Underground Oil Pipelines In The U.S.

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Abstract

Being simultaneously one of the largest producers and consumers of oil and petroleum products, in 2003, the US, on average daily, used 321.2 million decalitres (20.2 million barrels) of liquid fuel in terms of crude oil (25.7% of the total volume of Current world consumption), of which 176.5 million deciliters or 54.9% accounted for imports. Most of the imported oil is transported to the United States by sea large-capacity tankers; Inside the country, the delivery of oil and oil products to consumers is carried out by pipelines, water, rail, and road transport. The system of oil pipelines in the United States, which accounts for about 70% of the volume of domestic transportation of liquid fuels, is the most ramified in the world and about ten times longer than the pipelines of all European countries combined. Numerous oil storage, fuel terminals and oil pipelines located in all regions of the country create a significant threat of emergency spills, which are a dangerous source of environmental pollution. Almost every stage of oil production, transportation, storage, and processing is associated with the possibility of unforeseen losses. The current scale of this problem throughout the world and on the North American continent is characterized by the data showing the maximum and most likely expert estimates of the volumes of oil spills from various sources. This analytical report examines the creation and functioning of a modern system of state control over the spread of oil and oil product contamination in transshipment terminals, oil storages and main underground oil pipelines of the USA. In addition, the report examines the reason behind it, which has reduced the total amount of such polluting emissions to the environment by more than 10 times over the past 15 years.

Underground Oil Pipelines In The U.S.

The first oil pipeline in the USA was built in 1865. Its diameter was 60 mm, and its length was 9 km. By 1900, the network of oil pipelines in the country reached 29 thousand km, and by 1958 – more than 330 thousand kilometers. Here, you can add 65 thousand km of product pipelines. To date, these figures have doubled – the length of trunk oil pipelines now amounts to 660 thousand km, and the main product pipelines – have 120 thousand kilometers (Stift, Najafi, Ma, Kanchwala, & Pipeline Division, 2010).

A feature of modern US oil pipelines is a significant number of small pipelines with a small diameter of pipes: from DN 150 mm to 400 mm. Because oil pipelines in the United States belong to numerous owners, low-power pipelines often run parallel to each other and are used inefficiently. The construction of new pipelines in the country, according to experts, is unsystematic. The first main oil pipeline (DN1000 mm) was commissioned in the USA in 1968 to transport oil from St. James in New

Orleans to Patoka, Illinois. The length was 1012 kilometers and capacity – 160 thousand tons per day. The capacity of the main oil pipelines of the country is such that today they contain 24% of all oil stocks.

The Plains All American Pipeline network of trunk oil pipelines includes 20 1 thousand km of pipelines. The extended oil pipeline system of the company in the US is the Permian Basin Area in West Texas with a length of 4.7 thousand kilometers. It supplies oil, including the Basin System oil pipeline, which transports oil from West Texas (Midland) and eastern New Mexico through Wichita Falls to the Cushing terminal in Oklahoma (Amirat, Mohamed-Chateauneuf, & Chaoui, 2006). The length of the pipeline is 964 kilometers. In the west of the country, the company owns the All-American Pipeline system, 222 km long, along which oil from the California offshore fields is delivered to the continent and then transported to the Los Angeles refineries by a 570 km pipeline. In addition, the company has six 1 thousand km of oil pipelines in the region of the Rocky Mountains, for which oil, mainly from Canada, goes to the refineries of Utah, Wyoming and other states of the region.

One of the longest oil pipelines in the US is Keystone. It connects the Alberta region in Canada and the Illinois refinery. The operator of the pipeline is TransCanada. Keystone is shipping oil from the oil sands of Athabasca (Alberta, Canada) to oil refineries in the USA in Steel City (Nebraska), Wood River and Patoka (Illinois), and off the Gulf of Mexico in Texas. In addition to synthetic oil, molten bitumen, and oil sands in Canada, Keystone pipes transport light oil from the Illinois Basin (Bakken) to Montana and North Dakota (Dey, Ogunlana, & Naksuksakul, 2004).

The Keystone project includes four queues. Of these, three are in operation, and the fourth stage is waiting for the approval of the US authorities.

Section I, which supplies oil from Hardisty (Alberta) to Steel City, Wood River, and Patoka, was commissioned in the summer of 2010; the length of the site is 3.4 thousand kilometers. Section II (a branch of Keystone-Cushing, completed in 2011) – from Steel City to storage facilities and distribution facilities in the large Cushing hub (Oklahoma). These two stages have the potential for pumping oil of 82 thousand tons per day to oil refineries in the Midwest. The third stage – a branch off the coast of the Gulf of Mexico – opened in 2014 and has a capacity of up to 100 thousand tons per day. The total length of the pipeline is 4.7 thousand kilometers.

Proponents of the construction of the pipeline argue that the implementation of the project would not only help reduce the dependence of the US on oil imported from overseas but also contribute to the creation of tens of thousands of jobs. Opponents of the project note that jobs would be only temporary and argue that the construction would damage the nature of the states through which the pipeline was to be laid (Hopkins, 2014).

The construction of the northern section of the pipeline from Canada through the USA to the Gulf of Mexico has been postponed again for 2016. In the current year, the start of construction of Keystone XL has been postponed twice, pending the final decision of the US Administration. The cost of building an oil pipeline is estimated at $ 8 billion, and its throughput is calculated at 120,000 tons of oil per

day.

In the United States, the pipeline must pass through the territory of six states, where it is supposed to bring additional branches – from the deposits of shale oil discovered relatively recently in the United States of America.

The Government of Canada is ready for construction. The new pipeline will allow relatively cheap export of Canadian oil. Now, the word is for the United States.

The Seaway trunk line is a 1080 km pipeline that transports oil from Cushing, Oklahoma, to the terminal and distribution system of Freeport, Texas, on the Gulf Coast. The oil pipeline is an important link in the transportation of hydrocarbons between two oil regions in the United States (Ramirez & Mosley, 2015).

The trunk line was commissioned in 1976 and was originally designed to transfer imported oil from the ports of Texas to oil refineries in the Midwest. In this direction, oil was pumped until 1982, when it was decided to transport natural gas through the pipeline, but in the opposite direction – from north to south. In 2012, oil began to be pumped through this pipeline again.

The first thread is 55 thousand tons per day. The second line, with a capacity of 62 thousand tons per day put into operation in 2014 and runs parallel to the first stage of Seaway.

The largest oil transportation systems from Canada to the USA (Lakehead, North Dakota, Spearhead) are owned by Enbridge. The Lakehead system consists of two parts. External (length – 2, 3 thousand km) passes through the territory of Canada. The average length of 3 thousand km runs through the territory of the USA – from North Dakota to Chicago with branches to Buffalo and Patoka (Illinois). The capacity of the system is 100 million tons per year (Roh, Ryew, Yang, & Choi, 2001).

North Dakota (length – 531 km, throughput – 8.1 million tons per year) connects North Dakota and Minnesota. The Spearhead system (1,050 km length, DN600 mm, throughput 9.7 million tons per year) is a diversion from the main system in Illinois to the Cushing terminal (Oklahoma).

The Enbridge oil pipeline system transports oil and bitumen from Canada to the United States. Its total length is 5363 km, including several pipeline flows. The main pipeline system of the system is the Canadian section, with a length of 2306 km of Enbridge, and the section of the US highway, with a length of 3,057 km of Lakehead. The average throughput capacity of the pipeline system is 192 528 tons per day (Sastri, 2014).

A large network of oil pipelines is owned by ExxonMobil. Through the Mustang oil pipeline (length of 346 km, throughput of 5 million tons per year), heavy oil from Canada comes from North Dakota to Illinois. From there, the Pegasus pipeline, with a length of 1,408 km and a capacity of 4.8 million tons per year, is transported to Texas.

The highest density of the pipeline system is typical for Texas and the shelf of the Gulf of Mexico;

there are 6953 km of oil pipelines owned by Sunoco. The longest of these is Mid-Valley, connecting Longview in Texas and Toledo in Illinois. The company's main oil pipelines also include West Texas Gulf, Model, and Kilgore.

The Flanagan South oil pipeline (length – 955 km) was put into operation in 2014. On its way, it crosses the states of Illinois, Missouri, Kansas and Oklahoma. The pipeline transports oil from Pontiac in Illinois to the Cushing terminals in Oklahoma. The pipeline system has seven pumping stations (Amirat et al., 2006). Flanagan South also supplies oil to the refineries of North America and further through other oil pipelines on the coast of the Gulf of Mexico. The capacity of the pipeline is 85 thousand tons per day.

The length of oil pipelines in the United States is more than 120 thousand kilometers. Trunk oil product pipelines (DN 400-780 mm) are directed mainly from the South to the Northeast and North. Most of the product pipelines are laid from the oil refineries of the Pennsylvania coast, using oil imported into tankers. Petroleum products are pumped to the northern and central industrial areas. In the states of Wyoming, Indiana, Oregon, Washington and Montana, a long-distance gas pipeline is laid, forming an almost closed ring.

The largest independent operator of the product pipeline network in North America is Kinder Morgan. The main product lines of the company are Plantation (connects the Louisiana and Maryland refineries), Pacific (connects West Texas and West Coast refineries), and Cochin (connects Alberta refineries in Canada and Michigan) (Stift et al., 2010).

Kinder Morgan Energy Partners increases the capacity of the CALNEV system. To do this, the company plans to build an additional oil pipeline, which will run from the city of Colton (California) to Las Vegas. Its throughput will increase to 10 million tons per year.

Sunoco owns the Explorer product line, which connects the processing capacities of the Gulf of Mexico and Indiana, as well as Mag-tex, Wolverine, West Shore, Reading-Toledo, Reading-Buffalo, and others. For the supply of petroleum products to Mexico, the El-Paso-Monterrey product pipeline is used.

Being simultaneously one of the largest producers and consumers of oil and petroleum products, in 2003, the US, on an average daily, used 321.2 million decalitres (20.2 million barrels) of liquid fuel in terms of crude oil (25.7% of the total volume Current world consumption), of which 176.5 million deciliters or 54.9% accounted for imports. Most of the imported oil is transported to the United States by sea large-capacity tankers; Inside the country, the delivery of oil and oil products to consumers is carried out by pipelines, water, rail, and road transport. The system of oil pipelines in the United States, which accounts for about 70% of the volume of domestic transportation of liquid fuels, is the most ramified in the world and about ten times longer than the pipelines of all European countries combined (Sastri, 2014).

Numerous oil storage, fuel terminals and oil pipelines located in all regions of the country create a significant threat of emergency spills, which are a dangerous source of environmental pollution.

Almost every stage of oil production, transportation, storage, and processing is associated with the possibility of unforeseen losses. The current scale of this problem throughout the world and on the North American continent is characterized by the data showing the maximum and most likely expert estimates of the volumes of oil spills from various sources.

Emergency leakage of difficult to decompose in natural conditions oil and oil products pose a particular danger to natural resources and ecosystems, and it takes a long time to restore their useful properties and productivity. In addition to crude oil and petroleum products, millions of deciliters of organ silicon and mineral oils are used in the United States, as well as a variety of animal and vegetable oils. Like petroleum products, these fluids are stored in special storage facilities that can be sources of hazardous contaminants. The associated threat to the environment is no less serious than the consequences of oil spills.

In the early 70s of the last century, ever-increasing emergency oil spills in the US reached a critical level of 8 million decaliters per year, prompting the development of a system of legislative and organizational state measures nationwide. This danger became the most obvious after the largest catastrophic spill in the history of the USA because of the accident of the sea tanker Exxon Valdis off the coast of Alaska in March 1989, when more than 4.2 million decalitres of oil fell into the marine environment (Roh et al., 2001).

As can be clearly seen from the data of Fig. 1, despite the constant growth of oil consumption in the 1990s, the USA, for the first time, showed a steady tendency to reduce oil losses, and by 2000, it had already become 10.6 times less than in 1973. According to the analytical department of the Coast Guard Service, the US Office of Investigations and Analysis (US Coast Guard – OIA CG), for this period, 67% of all lost oil was released into the environment because of major unanticipated spills with a volume of one-time leakage of over 100 thousand gallons or 37.8 thousand decaliters. More than half of such accidents occurred in the inland waters of the United States and the 3-mile coastal sea zone, that is, in those areas where the total damage to the population and the environment is greatest. As for the sources of oil pollution, the largest number of them was associated with water transport since only about 50% of all oil spills occur in the United States on sea and river oil tankers.

Calculated according to Pollution Incidents in and Around US Waters: A Spill / Release Compendium 1969-2000. To combat oil spills in the United States, there is a special “Oil Program” coordinated by the US Environmental Protection Agency (EPA) and ten regional offices. The objectives of the program include the prevention, prevention, and elimination of the consequences of unforeseen oil pollution, which can occur in the marine and inland areas of the United States. For this purpose, a special “National Response System” (“NRS”) was created, combining forces and resources of executive bodies of all levels, as well as commercial companies and other organizations, if necessary (Ramirez & Mosley, 2015).

The system is based on the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), which aims to promptly attract additional federal personnel and resources in cases where there is not

enough strength on the ground to quickly eliminate dangerous accidents. The success of this program and the effectiveness of some specially enacted hard laws are evidenced by the fact that, as a result, by the present time, the total average volume of accidental spills has decreased to about 1% of the current oil reserves in commercial US stores.

The “Oil Pollution Act” (“OPA”) became the first in the history of the United States of a special legislative act that strictly regulates all issues of responsibility for pollution of the environment with oil and oil products. Various versions of this law had previously been unsuccessfully debated in Congress for 14 years but were constantly postponed since even their minimal restrictive measures meant the need for additional expenses for the oil industry. The main reason for breaking the resistance of energy corporations was the catastrophic consequences of the tanker Exxon Valdis, which occurred a year before.

The law obliged all fuel carriers, as well as it obliged owners of pipelines and oil storage facilities, to develop action plans for personnel of enterprises in emergencies. Special procedures were established for reporting accidents and providing federal support for the elimination of pollution; the procedure for allocating additional public funds and resources has been introduced. For this purpose, a new National extra-budgetary “Oil Spill Liability Fund” was formed, capable of allocating up to $ 1 billion for each of the emergency incidents, if necessary. The law prescribes that the “National Contingency Plan for Oil and Poison Contaminated Substances” be carried out in the course of the ongoing interaction of the three parties: the federal government, local emergency response committees, and ship owners or operators and storage facilities that are the most serious threat to the environment.

At the regional level, in most states, additional local laws and by-laws have been adopted that specify the provisions of the above-mentioned federal legislation, taking into account the local specifics of natural conditions and the organization of business.

In the US, there are about 1.2 million underground storage facilities for oil storage and refined fuel oil products. Most of them are intended for placing gasoline and diesel fuel at gas stations, aviation kerosene, and municipal fuel for heating houses and administrative buildings. Underground are any fuel tank and pipelines connected to it if at least 10% of the total storage volume is under the surface of the earth. All underground storage facilities are subject to appropriate federal regulation, which establishes requirements for the construction and operation of such facilities (Hopkins, 2014).

Since 1988, the new storage facilities that were being commissioned in the US had to have a certain safe design and be equipped with the necessary technical systems to prevent accidental leaks. For the conversion of old storage facilities, a transitional 10-year period was established until the end of 1998, during which time the owners had to bring them in line with the new requirements. Mandatory requirements for new and existing storage tanks are divided into three groups.

Requirements for leak detection include continuous automatic monitoring of reservoir integrity, monitoring of evaporation of soil cover, monthly inspection of the reservoir for the presence of cracks,

and monitoring of surface water composition. Regarding preventing corrosion, new tanks should be constructed using the most resistant materials, such as fiberglass or steel with polymer protective coatings; for existing steel tanks, additional protective materials should be applied. Measures to prevent leakage due to overflow of storage facilities include the installation of physical protection systems in the form of additional tanks for the collection of spilled oil products, systems for automatic shutdown of petroleum products, and remote warning signal systems.

In the event of a leak, the operator must take immediate measures to stop the spread. He needs to accurately determine the degree of threat of an explosion and the occurrence of a fire, the spread of toxic volatile compounds, and respond appropriately. The notification of the "National Emergency Response Center" should be made in all cases within 24 hours, except for small leaks of less than 25 gallons (9.5 decaliters), which can be eliminated on-site within 24 hours. After eliminating the immediate dangers of leakage, it is required to determine whether any damage has been done to the environment, and representatives of the Environmental Protection Agency should be notified within 45 days (Ramirez & Mosley, 2015).

Along with technical requirements, US legislation provides for underground storage facilities the need for risk insurance. The sizes of obligatory insurance guarantees vary depending on the volumes and types of underground storage facilities and are, as a rule, not less than 1-2 million dollars. For this, the storage operator is obliged to issue the corresponding insurance contract for the specified amount. The obligation to provide financial guarantees extends not only to owners and operators of storage facilities but also to local authorities. For the latter, a slightly smaller amount of financial guarantees is provided – $0.5 million for one emergency and up to $1 million in total. Since access to the resources of the insurance market for local authorities is very expensive, they can also apply additional mechanisms: assess collateral assets to secure loans, organize a local trust fund, and use inter-municipal guarantees.

Programs to eliminate leaks from old oil storage facilities. The fight against oil leaks from underground oil storage facilities aims not only to strictly comply with the technical requirements and financial responsibility of enterprises but also to obtain additional funds to eliminate the consequences of accidents caused by the wear and tear of obsolete production assets. To this end, in 1986, a special trust fund was established at the federal level to combat oil leakage from underground storage tanks ("Leaking Underground Storage Tank Trust Fund"). The funds in this fund were accumulated at the expense of an additional tax on the sale of motor gasoline for 0.1 cents per gallon, which was collected before the end of 1995. The total amount raised by this time exceeded $1.6 billion.

The funds of this fund can be used by the Environmental Protection Agency and the state authorities to control the quality of oil spills and to eliminate leaks for which responsible operators have not been found or have not been able to provide cleanup operations. Also, 45 of the 50 states also established their special local funds for these purposes, in which a total of $1.34 billion was accumulated. Unlike the main federal trust fund, such state auxiliary funds can be used not only for the Elimination of

pollution but also to provide financial assistance to the owners of oil storage tanks and compensation for the costs incurred by them (Hopkins, 2014).

As an example, we can cite the procedure for using the fund for cleaning oil contamination pcs. Wisconsin was established by the law of the State of 1987. The source of funds is a local tax on sales of petroleum products for 3 cents per gallon; all these revenues are about 90 million dollars a year. The fund's resources are used to compensate for the costs of accidents at large oil storage, as well as leaks from small land storage facilities and small storage tanks for oil products in agricultural areas. The objectives of the fund also include partial payment of insurance premiums. Before the formation of the fund, due to the high probability of contamination in the territory of oil storages and high risks, insurance companies were extremely cautious about concluding contracts and were ready to insure only those enterprises where the absence of past leaks was proved. The provision of insurance services at the expense of the fund allowed the owners of oil storage facilities to provide the financial guarantees required by law. At the same time, the first 7, 5 thousand dollars of cleaning costs are paid by the owner, and all subsequent expenses are reimbursed from the fund. The fund's participation in the payment of insurance services is designed for a limited period before modernizing the equipment of existing storage facilities. By the end of the 1990s, about half of the state's major commercial operators used this opportunity.

The extensive and extensive network of energy pipelines in the United States provides delivery and distribution to consumers of natural gas, crude oil, gasoline, diesel fuel and other petroleum products. In the US, over 200 large commercial operators are engaged in their operation for the wholesale transfer of all types of liquid fuels and more than 3,000 companies provide transportation of compressed and liquefied natural gas.

If the first place among causes of pipeline accidents are corrosion and hidden defects in structural materials causing fuel leaks, the second place is steadily occupied by their accidental mechanical destruction by construction companies during excavation in the construction of roads, housing, and industrial facilities (Dey et al., 2004). According to the US Department of Transportation (US Department of Transportation), the associated material damages an average of at least $20 million per year. In the third place, there are various wrong actions of operators of pipeline systems. To ensure their safe use, continuous remote monitoring is required, as well as continuous preventive measures to prevent the concomitant direct and indirect threat to the residential sector, industry and the environment. The main federal body responsible for ensuring the sustainable and environmentally safe operation of pipeline systems in the United States is the specialized Office of Pipeline Safety (OPS), established in the early 1970s in accordance with the Law on the Safety of Gas Pipelines ("Natural Gas Pipeline Safety Act of 1968"), later supplemented by the "Hazardous Liquid Pipeline Safety Act of 1979" and included in the organizational structure of the minis restive transport (Amirat et al., 2006).

The Pipeline Safety Department compiles normative documents containing mandatory standards for the design and construction of pipelines, their testing, operation, planning of necessary personnel

actions in emergencies, and routine maintenance of pipelines and associated technical structures and systems. All pipelines available in the country for pumping compressed and liquefied natural gas, crude oil, all types of processed liquid fuel, as well as other types of liquid and gaseous industrial raw materials for various purposes, are subject to federal control. To ensure compliance with established safety standards, the UBT carries out-licensing of operators, as well as preventive inspections, which, as a result, may suspend the activities of enterprises and impose penalties. The UBT specialists investigate all emergency incidents and monitor selected sections of the main pipeline systems that are associated with the maximum risk of damage to the environment or areas with a high population density. Under the current legislation, the UBT is also obliged to fully comply with all additional recommendations of experts from the National Transportation Safety Board (NTSB).

Directly on the development of regulatory documents, the introduction of new technical means and prospective studies from the federal budget for the UBT recently allocated $4.8 million per year. Also, all the programs of this department and the corresponding thematic grants allocated in the framework of its activities are additionally financed from the target extra-budgetary trust funds: the Pipeline Safety Fund and the Oil Spill Compensation Fund (“Oil Spill Liability Fund”). The amount of subsidizing of UBT obtained from these sources is set annually by a special decision of Congress (Stift et al., 2010).

The main costs necessary for the implementation of control and preventive and inspection programs of the UBT are allocated from the Pipeline Security Fund. On average, in recent years, the fund budget was approximately $17 million… Funds received from the “damage compensation fund as a result of oil spills” are used only for measures to eliminate accidents on pipelines, storage facilities and tankers, which are provided by the provisions of the federal “Oil Pollution Act 1990. “Both of these funds are formed as a result of targeted assessments of commercial operators of oil and gas pipelines, as well as from the fuel excise. The federal budget for 2002-2003. On long-term safety programs conduits of said trust funds allocated over $58 Mill…

Special attention is paid in the United States to the development of new technical means for remote monitoring of pipeline conditions, including new types of instrumentation, operational communication and telemetry, and computer systems for processing and storing all incoming observation data. Successfully developed methods for remote monitoring using satellite and radio systems and global positioning. Systems of anticorrosive cathodic protection and methods of applying multilayer insulating coatings to pipes are constantly being improved. For remote fetoscopy, automatic aggregates with elements of artificial intelligence, moving inside pipelines and transmitting the received data through the channels of wire and wireless communication, are designed (Sastri, 2014).

One of the most promising developments is the fiber-optic cable system for remote detection of any types of hazardous construction activities and disturbance of the soil structure near pipeline routes, which was first successfully tested in practice in January 2003. This system, consisting of a cable network and recording computer equipment, was created during the implementation of a long joint project of the US Department of Energy (US Department of Energy), the Gas Technology Institute

("Gas Technology Institute") and the famous Hughes Oni Energy Corporation "El Paso" (El Paso Corp., Houston). During the field tests, a single-mode simplex optical cable was laid over one of the pipelines in the northwestern part of the PC. Indiana, about 15-50 cm below the ground surface. Since any action of construction machines creates vibration and pressure, bending the cable instantly causes a change in the conditions for the passage of light, digital signals, which, knowing the speed of their propagation, can quickly determine the specific location and nature of the possible hazardous effects of the pipeline. The system also allows the rapid detection of weak deformations of the soil caused by natural erosion processes, landslides, and earthquakes long before the emergence of dangerous, hazardous situations associated with them for preventive purposes.

The conducted experiments showed that for laying such signal lines one could use both single mode and multimode simplex and duplex optical cables, and the unit costs are lower than when using electrical conductors. For optical signal lines, there is no need for earthling and electrical safety, complete galvanic isolation of the equipment is achieved, there is no need to observe special rules for moisture protection and explosion safety. The absence of electromagnetic radiation from such a cable guarantees the secrecy of information transfer and the fundamental impossibility of unauthorized contactless access for sabotage purposes. Low attenuation allows the use of lines up to 100 km long without amplifiers and repeaters, which introduce distortions of weak signals (Roh et al., 2001).

The many years of American experience show that the establishment of strict norms of civil, administrative and criminal liability for environmental pollution by oil and other dangerous substances played an extremely important role in reducing the number of emergent emergencies. Another equally important factor is the consistent implementation of preventive measures to combat oil spills. The preventive measures used in the US are complex, as close as possible to sources of leakage, and include both the necessary technical requirements and various organizational approaches. Their integral part is the constant training of personnel of enterprises and rescue services on actions in emergencies.

A special feature of the US approach to financing oil pollution clean-up operations is the establishment of special funds, replenished with sales taxes and various types of charges in fuel industries. The funds of such funds are used to eliminate emerging emergency leaks, prevent new pollution, and compensate for the resulting direct and indirect losses from accidental spills. The most important mechanism to minimize the damage from occurring leaks is the integrated national system for rapid response to leaks (Ramirez & Mosley, 2015). The result of its use is prompt information on all emergent emergency incidents, multi-level continuous coordination of restoration work, as well as the concentration of data on the leakage in a single information system open to public access. Synthesis and analysis of available information play an important role both in optimizing emergency response measures in emergencies and in developing insurance schemes, in improving the effectiveness of decision-making mechanisms, and in developing appropriate research and development work.

A distinctive feature of the American system of environmental regulation in general and of the mechanisms for combating oil spills, in particular, is the full availability of all available information,

both for decision-makers and for the entire population. At the same time, the rigidity of regulatory legislative and administrative measures is to a certain extent compensated by their clarity, consistency, and transparency, as well as the constant provision of necessary support for all actions of entrepreneurs and authorities in critical situations by the relevant federal and regional public services (Hopkins, 2014).

Positive elements of the American experience of state control of ensuring the safety of fuel and energy storage facilities and pipelines can be widely used in Russia, where, due to the progressive aging and deterioration of the entire transport infrastructure, such tasks are also becoming more relevant. This area is very promising for the further development of scientific and technical cooperation, both at the level of government agencies and private companies. As was particularly emphasized in the joint Statement of Intent between the Ministries of Energy of Russia and the United States on the Prevention and Elimination of Oil Spills, Russia and the United States are equally deeply interested in closer cooperation on the problem of oil spills (Dey et al., 2004).

This document, which was signed in Moscow on March 12, 2003, by Russian and US energy ministers Igor Yusufov and Spencer Abraham, notes that both ministries intend to establish close cooperation in the exchange of information and experience in the fight against oil spills on the basis that both countries have in this area modern technology and considerable experience. For this purpose, both sides intend to prepare an extensive program of exchanges, joint consultative seminars and practical training of specialists within the framework of the work of the permanent US-Russian energy expert working group. Additional areas of mutually beneficial Russian-American cooperation could be training and retraining of personnel, improving training programs and methods for professional testing of dispatch personnel using computer simulators and training game simulation programs for emergency situations. It is possible to exchange experience in the operation of large dispatch control systems for main pipelines and oil storages, which in our country are historically more developed and centralized than in the United States. The constantly growing demand for sophisticated control equipment, remotely controlled sensors and means of industrial communication of various systems could become the basis for entering the US markets of many Russian research and production enterprises, which often already have many years of experience in such multidisciplinary applications.

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