

Adaptive control methods

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ENVIRONMENTAL MANAGEMENT AS A COMPONENT OF AN INTEGRATED MANAGEMENT SYSTEM FOR GAS CONDENSATE AND OIL PROCESSING ENTERPRISES

Abstract. The results of activity and stages of implementation of various measures of environmental policy of the enterprise are considered on the example of Shebelinsky department of gas condensate and oil processing. The structural scheme of the ecological management system model as an important component of the integrated management system of the gas condensate and oil refining enterprise is proposed on the basis of scientific literature, regulatory and legal documents using structural-logical method, systematization and generalization, and methods of meaningful and comparative analysis. This work also describes the specifics of ecological standards implementation based on ISO 9000 and ISO 14000 series for integrated management system development. It has been proved in practice that development and implementation of the integrated management system in the natural gas liquids and oil processing enterprise provides certain advantages, specifically, improves the overall products competitiveness, helps to adapt faster to the market environment, shapes environmental policy and approaches for effective resource management. The integrated management system development process consists of 4 basic stages, namely, planning, implementation, verification, and adjustment. Complex process and system approach represents an integral part of the integrated management system development. While being gradually implemented, the application of the additive and simultaneous integration models made it possible to create a single management system based on the requirements of different standards and significantly reduce the documentation volume.

Keywords: environmental management; integrated management system; oil refineries; international standards.

Introduction

The operation of oil refineries leads to significant pollution of the atmosphere, so addressing environmental issues in the light of current international best practices is an important task. At the current stage in the European integration processes deployment, it becomes crucial to upgrade the manufacturing processes and to find out the optimal balance between the maintenance of the environment and basic public needs satisfaction for ensuring the profitability of the industrial systems, and competitive production. The study of different countries experiences in implementing environmental measures at the processing enterprises, allows to determine a set of such measures and to choose the higher-priority ones. First of all, these are measures on environmental management systems implementation that are based on the requirements of DSTU ISO 14001:2015 [1]. The specifics of oil and gas processing enterprises imply following the industry sector code that is elaborated by the National Joint Stock Company "Naftogaz of Ukraine".

This is the implementation of the Environmental Management System for oil and gas facilities as required by ISO 14000. The environmental policy of the company should be based on the interaction between productive activities and various measures to protect the environment. The environmental activities of the company must consider all aspects, both favorable and unfavorable, standard and nonstandard regulations that emerge during the products and services life cycle of an oil and gas processing enterprise.

It is possible to trace the peculiarities of the issue of implementation of environmental management systems at the transport enterprise by V.O. Khrutba [1]. An overview

of the problem of creating integrated management systems as a more promising and effective form that provides cross-cutting consistent management of material and information flows for the pharmaceutical sector can be found in the publication V.V. Trokhymchuk and S.G. Ubobov [2]. The most tendency of the implementation of environmental management systems was considered by K.A. Demyanenko [3], I.I. Dudnikova [4], Y. Markov and others [5]. Experience of environmental policy on oil and gas companies disclosed publications S.O. Storchak and others [6] and O.R. Stelmakh [7]. The authors consider the peculiarities of implementation of the international environmental standards of the ISO 14000 series for the creation of an environmental management system in the National Joint Stock Company "Naftogaz of Ukraine". Positive and negative experience of implementation of environmental management systems at various industrial enterprises was conducted by M.D. Mikhailova and O.K. Kostenko [8]. An analysis of the scientific literature on the problem identified suggests that there is no separate study on the creation of a multi-level management system for processing enterprises.

The purpose of the article is formation of ecological management system model as an important component of integrated control system of gas condensate and oil processing company based on attraction of scientific literature, normative legal documents with application of structural-logical method, systematization and generalization and methods of meaningful and comparative analysis.

Presentation of the main material

An important component of an integrated management system is the environmental management

system (EMS). Environmental management covers almost all areas of activity of processing enterprises. Environmental management is based on the environmental policy of the enterprise and implements a number of measures aimed at achieving the goal. Consider the stages of implementation of various measures of environmental policy of the enterprise on the example of Shebelinsky branch of gas condensate and oil processing (Andriivka village Balakliysky district Kharkiv region).

A study of the previous activity of a gas and condensate processing company producing gasoline 76, 92, 95, 98, diesel, propane, butane, fuel oil, bitumen, and self-contained electricity was conducted. The production volumes of environmentally friendly high-octane gasoline are driven by market demand. In 2018, the company's output was 8703,000,000 m³ of gas, which is 55% of the total output of the joint-stock company «Ukrgezvydobuvannya», more than 141000 tons of gas condensate and oil, 8304000 tons of liquefied gas.

Shebelynka gas processing plant was established in 1956 as a point of collection and loading of gas condensate, which is fed from Shebelinka gas field. In 1960, the first gas-fractionation plant was commissioned. The cycle of water supply at the enterprise is closed and has its own complex of treatment facilities. The raw material for the production of Shebelynka separation processing gas condensate and oil condensate is stable. Stable condensate must be cleaned of chloride salts and mechanical impurities before processing, since the presence of these substances will adversely affect its further processing and environmental status [9].

As a result of the activity of Shebelinsky Department of Gas Condensate and Oil Processing in 1984, the presence of petroleum products in individual wells for drinking water of the residents of Andriivka village, which is located 800 m from the plant, has been detected. Considering these factors, a number of environmental measures were carried out during the reconstruction of the enterprise. In particular, for the extraction of petroleum products from the groundwater of the contamination zone: 24 filter wells have been installed from where the petroleum product is pumped out; a special filter is installed; wells drilled and equipped to monitor the state of the Andreev contamination zone. At the enterprise almost all sewer system was replaced, all technological pipelines were removed from the ground to the trestle. As a result of the measures taken, the area of the contamination zone has stabilized and is not further marked. Over 20 years of operation of the filter wells, 17,550,546 tons of petroleum products have been recovered from the Andriivsky contamination zone [10].

In 1997, the company was further modernized using the technology of the American company UOP. The state-of-the-art catalytic reformation facility in Ukraine has enabled the production of high-octane environmentally friendly A-95 and A-98 gasoline. Due to the modernization of the plant «Shebelinka-zvydobuvannya» and the transition to the production of

Euro-4 eco-grade gasoline, modernization and environmental management systems are underway. In order to increase the competitiveness of the enterprise, in the development and implementation of measures for environmental management focused not only on their own standards, but also on national, international standards. The company has launched the implementation of the "7 golden rules of labor protection", which are developed by the International Labor Organization and effectively operate in many enterprises of the European Union.

It is proposed for the enterprise to introduce a developed environmental management system in accordance with the requirements of the international standard ISO 14001. To establish an effective environmental management system at different levels, it is necessary to carry out: administrative reform, including reform of the legislative and regulatory framework; transformation of investment activity taking into account the environmental factor; improvement of organizational and economic mechanism of ecological management system creation. Having a certified environmental management system can be an integral part of strategic partners' requirements during contracting, will raise the image of the concern for consumers. The implementation of the environmental management system will allow the organization to reach the higher level of ecological problems regulation.

The analysis of environmental protection activities of Shebelinsky Department of Gas Condensate and Oil Processing allows to establish that the following management systems are successfully applied to preserve the life and health of working personnel, ensure ecologically-stable level of production, minimize the impact of economic activity on the environment:

- system safety Shebelynka department for processing gas condensate and oil EMS 09.1-30019775-121:2013 (third edition), agreed Derzhhirpromnahlyad Ukraine and certified for compliance with ISO OHSAS 18001:2010 «Systems management safety and health. Requirements»;

- environmental management system of Shebelynka SEU 11.2-30019775-171:2010 «Environmental Management System. Guideline» and EU 11.2-30019775-172:2010 «Environmental Management System. Identification of Legislative Requirements», which are certified for compliance with the requirements of DSTU ISO 14001:2006 «Environmental Management System. Application requirements and guidelines».

As of January 1, 2016, the Euro-5 environmental standard has been put into effect in Ukraine, with increased requirements for sulfur content. And since the beginning of 2018, the requirements of the "Technical Regulation for Motor Gasoline and Diesel", which prohibits the circulation of Euro-4 gasoline and diesel, have become mandatory. That is, the mandatory minimum is Euro-5 gasoline and fuel. Today, the list of main products includes: solvent C5-50/170 oil according to TU 20.3-30019775-046:2016; product of highly flavored catalytic reforming plant according to TU 24.1-30019775-021:2013; gasoline automobile A-92-Euro4-E5 according to DSTU 7686:2015; diesel fuel

DP-C (L)-Euro5-B0 according to DSTU 7688:2015; fuel oil 100 ash sulfur high paraffinic according to DSTU 4058-2001 [12-14]. Joint-Stock Company «Ukrigasvydobuvannya», which includes Shebelinsky Department of Gas Condensate and Oil Processing has received a certificate of conformity of its own environmental management system with the international standard DSTU ISO 14001: 2015.

In this regard, the introduction of the latest environmental management system and the implementation of integrated measures aimed at improving the level of environmental safety. Compliance with the requirements of these internal normative documents, as well as with the requirements of the state normative legal and legislative acts on safety, road safety, fire, environmental, radiation and technogenic safety allows Shebelinka branch of gas condensate and oil processing to carry out production activities within the environmental permits safety with an acceptable level of occupational injuries according to the classification of the International Labor Organization, and the facilities to operate within the current legislation on labor protection. The company has already developed and implemented SOU 09.1-30019775-171:2018 in order to unify the requirements for interaction with environmental contractors [15].

At the present stage of production development, the most effective way of management is integrated management system implementation. Of course, quality

management systems are a priority for the company, but environmental, safety and production conditions are equally important. Comparative analysis of the integrated systems effectiveness shows the popularity of these measures at European enterprises. In particular, according to national standardization organizations, the implementation of integrated systems is increasing. The introduction of integrated management systems at oil and gas processing enterprises has significant advantages, above all ensuring greater consistency in the internal environment of the enterprise and between different management systems, improving the efficiency and use of resources, optimizing internal and external communications and workflow for all enterprise levels. Also reduce the cost of developing and implementing a number of management systems [16].

The integrated management system is based on methodological approaches, such as development of an additive model, which involves the gradual addition to the basic structural model of the quality management system of other systems and the model of simultaneous integration, which involves the simultaneous integration of different management systems into a single scheme. Based on the cyclical model of quality management, created by E. Deming, the structural and logical scheme of the integrated control system model for the gas condensate and oil processing company, which is a component of the whole enterprise management system, is proposed [17] (Fig. 1).

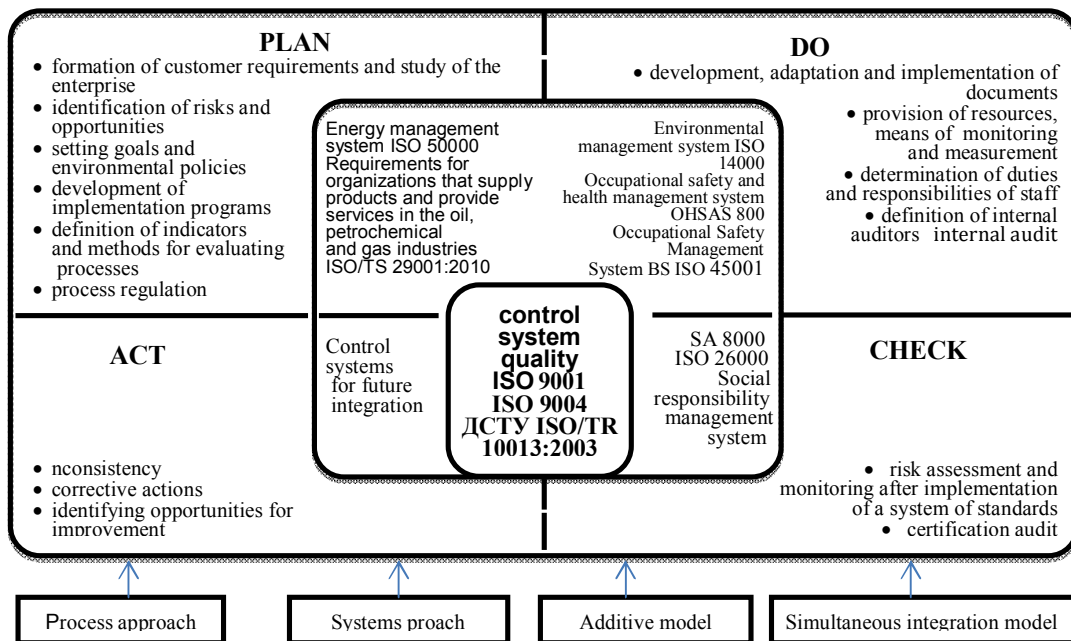


Fig. 1. Structural-logical scheme of integrated management system model for the oil and gas processing enterprise

Undoubtedly, the development of an integrated system should begin with the implementation of quality management system based on DSTU ISO 9001:2015, as well as ISO 9004 (management to achieve sustainable success) and DSTU ISO/TR 10013:2003 «Guidance on the development of quality management system documentation» [18].

Besides, it is necessary to take into account the specifics of implementation of quality management

systems at the enterprises of the oil, petrochemical and gas industry of the region in accordance with the requirements of DSTU ISO/TS 29001:2010 «Quality Management Systems. Requirements for organizations supplying products and services in the oil, petrochemical and gas industries (ISO/TS 29001:2010, IDT)» [19].

The next step in the integrated system development is the implementation of an environmental management system based on DSTU ISO 14001:2015.

In addition, occupational health and safety management has been introduced in accordance with DSTU OHSAS 18001:2010, as well as a new regulatory document effective 12.03.2018-BS ISO 45001:2018 Occupational Safety Management Systems. Application requirements and guidelines». This is a new generation standard that has been developed to integrate with other standards of ISO management systems, and most importantly it has a high level of compatibility with the latest versions of ISO 9001 and ISO 14001. The result expected from the implementation of the new health and safety management system, is first and foremost the prevention of injuries and harm to the health of employees, as well as the provision of safe workplaces in terms of health and working conditions; minimizing risks and taking effective preventative measures [20; 21].

ISO SA 8001:2008 «Social Accountability 8000» is included in this system, which aims at assessing social issues of integrated management. The purpose of this document is to improve working conditions and the standard of living of employees. It can be applied in developing and industrialized countries, both for small and large enterprises, as well as for NGOs. This document is based on the provisions of the International

Labor Organization, the United Nations Convention on the Rights of the Child and the Universal Declaration of Human Rights. Also, the system of social responsibility management should be strengthened by the standard ISO 26000:2010, which helps to adjust the activity of enterprises in a socially appropriate way to the needs of society [22].

Important for the organization of the activity of an oil and gas processing enterprise is the introduction of ISO 50001 «Energy Management System. Application requirements and guidelines». It is the core standard in this series that can be applied to any organization and sets requirements for the development, implementation, support and improvement of a PDCA cycle based energy management system. The set of these standards is the organizational and methodological basis for the creation of an integrated management system [23].

Within the framework of an integrated management system, environmental protection is an important consideration. Based on the analysis, a structural and logical scheme of a model of the environmental management system of a gas condensate and oil processing enterprise is proposed. The basis for the environmental management system again became the Deming model and principles: plan-do-check-act [24] (Fig. 2).

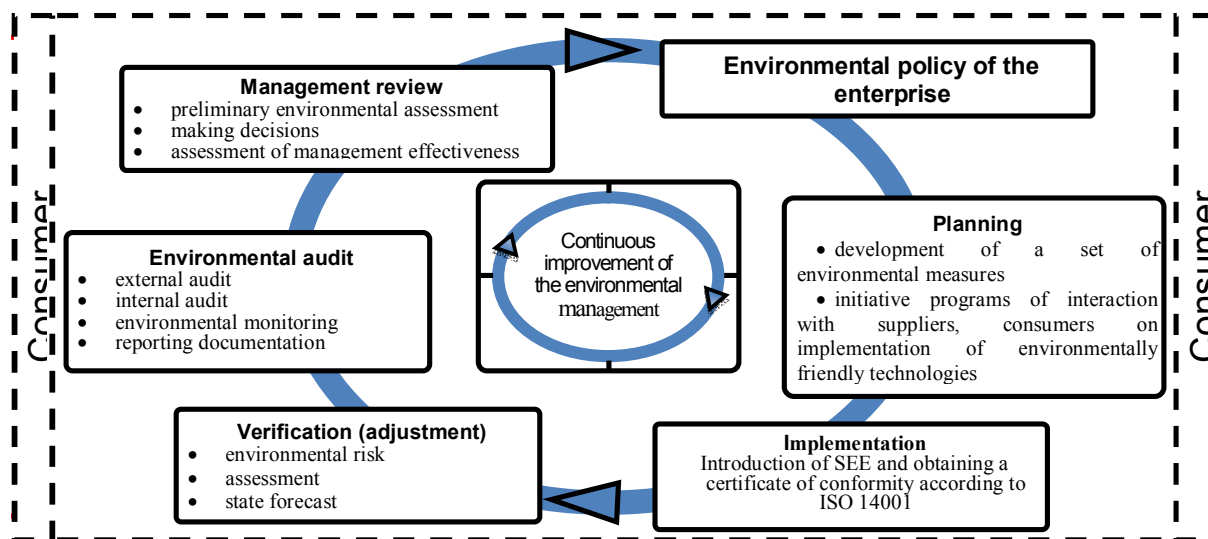


Fig. 2. Structural-logical scheme of ecological management system model of gas condensate and oil processing enterprise

The main document for the development and implementation of the environmental management system has become the regulatory document ISO 14001:2015. The standard has been implemented in Ukraine since 01.07.2016 – DSTU ISO 14001:2015 «Environmental Management Systems. Application requirements and guidelines (ISO 14001:2015, IDT)». This updated version of the standard has significant additions to ISO 14001:2007. A number of new terms have been used, including life cycle, documented information, mandatory requirements, risks and opportunities. The new version was introduced by the new requirements for the needs and expectations of the stakeholders, defining the scope of the environmental management system. The company should also extend control to every hundred lifecycle actions: raw material

acquisition, design, production, transportation, use, utilization [25].

Supplement this ISO Guide 64, which provides general guidance on environmental issues and guidelines for the implementation of ISO 14004 environmental management systems and ISO 14005 for step-by-step development, implementation, maintenance and improvement of environmental management systems. Also included is:

- ISO 14006, which focuses on environmental considerations when designing and developing products;
- ISO 14040, which outlines guidelines for life-cycle research principles and methods;
- ISO 14045 for assessing the environmental performance of production systems;

- ISO 14031 with environmental performance assessment;
- ISO 14020 outlining approaches to the use of environmental declarations and markings that indicate the environmental performance and benefits of products;
- ISO 14034 defining principles, procedures and requirements for verifying environmental technology [26].

Conclusions

Therefore, the development and implementation of a gas condensate and oil refinery integrated management system has some advantages, including

improving overall product competitiveness and adaptation to market conditions, environmental policymaking, and resource efficiency approaches. The system includes four adapted control systems that meet the requirements of international standards. Complex process and system approach represents an integral part of the integrated management system development. While being gradually implemented, the application of the additive and simultaneous integration models made it possible to create a unified management system based on the requirements of different standards and to reduce the volume of documentation.

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Екологічний менеджмент як складова інтегрованої системи управління на підприємствах із переробки газового конденсату та нафти

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Анотація. Розглянуто результати діяльності та етапи впровадження різних заходів екологічної політики підприємства на прикладі Шебелинського відділення з переробки газового конденсату та нафти. Запропоновано структурну схему моделі системи екологічного управління як важливої складової інтегрованої системи управління підприємства з перероблення газового конденсату та нафти на основі залучення наукової літератури, нормативно-правових документів з застосуванням структурно-логічного методу, систематизації та узагальнення та методів змістовного та порівняльного аналізу. Розглянуті особливості впровадження міжнародних екологічних стандартів серії ISO 9000 та ISO 14000 щодо створення інтегрованої системи управління. Доведено, розроблення і впровадження на підприємстві з перероблення газового конденсату та нафти інтегрованої системи управління надає деякі переваги, зокрема підвищення загальної конкурентоспроможності продукції та адаптації до ринкових умов, формування екологічної політики, та підходів до ефективного використання ресурсів. Формування інтегрованої системи управління відбувається впродовж чотирьох основних етапів, це планування, впровадження, перевірка та коригування. Невід'ємною складовою процесу формування інтегрованої системи управління є використання у комплексі процесного та системного підходу. Застосування адитивної моделі та моделі одночасного інтегрування дало змогу при поступовому впровадженні створити єдину систему управління на основі вимог різних стандартів та значно зменшити обсяг документації.

Ключові слова: екологічний менеджмент; інтегрована система керування; нафтопереробні підприємства; міжнародні стандарти.

Экологический менеджмент как составляющая интегрированной системы управления на предприятиях переработки газового конденсата и нефти

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Аннотация. Рассмотрены результаты деятельности и этапы внедрения различных мероприятий экологической политики предприятия на примере Шебелинского отделения по переработке газового конденсата и нефти. Предложена структурная схема модели системы экологического управления как важной составляющей интегрированной системы управления предприятия по переработке газового конденсата и нефти на основе привлечения научной литературы, нормативно-правовых документов с применением структурно-логического метода, систематизации и обобщения и методов содержательного и сравнительного анализа. Рассмотрены особенности внедрения международных экологических стандартов серии ISO 9000 и ISO 14000 по созданию интегрированной системы управления. Доказано, разработка и внедрение на предприятии по переработке газового конденсата и нефти интегрированной системы управления предоставляет некоторые преимущества, в частности повышение общей конкурентоспособности и адаптации к рыночным условиям, формирование экологической политики, и подходов к эффективному использованию ресурсов. Формирование интегрированной системы управления происходит в течение четырех основных этапов, это планирование, внедрение, проверка и корректировка. Невъемлемой составляющей процесса формирования интегрированной системы управления является использование в комплексе процессного и системного подхода. Применение аддитивной модели и модели одновременного интегрирования позволило при постепенном внедрении создать единую систему управления на основе требований различных стандартов и значительно уменьшить объем документации.

Ключевые слова: экологический менеджмент; интегрированная система управления; нефтеперерабатывающие предприятия; международные стандарты.