



Perspectives of QR Codes Implementation in Forensic and Environmental Examination of Hydrocarbon Storage Tanks

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The paper analyzes the perspectives to implement QR codes in forensic and environmental examination of hydrocarbon storage tanks. The emphasis is on the importance of quick access to information and evidence obtaining during expert research in the environmental safety field.

Keywords: QR codes; forensic environmental examination; storage tanks; hydrocarbons.

Перспективи застосування QR-кодів для проведення судово-екологічної експертизи резервуарів зберігання вуглеводнів

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Проаналізовано перспективи впровадження QR-кодів у судово-екологічну експертизу резервуарів для зберігання вуглеводнів. Акцент зроблено на важливості швидкого доступу до інформації та отримання доказів під час експертних досліджень у сфері екологічної безпеки.

Ключові слова: QR-коди; судово-екологічна експертиза; резервуари; вуглеводні.

Environmental assessment is an environmental study, analysis, and evaluation of the results of economic activities that have or may have a negative impact on

the natural environment. Environmental assessments are aimed at preventing the emergence of new sources of negative impact on the natural environment



and public health, as well as limiting or eliminating existing ones. The object of an engineering and environmental assessment is material and materialized sources of information containing factual data on the circumstances of an environmental emergency, including material evidence, fragments of the scene, equipment, communications, means of production that ensure the environmentally safe operation of the enterprise, as well as any other circumstances of the event recorded (described, reflected in diagrams, photographs, plans, etc.) in the case files [1]. Environmental expertise, as an important tool for ensuring environmental safety, requires the use of modern technologies to improve the effectiveness of expert research and evaluation of results. One such modern technology that is gaining popularity in various spheres of human activity is the use of QR codes.

QR codes are two-dimensional (matrix) codes designed to enable companies and individuals to quickly and easily sell or promote their products, skills, and events.

QR codes are a modern technology due to their ease of use, contactless interaction capabilities, lack of need for special scanning equipment, and ability to store large amounts of information, which is especially valuable in situations where speed and timeliness of information retrieval are crucial, particularly during forensic examinations.

Currently, international practice demonstrates the successful implementation and use of QR codes in various fields. For example, in Indonesia and Japan, research has been conducted

on the use of QR codes on waste containers in the waste management system at landfills [2; 3]. In Malaysia and Indonesia, it is also proposed to use QR codes to track and place laboratory equipment [4]. In Kansas, QR codes are used in academic libraries and other educational institutions. QR codes can be seen in advertisements for various products, retail stores, medicines, airlines, restaurant menus, museums, exhibitions, etc. [5; 6].

Relevance of using QR codes in judicial environmental expertise is determined by several key aspects, in particular

- determining circumstances related to the occurrence of an environmental emergency;
- establishing technical and organizational causes of violations of the production process, if this contributed to the release of pollutants, energy, and emissions of other harmful substances, and the accumulation of industrial waste;
- establishing compliance of actions (or inaction) of persons involved in an environmental emergency with requirements of regulatory acts in the field of environmental safety, environmental protection and natural resource use;
- establishing cause-and-effect relationships between the actions/inaction of specially authorized persons (in the field of environmental protection, natural resource use, and environmental safety) and the consequences that ensued [1].



It should be emphasized that QR codes can contain a large amount of information in a compact format, making them ideal for systematizing data. A single QR code can contain various object parameters, such as technical characteristics, operating history, previous inspection results, and recommendations. In addition, QR codes simplify the process of identifying and labeling material evidence, soil, water, air, and other objects of environmental expertise. QR technology helps speed up the exchange of information between expert institutions, judicial authorities, and other participants in the investigation of environmental crimes. QR codes can be used to ensure effective communication between environmental inspectors, forensic experts, and other interested officials.

The use of QR codes in forensic environmental testing of hydrocarbon storage tanks opens up new opportunities for speeding up the expert examination process. The introduction of modern technologies in this area will increase the interest of specialists and improve the organization of the work of forensic experts.

QR codes can be used as a modern tool for collecting evidence in criminal proceedings related to environmental crimes, which is important for forensic examination. This will simplify the investigation process, as data can be quickly scanned and analyzed.

Based on the above, our scientific position is to use QR codes in the future for judicial environmental expertise of liquid hydrocarbon storage tanks. To this end, it is necessary to develop, im-

plement, and place QR codes with relevant information about the condition of the tank, its design parameters, date of commissioning, operating conditions, tank filling, fluid parameters, date and results of the last inspection, etc. This will provide environmental inspectors, employees of the State Emergency Service of Ukraine, forensic experts, and other officials with prompt access to the necessary information and enable them to quickly resolve issues related to the inspection and examination of the tank, which will further contribute to the prevention of emergencies and negative impacts on the environment. The use of QR codes in forensic environmental expertise can also significantly increase its effectiveness by ensuring the timely collection of evidence.

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