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DETECTION OF DANGERS IN A LIFE CYCLE OF MAIN PIPELINE TRANSPORT

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This article is devoted to identifying dangers at different stages of the life cycle of the main pipeline transport with the use of the process approach. The essence of the process approach is to identify processes and provide their interoperability. Preference in selection of process approach was based on the statement that the creation of quality and emergence of quality loss, and thus the security as a component of quality happen in processes. It was also proposed to use a graphical display of the processes in the technical normative legal acts because the presentation of processes becomes concise, well received, intuitive and at the same time meaningful and informative.

The activity of any organization can be graphically represented in the form of interrelations between personnel, processes, legal acts, raw materials. This allows us to visually see the scheme and understand the purpose of the organization's functioning, to identify and evaluate inefficient links. In this regard it is convenient to apply a process approach in assessing the effectiveness of the organization's activities. The essence of the process approach is the systematic identification of processes and ensuring their interaction.

The application of the process approach implies the consideration of company activities as a set of processes that use resources and transform inputs into outputs under the influence of control actions to achieve the organization's main goals. In this case the organizational units are viewed not as structural units with their separate goals but as participants in the process. When presenting the process of producing products or providing services in the form of a sequence of processes the structure of product value formation is better understood, it is possible to analyze the causes of the loss of quality and its constituent - safety from possible hazards. In its turn for the competent construction of a network of processes it is necessary to have information on their classification.

All processes of any activity can be divided into life cycle processes, management processes and resource provision processes [1].

As indicated in [2] the processes necessary for a quality management system should include management processes, support processes, life cycle processes and measurements. This classification of processes should be considered the most complete since it covers all the processes that are present in the activities of the organization. Considering that safety is one of the quality indicators in describing the network of processes to assess their safety it is advisable to use this classification of processes.

Management processes should include planning and analysis by management. A distinctive feature of this class of processes is the results which are the developed conditions under which the support processes, life cycle processes and measurement processes should function.

Processes for providing resources are auxiliary processes. They cannot be attributed either to managerial processes or to the life cycle processes. A distinctive feature of these processes is that the results of these processes are the resources that are used in the implementation of life cycle processes and resource management.

Life cycle processes can be divided into separate processes each of which corresponds to a certain stage of the product life cycle: planning, design, product development, procurement, production and maintenance. A distinctive feature of these processes is that the result of these processes is the product or service provided.

Measurement processes should include processes for monitoring, analyzing, measuring, managing inappropriate products and improving. A distinctive feature of these processes is the results which are indications that are aimed at improving the product or services provided and are used in the management, provision and life cycle processes.

An accurate and detailed description of the network of processes in the main pipeline transport requires the presentation of peculiar features as well as the processes and resources involved in it at all stages of its life cycle.

Among the features peculiar to the main pipeline transport in its functioning and distinguishing it from other types of transport the following features can be shown:

- as a result of the operation of the main pipeline transport products are not produced but a service is provided for the transportation of gas, oil and oil products from their production sites to the places of consumption;

- the main pipeline transport is a linear-extended type construction. Its main component is a linear part representing a continuous thread welded from individual steel pipes and laid along the route in one way or another;

- this type of transport is characterized by the possibility of its ubiquitous laying, so it can be used in a variety of topographic, geological, hydrological and climatic conditions;

- during functioning of this mode of transport a low cost of transportation is ensured in comparison to other types of transport;

- during transportation of hydrocarbon carriers by pipeline transport their quality is ensured due to the complete hermetic sealing of the pipe;

- during operation the automation of pouring, pumping, transporting and discharging of the energy carrier is maintained;

- the main pipeline transport is serviced by a small number of personnel

- in abnormal operation mode the main pipeline transport as a hazardous production facility becomes a source of a number of hazards accompanied by large negative consequences for the environment, personnel, population and other technical facilities.

In the life cycle of the main pipeline transport 7 main stages can be highlighted: design, construction, operation, reconstruction, overhaul, conservation, liquidation [3].

The interaction between the processes at each stage is organized sequentially, in parallel or in series-parallel which is connected with the possibility of performing the next process when one or several simultaneous processes arrive at its input.

Dangers can occur at each stage of the life cycle. Each stage is characterized by its inherent danger which happens due to the presence of individual material and information flow at each stage. Possible types of hazards that are inherent in this or that object of technical regulation and respectively the main pipeline transport are presented in [4] and consist of 11 species. The most interesting from the point of view of the origin and manifestation of hazards are such stages of the life cycle as design, construction, operation, reconstruction and overhaul. In the process of conservation and liquidation less hazards are observed.

Designing is a very important stage. Designing is the only stage of the life cycle where there is no manifestation of the dangers associated with the operation of the main pipeline transport. At this stage the basics for the operation of the main pipeline transport and the potential conditions that lead to the emergence of danger in the future are laid.

At the stage of construction of the main pipeline the quality of the installation works determines its failure-free operation in the future. Poor work performance during construction will contribute to the emergence of hazards and their transition to the next stage of the life cycle – operation. The interaction between processes on a given stage of the life cycle occurs predominantly sequentially. It should be noted that the processes and their results are subject to production, operational, inspection and author supervision. Each process during the construction of the main pipeline is a carrier of potential danger. To identify these processes on a more detailed level it is necessary to decompose the processes of the first level.

Visual detailed representation of the processes creates convenient conditions for further analysis of the possibility of a particular hazard occurrence. Comparing each process of the second level of decomposition to potential hazards it is possible to compile a list of the dangers inherent to processes at different stages of the life cycle. After considering each process at a lower level of decomposition and comparing possible hazards it can be concluded that the following types of hazards can occur at the construction stage: mechanical, fire, thermal, electric.

Operation is the longest stage of the life cycle in the main pipeline transport corresponding to the standard service life and even longer periods. It is during the operation that all the shortcomings of design solutions and construction are revealed. A distinctive feature of this stage is the simultaneous both sequential and parallel interaction between processes. While analyzing each process at the second level of decomposition for the appearance of danger it was revealed that at the operational stage the greatest number of hazards occur and they are related to the following types: mechanical, industrial, chemical, fire, explosion, thermal, electric.

Overhaul of the main pipeline transport is a complex of technical measures aimed at the full or partial restoration of facilities to design characteristics. Overhaul is carried out after elimination of the detected during diagnostics defects. Potentially dangerous defects are eliminated in the process of overhaul. Interaction

between processes is mainly sequential. The applied approach allowed to determine that at the given stage of the life cycle the following types of hazards can arise: mechanical, industrial, fire, explosion, thermal, electric.

Reconstruction of the main pipeline is a complex of measures for the reorganization or technical re-equipment of the main pipeline. In terms of the content of the works performed and the application of technical basic legal acts this stage of the life cycle is similar to construction. At this stage of the life cycle the following types of hazards can occur: mechanical, industrial, fire, explosion, thermal, electrical. Interaction between processes is mainly sequential.

Conservation of the main pipeline is a set of measures to protect the main pipeline facilities from adverse environmental impacts and other factors after the main pipeline is taken out of service. At this stage of the life cycle there may be such hazards as mechanical, fire, explosion, thermal, electrical. Interaction between processes is mainly sequential.

The liquidation of the main pipeline is the actions for dismantling, demolition or re-profiling of the main pipeline facilities and bringing the environment into a condition that is safe for life and health of citizens and suitable for further use. At this stage of the life cycle there may be such hazards as mechanical, fire, explosion, thermal, electrical. Interaction between processes is mainly sequential.

The presentation of the stages of the main pipeline transport life cycle at the second level of decomposition with the help of the process approach made it possible to compare the types of hazards to the stages of the life cycle.

Dangers in the main pipeline transport can originate at any stage of the life cycle. Among them the most important are designing and construction. The manifestation of hazards can occur at all stages of the life cycle with the exception of design. During the construction of the main pipeline, 4 types of hazards can occur, during operation – 7, during major repairs – 6, during reconstruction – 6, at liquidation – 5. Operation as the life cycle stage of the main pipeline transport is the most dangerous and responsible both in quantity of dangers and the scale of their manifestation.

Thus, from all stages of the life cycle operation requires the most thorough systematic assessment of hazards. Performing an assessment of the dangers must be carried out by focusing on the process approach because both quality assurance and loss of security are observed in the processes. The display of processes and the interrelationships between them in a graphic form facilitates the process of assessing hazards since such a graphical representation is concise, intuitive, well perceived and at the same time informative.

The proposed approach of mapping processes in graphic form is expedient for applying in the development of technical normative legal acts in the main pipeline transport. Currently the most of the technical regulatory legal acts are presented in text form. This is not always convenient for understanding because the text can poorly trace the sequence of processes and doesn't describe the inputs to processes and outputs from processes. Graphical display of processes with inputs, outputs, control actions will eliminate this disadvantage. Along with that this approach allows to take into account the maximum possible list of hazards arising in processes at various stages of the life cycle when developing technical regulatory legal acts. This feature is realized by decomposing the processes of the highest level to simple operations.

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