

Globalization of safety on the basis of non-destructive testing (NDT) and technical diagnostics (TD)

Development of civilization along with the progress and innovations is characterized by alternation, wear and degradation of many large structures including hydro-electric power stations, nuclear facilities (stations, submarine fleet, weapon), all means of transport (rocket-space, aviation, railway, maritime), agriculture and building structures etc. In the course of time, losses caused by technogenic, ecological and terrorists activities are increasing rapidly. For the purpose of solving these problems, especially, together with the human factor, it is necessary to maximally develop and globalize non-destructive testing (NDT) and technical diagnostics (TD).

NDT and TD globalization, first of all, anticipates a large scale increase of diagnostics operations and technologies for achieving ecological, anti-terrorist and technogenic safety, which, in its turn require integrated international cooperation of developments and production of technical means and informational technologies.

Presently, in order of unexploredness and unpredictability, ecological safety issues head the list. They are associated with high-cost monitoring and continuous measuring hundreds of environment diagnostic parameters for scientifically-based forecasting hazard degrees of natural anomalies: earthquakes, floods, fires, hurricanes, radiation and other contaminations of air gas content, conditions of flora, fauna, water environment etc. The Asian Tsunami alone claimed more than 230 thousands lives.

Events in New York on 11th September 2001 have shown the enormous losses that terrorism can cause and which were once again proven out in 2009 on railway transport in Russia. In order to prevent such situations, first of all, a complex diagnostic support is necessary i.e. systems of artificial vision, testing, surveillance, informational search, analysis etc. That is why, means and methods of anti-terrorist diagnostics such as minesweepers, x-ray, fluoroscopy and television systems, night vision devices, infrared and ultraviolet criminalistic complexes, nanosecond neutron and spectrometric nuclear-physical and terahertz units for explosives testing are rapidly developing.

The biggest volumes of production and reduction to practice are traditionally held by medical diagnostics, in which the developments of digital x-ray fluorography, nuclear-magnetic resonance and Compton radiation tomography, chemical analysis, thermal vision etc. can be pointed out.

In respect of losses caused by emergency situations due to wear off up to 80% and degradation of equipment, the technogenic safety also remains the most relevant issue. In this direction, examples of the largest accidents at Chernobylskaya atomic station in 1986 and Sayano-Shushenskaya HPP in 2009 can be given.

In the process of NDT and TD globalization, the main points remain the same i.e. further intellectualization of diagnostic operations, transfer to obligatory

evaluation of a residual resource and operational risks at technically and ecologically hazardous facilities, formation of databanks and databases for defects, accidents, facilities under monitoring and their peculiarities, and related large volumes of statistical measurements of physical fields, chemical content and mechanical properties of a substance. NDT and TD globalization is connected with development of space, aircraft, maritime and automotive monitoring systems, minimization of personnel influence on making a final decision, and also with application of a full range of methods and means of electrometry, introscopy, vibrometry, measurement of dimensions, temperature, pressure, mass, time and other complex diagnostics procedures.

Global NDT and TD system is the system of increased reliability methods and means that features a unity of measurements in the international ISU, objectivity (trueness) within the frames of permissible indeterminacy of NDT and TD, compliance with internationally recognized and current quality systems and also transparent procedures of personnel competency assurance.

Measures for restoration of equipment technical state in the process of operation must not be performed within the specified timeframes but on the basis of continuous monitoring and diagnostics. For instance, operating principle of transfer pipelines must be performed not only on the basis of rating but with regard to temporally diagnosed individual characteristics of mechanical properties and dimensions of pipes.

The most hazardous defects in industry and construction are corrosion, wear and fatigue of materials lead to accidents. Losses caused by the latter, are annually estimated to more than 100 billions of dollars in USA and Russia. If we add here the untrained personnel, it makes the technogenic safety problems even worse in respect of time and scales of an accident. Each facility is characterized by a vector of diagnostic parameters which determine its condition and must always be under constant (regular) monitoring.

Along with locating dislocation parameters, dimensions of macro and microdefects; the analysis of stress-strain state of supporting members and quantitative measurement of facilities' residual resource and operational risks, nano- and giant diagnostics have become new branches of NDT and TD. In technogenic, ecological, anti-terrorist and medical diagnostics there were tens of thousands of devices, hundreds of physical and chemical methods evaluating thousands of diagnostic, technical and physical parameters created for the single purpose only and that is the evaluation of number of years, days and hours of a residual resource, which, in the course of time, must become an official passport of any complex unit and environment.

For the purpose of solving the problem, societies of NDT and TD specialists started to create all over the world 50 years ago. Particularly, such society was founded in USSR, which in 1989 was transformed into the Russian society for non-destructive testing and technical diagnostics – RSNTTD.

At present, RSNTTD has 52 regional branches, more than 300 enterprises and more than 10000 of individuals. It is a member of European federation for NDT (EFNDT) and International NDT committee (ICNDT). It has cooperation and

mutual recognition agreements concluded with NDT societies from 28 countries of the world. From 7th till 11th June 2010, RSNTTD in cooperation with EFNDT will hold the jubilee 10th European conference on non-destructive testing in Moscow. Participants from 50 countries of the world will take part in the event. The conference programme consists from 650 reports, prepared by 1200 authors. The biggest international exhibition on NDT and TD equipment will be organized at the venue area of 7500 sq. meters.

The most reports of the conference are traditionally dedicated to ultrasonic testing methods, acoustic emission and vibration diagnostics. Then follow the analysis of methods and means of computed tomography (radiation, ultrasonic, atomic-magnetic resonance), magnetic, eddy current, optical, thermal, microwave, capillary, leak detection, x-ray and others. The topic of two large sections is dedicated to ecological and anti-terrorist diagnostics issues. NDT issues of transport (air, railway, automotive), oil and gas pipelines, electro hydro and nuclear power stations and NDT in metallurgy, chemical and construction industry. For the first time ever, a separate section on nanotechnologies in NDT will operate. Interesting results were achieved in development of new types of transducers (phased arrays, matrix transducers for ultrasonic, magnetic, thermal, optical and electromagnetic testing), complex receiving systems etc.

RSNTTD informs scientific society on achievements and developments of Russian and foreign testing equipment, devices, means and technologies through magazines "Testing. Diagnostics", "Defectoscopy", "Non-destructive testing world", "Plant laboratory. Materials diagnostics", "Devices". For the past years, 8 volumes of the NDT handbook, including 6 volumes in English were published. The following methods are subjects of the handbook: visual and measuring, radiation (vol. 1), hermeticity and eddy current testing (vol. 2), ultrasonic (vol. 3), acoustic strain-gauging, magnetic powder and capillary (vol. 4), thermal and electric (vol. 5), magnetic, optical and radiowave (vol. 6), acoustic emission and vibrodiagnostic (vol. 7), anti-terrorist and criminalistic methods, ecological diagnostics (vol. 8).

In RSNTTD a system of voluntary certification of NDT personnel (SVCNDTP) has been developed and operates. It is harmonized with international documents, officially recognized by EFNDT which means the recognition of its certificates in other countries using EN-473 and ISO9712 international standards.

SVCNDTP comprises areas of effect, organizational structure, list of normative documents for certification, procedures of certification bodies' conformity assessment, procedure of qualification exams for three levels of qualification.

SVCNDTP and RSNTTD carry into effect the personnel certification bodies that passed the procedure of conformity to the new requirements of EN ISO/IEC 17024:2003 "Conformity assessment. Main requirements for personnel certification bodies".

"Databanks of examinational questions for personnel certification of I, II, III levels" has been developed and published, similar to ASNT (American society for nondestructive testing) and EFNDT. Random questions selection program provide

a set of tasks compiled from all disciplines for each candidate. In conclusion, it is necessary to notice once again the main unfinished task of NDT and TD globalization in Russia i.e. creation at governmental level of a national body for accreditation of certification bodies in the image and likeness as in the number of European countries.

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