this information will lead to the fact that the decision made on the development of the system will not correspond to the actual situation and will not lead to a significant improvement in the water supply of consumers, will not provide the ability to connect new subscribers to the system and normal operation of the system for the entire accepted estimated period of the project. Experimentally determined coefficients of hydraulic resistance of pipelines of the WDP system make it possible to calculate correction factors for tables of these resistance values. However, automatic extrapolation of such data to all elements of the calculation scheme is possible, since even for pipes of the same laying year and made of the same material, the hydraulic resistance coefficients can actually have significant differences. In addition, the elements of the design scheme, obtained by combining several sections connected in parallel or in series, have an equivalent resistance, which should be corrected very carefully according to the measurement data. Therefore, the next stage of the described work is to identify the design scheme, i.e. in its correction in such a way that the values of piezometric pressures calculated by hydraulic calculations according to this scheme at the network nodes coincide quite accurately with the data of field measurements. Here, a step-by-step correction of the parameters of the design scheme is used, which is carried out until the difference between the measured and calculated piezometers is ≤ 1 m. Usually, it is enough to carry out 5–6 correction stages at which the coefficients of hydraulic resistance of the lines of the design scheme are multiplied by the value

$$K_i = \Delta h_{i\,fakto} / \Delta h_{i\,dif}$$

where K_i - correction factor for the *i*-th section of the network;

Δh_{ifakto} - difference between the heads measured at the ends of the *i*-th section;

Δh_{idif} - difference of design pressures at the ends of the *i*-th section.

In the process of correcting the parameters of the design scheme, the measurement of the values of the hydraulic resistance coefficients serve as restrictions on the values K_i (greatest deviation K_i from the measured values should not exceed ± 50%) for those sections of the design scheme on which the measurement was not carried out.

References

1. I.V. Kozhinov, V.V. Kolesov, M.P. Maysals, I.S. Egilsky. Overlay and intensification of the operation of urban water supply and distribution systems. M., Stroyizdat, 1998
2. Vennikov V.A. Calculations and analysis of network operation modes. - M .: Energia, 2000.
3. Verbitsky A.S., Bakhramov U., Mesropyan E.A., Methods for managing the development of water supply systems in large cities, series - Problems of large cities. Review information, GOSINTI, M.: 1995 issue No. 46.
4. Baxramov U., Makhamataliev I. Modeling of the Random Process of Changing the Structure of an Engineering Network. International Jornal of Scientific & Technology:- India. Research. India. Volume 9- Issue 2, February 2020 Editon. ISSN 2277-8616. p.2676-2678.

5. Baxramov U., Obidjonov A. Simulation of Engineering Networks and Assessment of the Accuracy of the Mathematical Model. Solid State Technology. USA. Volume: 65 Issue: 1 Publication Year: 2022. p. 69-79.
6. Baxramov U., Kaxarov B.,, Obidjonov A. Simulation of Consumption Processes of a Target Product in Engineering Networks. Solid State Technology. USA. Volume: 65 Issue: 1 Publication Year: 2022. p. 63-69.
7. Baxramov U. Parametric Optimization of Engineering Networks, Taking into Account the Stochastic Nature of the Processes of Consumption of Target Products. Solid State Technology. USA. Volume: 65 Issue: 1 Publication Year: 2022, p. 283-292.
8. Baxramov U. Developmemt of a matematical model of stochastic flow distribution in pipeline ingineering networks. Gongcheng Kexue Yu Jushu. Advanced Engineering Jurnal ID: ES . India . SN: 2096-3246 , p. 5739-5746.
9. Hungarian. –M., Energy, 1996. - p.360
10. Yu.A. Fokin. Textbook for the course "Mathematical Problems of Energy", Methods for calculating the integral characteristics of the modes of power supply systems in determining the design loads. M., MPEI. 2005. p. 285
11. Rasulov, M., Ibragimov, U., Mirakhmedov, M., & Rizaev, A. (2014). Central Asian transport corridors and prospects of Uzbekistan's further integration to the global transport network. In *7th International Symposium for Transportation Universities in Europe and Asia//Dalian Jiaotong University, China-2014.–pp* (pp. 25-30).
12. Rasulov, M. H., Rizaev, A. N., & Rahimov, R. V. (2016). Theoretical research for defining the body durability characteristics of cement carrier rail car manufactured in the Republic of Uzbekistan. *Journal “Innotrans”.–Ekaterinburg*, (4), 22.
13. Rasulov, M., Ibragimov, U., & Rizaev, A. (2015). Kh. Turdiev: The combined transportation as a background for establishment of a new railway corridor China–Kyrgyzstan–Uzbekistan. In *8-th International Symposium for Transportation Universities in Europe and Asia, Nanjing Institute of Railway Technology, China*.
14. Rizaev, A. (2020). Research methods of water purification from pollution with petroleum and petroleum products. *International Journal of Psychosocial Rehabilitation*, *24*(08), 5630-5634.
15. Abdumalik, R., Dilshod, K., Umarkhodzha, B., Gulchehra, R., & Uchkun, U. (2023). STUDY OF THE SEDIMENTATION PROCESS OF SUSPENDED SOLIDS IN HORIZONTAL SEDIMENTATION TANKS FOR WASTEWATER. *Universum: технические науки*, (3-4 (108)), 54-58.
16. Rikhsikhodjaeva, G. R., Rizaev, A. N., & Esanmurodov, S. V. (2023). ADVANCEMENT OF CORROSION AND SALT DEPOSITION INHIBITOR FOR PROTECTION OF HEAT EXCHANGE EQUIPMENT OF OIL REFINERIES. *CENTRAL ASIAN JOURNAL OF MATHEMATICAL THEORY AND COMPUTER SCIENCES*, *4*(3), 74-78.
17. Набиевич Р.А., Нажим М., Рашидходжаевна Р.Г., Умарходжа Б. и Вафокулович У.У. (2023). Повышение эффективности очистки нефтесодержащих сточных вод за счет использования флокулянтов. *Nexus: Journal of Advances Studies of Engineering Science* , *2* (3), 59-63.
18. Худайберганова Н., Ризаев А. и Абдурахмонов Э. (2021). Адсорбционные свойства паров бензола на активированном угле из кокса и асфальта. В *E3S Web of Conferences* (том 264, стр. 01022). ЭДП наук.

19. Rizaev, A., & Bakhromov, U. (2007). Water intake structures. *T. Aloqachi Publishing House*.
20. Ризаев, А., & Режабов, С. (2022). Совершенствование очистки нефтесодержащих сточных вод транспортных предприятий. *Miasto Przyszłości*, *24*, 176-178.
21. Рихсиходжаева, Г. Р., & Ризаев, А. Н. (2020). Технология получения ингибитора коррозии и солеотложения для теплообменного оборудования. *Universum: химия и биология*, (8-2 (74)), 22-24.
22. Rikhsikhodjaeva, G. R., & Rizaev, A. N. (2022). Analysis of modern methods of salts and corrosion destruction of petroleum equipment. *Advanced Engineering Science*, *54*(02), 5747-5752.
23. Rikhsikhodjaeva, G. R., Esanmurodov, S. V., Rizaev, A. N., & Vafokulovich, U. U. (2023). THE APPEARANCE OF MINERALS AND STRATEGIES FOR DECIDING OVERABUNDANCE MINERALS IN WATER. *Open Access Repository*, *4*(3), 1524-1529.
24. Rashidkhodjaevna, R. G., & Muzaffar, M. (2022). Water Treatment Against Salt Accumulation for Circulating Water Supply System. *European Journal of Life Safety and Stability (2660-9630)*, *15*, 236-239.
25. Rixsixodjaeva, G. R. (2021). CORROSION AND SCALE FORMATION ARE ASSOCIATED WITH THE CHARACTERISTIC FEATURES OF WATER AND METALS. *ResearchJet Journal of Analysis and Inventions*, *2*(12), 71-76.
26. Nabievich, R. A., Nazhim, M., Rashidkhodzhaevna, R. G., Umarkhodzha, B., & Vafokulovich, U. U. (2023). Improving the Efficiency of Oily Wastewater Treatment Through the Use of Flocculants. *Nexus: Journal of Advances Studies of Engineering Science*, *2*(3), 59-63.