ISSN: 2582-4686 SJIF 2021-3.261, 2022-2.889, 2023-5.384, 2024-6.875 ResearchBib IF: 9.948 / 2024

THE MULTIDISCIPLINARY JOURNAL OF SCIENCE AND TECHNOLOGY

VOLUME-5, ISSUE-2

CRITERIA FOR SELECTION OF WATER NETWORK PIPELINE RESTORATION OPTION

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Abstract. This article discusses the issues of choosing the most legitimate service life of equipment that meets the required level of reliability of water supply, payback period, which is determined on the basis of statistics on accidents and damage to sections of pipes in operation, averaged for any operating conditions of pipeline systems.

Keywords: pipeline, water supply, the reliability of pipelines, re-laying a pipeline.

Аннотация: В *данной статье рассматриваются вопросы выбора наиболее обоснованного* срока *службы оборудования, отвечающего требуемому уровню надежности водоснабжения,* сроку *окупаемости, который определяется на основе статистики аварий и повреждений участков труб в* процессе *эксплуатации, усредненной для любых условий эксплуатации трубопроводных систем.*

***Ключевые* слова:** *трубопровод, водоснабжение, надежность трубопроводов, повторная прокладка трубопровода.*

Of particular importance when implementing a program to modernize the city's water supply network is the task of timely identification of pipeline sections that in the near future will prove unsuitable for further normal functioning and will require their restoration. The functioning of the pipeline operation database (DB) allows you to reasonably select priority repair objects. And then the problem arises of choosing the type (option) of restoration - replace the pipe section, or rehabilitate it, or continue its operation by carrying out repair, restoration and preventive work to ensure that the pipeline section is maintained in working condition.

Currently, the replacement or rehabilitation of pipeline sections is carried out on the basis of operating experience and, in some cases, expert assessment. At the same time, the required costs for carrying out certain works are assessed promptly as accidents occur, without taking into account the specific operating and construction conditions and assessing the level of their reliability, as well as the actual service life of the pipeline.

The basis for making one or another decision to ensure the reliability of pipelines, along with the high accident rate of pipeline sections in certain places of the network, an expert assessment of their condition and the end of the standard service life, is the estimated useful life. To assess the useful service life of a pipeline corresponding to a given level of reliability, an economic-statistical model is used, which takes into account actual data on the failure rate of pipelines with different laying periods and different operating conditions. Research has shown that this service life can be either longer or shorter than the standard service life, which is determined by the impact of various external and internal factors on pipelines, as well as construction and operating conditions in a particular case. The share of each factor in the total impact may be different, which is practically very difficult to establish in real operating conditions. However, the sum of the generalized impacts allows us to give

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a reasonable picture of the need to modernize the city water supply network from both technical and economic positions. In addition, it is obvious that when the pipeline is operated beyond its useful life, the reliability of water supply through it decreases and does not correspond to the specified one. At the same time, the technical feasibility of operating the pipeline in its existing state is determined by the compliance of the actual level of its reliability - accepted as the standard. Economic feasibility at a given level of reliability is determined by the new (actual) service life and the corresponding values of deduction rates for depreciation, as well as the costs of major and current repairs. When taking into account the specifics of specific operating conditions of pipelines and, if it is necessary to comply with the required (given) level of reliability of water supply, the actual costs of major, current repairs and depreciation will also not correspond to the standards established for average operating conditions.

In specific conditions, they can be either more or less than the normative ones. After assessing the useful service life (at a given level of reliability), two options are possible for making a decision on the further operation of the pipeline:

- the first provides for the investment of additional funds (at the old values of deductions for all types of repairs) to maintain the operability of the pipeline at reduced values of the reliability level;
- the second provides for the possibility of re-laying a pipeline, the operation of which in its previous form has become economically impractical, or carrying out special work to restore it (rehabilitation) in order to ensure its operational condition with the required level of reliability. In accordance with regulatory documents [1,2], the indicator of the best option is the minimum of the given costs. Reduced costs Ppr. for each option they represent the sum of current costs (operating costs Pek) and one-time costs (capital investments Ps), reduced to the same dimension in accordance with the standard efficiency of capital investments E, or the standard payback period of capital investments Current.

That is, we have the following expressions for determining the values of reduced costs:

Ppr. = Ps + EPek ← minimum

Ppr. = Ps To + P ek ← minimum

Thus, the main dictating components of the given costs when choosing options for restoring the operability of pipelines will be:

- capital costs for the construction of a new pipeline, the residual cost of the laid (operating) pipeline by the year of the end of its optimal service life, the year the decision was made, capital costs for repairs, the annual cost of electricity.

According to the existing (not yet cancelled) methodology for determining the effectiveness of capital investments, the payback period for capital investments (guideline) is 8.3 years. According to this methodology, this meant that the option with the highest capital costs would be more economical if the additional capital costs will pay for it through savings in operating costs over a period of up to 8.3 years. This policy period was the result of planned management of the national economy and reflected the level of development of the country's economy.

In modern conditions, there is no centralized management of the economy. Each industry, depending on the level of its economic situation, can invest capital investments in the development of the industry in completely different ways. Therefore, in modern conditions it is impossible to focus on this period. Some researchers believe that, by analogy with developed foreign countries, we now need to accept this period of 4 - 6 years. But this value of the economic payback period does not correspond to the level of development of the economy of Uzbekistan.

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Therefore, in our opinion, in relation to water supply and distribution systems, the most legitimate thing is to consider the issue of the so-called useful life, corresponding to the required level of water supply reliability. It has the advantages over the payback period that is determined on the basis of statistical data on accidents and damage to sections of operated pipes, that is, it is not prescriptive, averaged for any operating conditions of pipeline systems. Then, when carrying out optimization calculations for the above two main options, if the calculation turns out that the economic service life of the pipeline section will be less than the service life corresponding to the required level of reliability, then this will indicate that replacing this section with a new one will have both technical and the economic side is completely justified.

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