1.14.18. NORMATIVE-METHODOLOGICAL AND SOFTWARE-TECHNICAL SUPPORT OF COMPLEX MONITORING OF TECHNICAL STATE OF BUILDINGS AND CONSTRUCTION OF HAZARDOUS PRODUCTION FACILITIES

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The most important direction in safety provision for buildings and constructions of hazardous production facilities (HPF) is their equipment with systems for complex monitoring of technical state (CMTS systems). CMTS purpose is accident-free and continuous (over the klong term) of object operation. The CMTS tasks are: timely detection of defects in structures; acquisition and storing of technical diagnostics data; prediction of variation of the structure technical state in time; automation of diagnostics and reduction of the human factor role.

Implementation of CMTS systems is related with its organizational, normative-methodological and software-technical support.

Organizational matters are disclosed in [1, 2]. Normative support of the CMTS system for "engineering and technical structures (structural elements) of objects" within composition of "structured monitoring and control systems for B&C (buildings and constructions) engineering systems (ESMS)" for potentially hazardous, especially hazardous, technically complex and unque objects is reflected in the National Standard of the Russian Federation (NS RF) GOST R 22.1.12.2005 [3] and requires further detailing and methodological developments. Thus, for civil B&C, "Methodology of monitoring the state of B&C bearing structures" is proposed. This methodology is approved by authors during creation of systems monitoring the state of bearing structures of the whole number of constructions: Sports Palace "Megasport"; sports constructions of the Figure Skating Center of E.A. Chaikovskaya; "Moscow Wedding Palace"; MMDC "Moscow-City" and others. Paper [4] reports on results of 4.5-year instrumental monitoring of deformations of underground car parking "Parking-1" and shopping center "Manegnaja Square". Three-dimensional computer simulation of strains and stresses made it possible to reveal the interaction nature of existed and erected underground and overground buildings in specific engineering and geological conditions and to evaluate the safety degree of buildings in conjunction with varying state of soil mass in the result of reconstruction of the "Moscow" Hotel.

Authors recommend above-mentioned developments for civil engineering projects, but they do not deal with questions of industrial safety of hazardous production facilities (HPF).

However, industrial B&C of HPF possess with very significant specific features related with high risks and operation conditions: high mechanical load (static, short-cycle, fatigue, vibration loads from technological and carnage, technological pipelines, etc.); impact of aggressive products from technological processes and gas-air millwide environment; wear-and-tear of B&C building structures at HPF exceeding 70 – 80%; risks of accidents and catastrophes related with failure of B&C building structures and subsequent breakdown of technological equipment, which, in its turn, threatens the life and health of the enterprise employees, population of nearby territories, ecological situation of local and regional scale. As a result, dozens and hundreds thousand people at contaminated territory can be left without electric power, water and dwelling, while material losses from conse-

quences of the one only accident of average category at chemical or oil-processing plant run into millions of dollars.

In order to elaborate the risk control and technical state monitoring system, it is necessary to collect the initial data, and namely: to carry out analysis the enterprise general plan and technological scheme, technical parameters of B&C and equipment, operational conditions, loading modes, repairs, inspections, incidents and accidents; to analyze the industrial safety system functioning; and to evaluate the personnel training level. It will result in analysis of potential risks and probabilities of possible accidents.

Furthermore, HPF technical state is monitored selectively by individual structures, units or elements of a building, which are in operable state that defines the safe operation of the building in general. Thus, the main development stages for the risk control and technical state monitoring system are: investigation and examination of industrial safety of B&C building structures; analysis of interrelation between damages in structures and technological equipment; analysis of structural material properties; evaluation of the level of actual and admissible risks. Then, by risk criteria, B&C responsibility levels are assigned and critically important zones of structures and units are defined.

Next stage is the elaboration of methods for determination of the periodicity of examination of structural elements, complex monitoring of the technical state of essential structural elements and units of especially hazardous B&C, monitoring of technological impacts of industrial processes and equipment of the B&C bearing structures.

At the stages of CMTS system creation, the following is provided: selection of nondestructive testing methods being optimal for solution of monitoring tasks; determination of types and characteristics if sensors and other sources of objective data; elaboration of system of criteria and CMTS decisions adoption; development of CMTS bundled software; development and production of the system hardware and its trial operation; elaborations of recommendations of actions in critical situations.

Modern instrument engineering is able to meet the level of requirements to nondestructive testing instruments and equipment, as well as to means for determination of stressed-strained state. Methods used in CMTS are: acoustic emission; vibration diagnostics; thermal imaging; measurement of stressed-strained state; measurement of linear displacements and inclination angles; free oscillation method for structural elements and B&C in general; measurement of B&C indoor and outdoor parameters of gas-air environment; measurement of seismologic situation parameters; measurement of geotectonic situation parameters in the zone of HPF B&C location.

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