

Human Factor in The Problem of Russia Nuclear Industry Safety

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The experience of normal work and an event cases on Nuclear Power Plants (NPPs) shows that the human factor provides both reliability and failure cases. It is difficult to overestimate the role of human factor. Our approach in definition of the human factor role consists of recognition and measurement as possible more complete list of the factors, which influence on mistakes and (or) work successful of the NPP-personnel. The safety culture is actually the main factor.

The enhancement in Nuclear power industry includes an optimisation of organizational structures and development of personnel safety attitudes (INSAG –3, INSAG –4, INSAG – 12, etc) as global problems. Organizational factors can be root causes of human errors, they need to be identified, assessed and improved. Now twelve organizational factors are identified as an important for access in determining organizational safety performance, "organizational safety " (IAEA - OECD NEA PWG1 and ETF Members SOAR reports, 1998).

The system of maintenance of reliable work includes two subsystems:

- Measure on maintenance of high quality of works at all stages of life cycle in objects of atomic energy branch,
- Organization of the control and supervision in the field of a safety.

The system of maintenance of the personnel reliable work is reflected in the legal documentation creating the rules of works and legal space for realization of the personnel activity in objects, using atomic energy, at a faultless level. Reliability of the human factor depends on many parameters, external and internal, psychological. In a fig. 1 we represent the simplified scheme of influence of the external environment factors and persons features of the man on his work reliability.

The legal documentation of maintenance system for the personnel reliable work has hierarchical structure, where the measures and legal documents are included. It means the international meaning, governmental level, inter-branch both branch and levels, level of maintaining organizations, level of separate organization (enterprise), and also measures, rules and instructions inside organization on interdivision, on division (on part of enterprise) and at individual levels. The system of the personnel reliable work maintenance

makes the integral part of activity on safety maintenance an object, using atomic energy.

The reliability researches of the human factor in Russia have been carried out for more than 20 years. The researches have shown that there are a lot of external factors, which influence on performance and activity of the man, but which can be compensated by influence of human psychological readiness of worker.

The decrease of psychological readiness becomes obvious in a situation of wrong action and incident at station. The psychological situation of events caused by a human error depends on:

- 1) The professional competence,
- 2) The professional motivation,
- 3) The some professionally important psychological and psychophysiological qualities of a person, including mentality, attention and memory data,
- 4) The functional state of human in the work time. This parameter is most vulnerable to influences of external environment. The latent mood or weariness influences on the accuracy of hands movement, on correctness of the decision acceptance.

The organizational factors of safe conducting works, intended to the maintenance successful performance of personnel work, are developing in two directions:

- "Perspective" direction – prevention of infringements in work of the personnel of an object, using atomic energy;
- "Retrospective" direction - analysis of the occurred infringements in work of object, using atomic energy. The analysis of wrong actions of the personnel has the purpose to raise (increase) reliability of work, with the help of mistakes correction, improvement of rules and methods of work.

Following logic of influence to the man behavior from external organizational factors in Russia as well as over all countries - IAEA members, the work in two directions is carried out:

- Prevention of infringements and preventive maintenance of failures;
- Analysis of the direct and root reasons of infringements in work of plants

In Russia the careful activities of a legislative and organizational character are carried out. So, The Law on Use of atomic energy was accepted, some decisions of the Russian government were accepted, including strengthening of a request on professional training and health in admission of staff to work. The requests to the personnel selection organization are changed. As to the second problem of safety culture - to form the staff "safety attitudes ", such problem is concerned with psychological area and decided due to a context of the world and national culture. Both problems of the safety culture - perfection of organizational structures and formation of the personnel attitude to priorities of safety -are interconnected and decided only simultaneously.

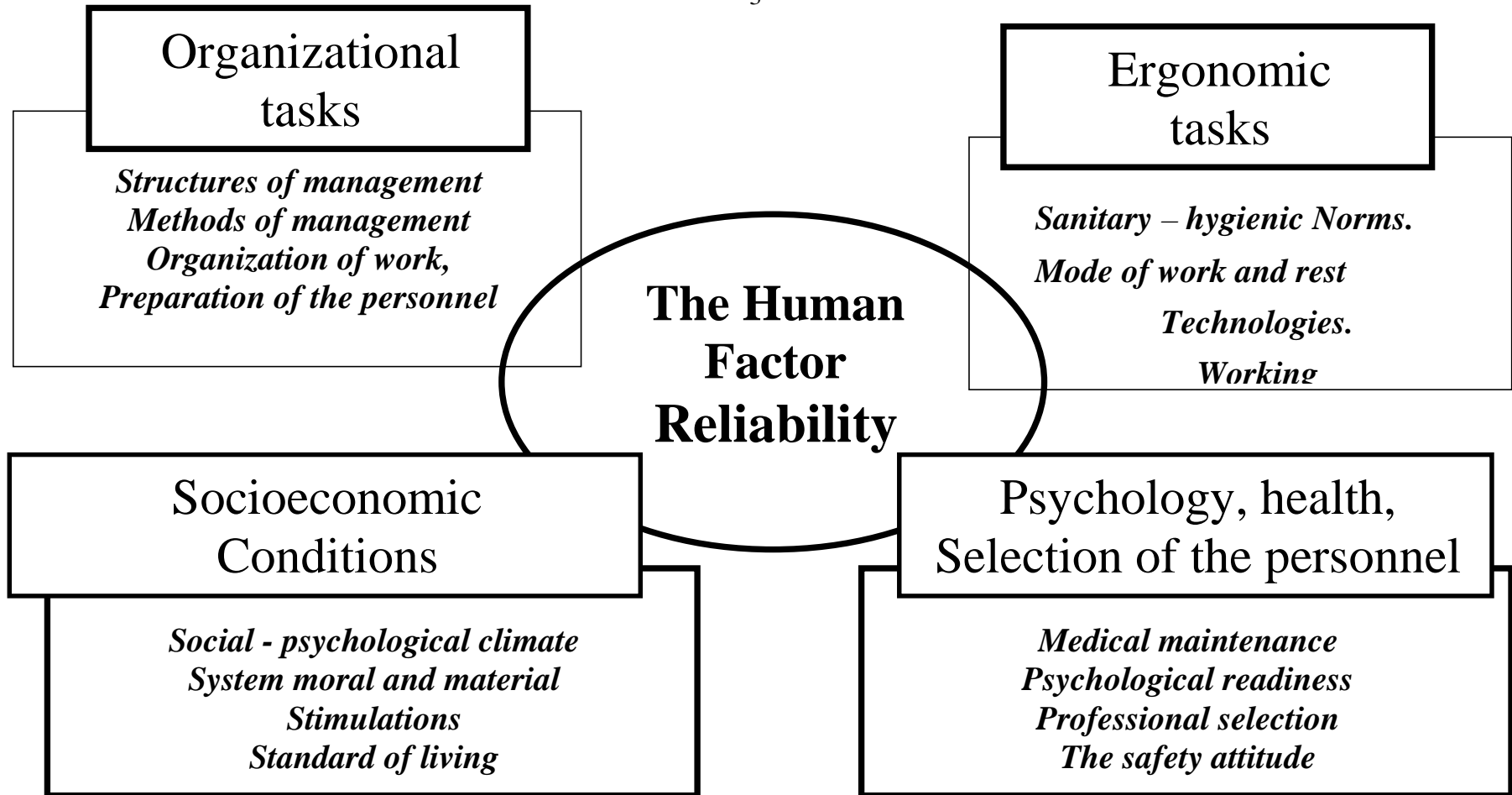


Fig. 1. Components of the human factor reliability

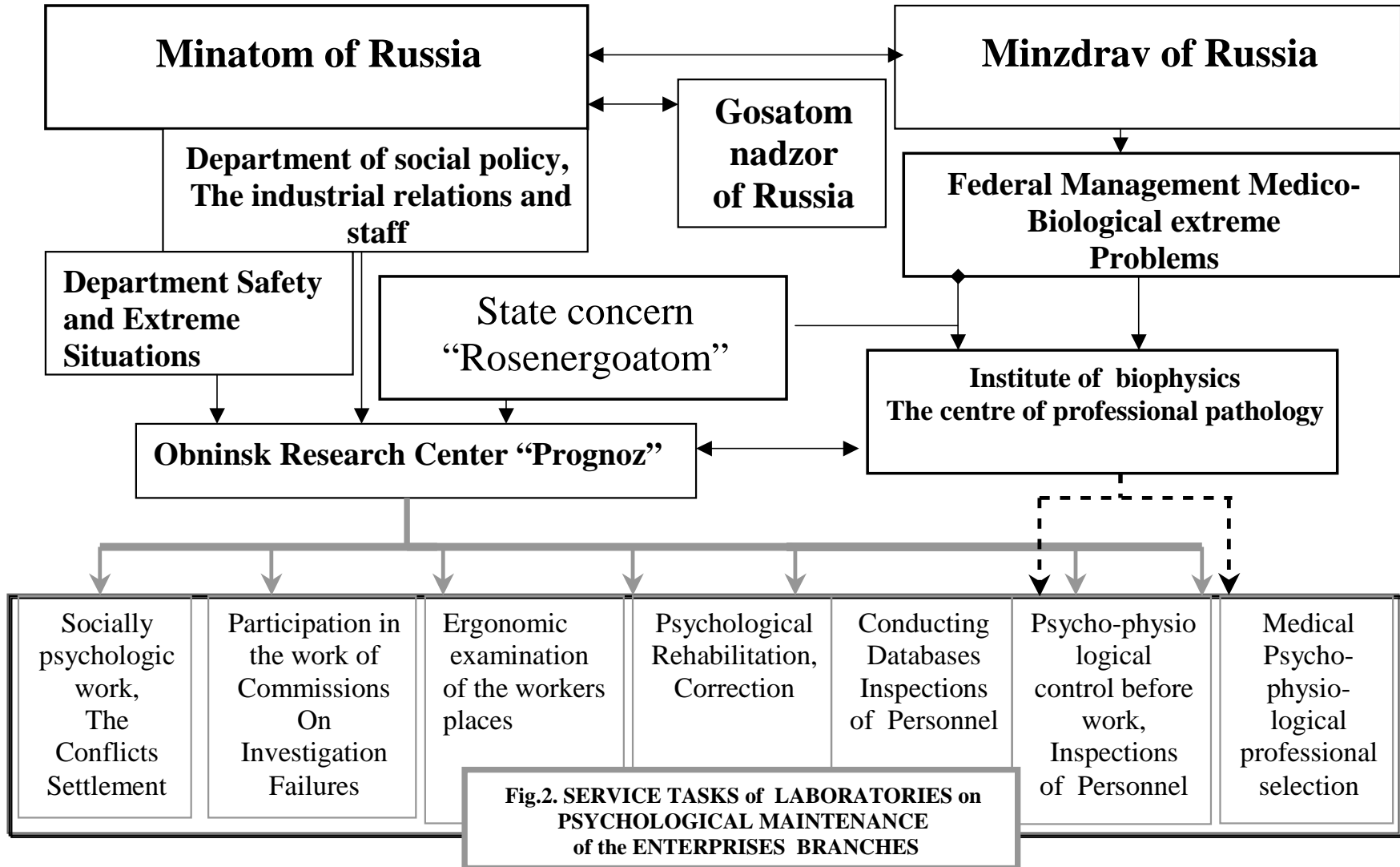
The appropriate methodical maintenance is developed for deriving an objective picture about outcomes of such correlation.

In Russia the method of reasons of the staff incorrect actions in failures of the NPP operation analysis is unique for the global experience. Not only operational and technical characteristics of incorrect actions are studied, but also psychological root reasons, which induced the person to take these actions. The application purpose of this method is to study factors reducing and raising professional reliability of the worker, synthesis of optimising measures of staff activity.

There is a specialized service on problems of HF reliability, which represents a system of Psycho-physiological Maintenance Laboratories (PML, See fig. 2), at the enterprises of Russia Ministry for Atomic Energy on many objects of atomic energy usage. This system realizes:

- Psycho-physiological inspection and monitoring in the medical selection system (according to desire of supporting and monitoring of Russia Health Services),
- psychological support and rehabilitation of staff,
- ergonomical examination of jobs and technological processes, monitoring of social and psychological climate and settlement of conflicts,
- participation in the work of commissions on investigation of the direct and root reasons of failures and malfunctions in work of the enterprises,
- management of data bank with results of the psychological service work.

PML are successfully working functioning almost on every Russian NPP. The purpose of creation of a service on NPP, and now at the remaining enterprises of Russia Ministry for Atomic Energy - extension of professional longevity of staff and increase of the human factor reliability of industry.



The scientific - methodical management of a psychological service, including PLM, is carried out by Obninsk Research Center "Prognoz" (ORC "Prognoz"), which was founded in 1990. The personnel of ORC "Prognoz" consists of PHD specialists in psychology, biology, medicine, sociology, pedagogy (teaching) and etc. The ORC "Prognoz" implements scientific research and services under the contracts with different organizations.

The main objectives of the ORC "Prognoz" are:

- Psychological assistance to the population in extreme conditions
- Organization and methodical co-ordination of the centers of psychological assistance on the territory affected by the Chernobyl disaster
- Socio-psychological monitoring of the problems of population living in districts with bad environment

Activities of the ORC "Prognoz":

- Legal and methodical co-ordination of the laboratories of psycho-physiological maintenance (LPM).

Methodological co-ordination of work of the nuclear security services, labor protection service and other services of the NPPs and organizations, which are in charge of the improvement of the situation with personnel safety

- Socio-psychological maintenance of the activities of the personnel department
- Sociological analysis of the NPP personnel problems, analysis of the work motivation, organization of the monitoring examining socio-psychological climate on the NPPs, creation of the prognosis concerning social tense on the NPPs and working-out recommendations for managers to adjust conflicts
- Working-out the problem of reliability of personnel working on NPP
- Ergonomical research concerning work conditions on the NPP and socio-psychological analysis of climate among the employees
- Consulting and rendering psycho-pedagogical services
- Central database for the industry, which holds more than 10.000 psychological and psycho-physiological tests of the personnel of companies of Minatom of Russia

- Central database of the industry of the incorrect activity of the personnel (including psychological and psycho-physiological, ergonomical, socio-psychological, economical and socio-political factors), which led to the breaches in the work of the NPP and affected the professional reliability of the personnel:

- Conception of psychological service in the industry of nuclear power·

Unique methods: measuring the maturity and satisfaction of work motivation of the personnel, motivation of the improvement of safety culture on the NPPs; analysis of the causes of incorrect activity, which led to the breaches of the work of the NPP·

Number of diagnostics psychological methodics and criterions, which help to estimate the psychological reliability of the management of the NPPs

Besides, the "Prognoz" conducts researches of regional problems of the population of territories, affected by the Chernobyl disaster, and problems of the population of territories, located close to nuclear stations.

- Creation of a network of the centers of psychological assistance to the population living on the territory affected by Chernobyl disaster

- Social adaptation and rehabilitation of people being in difficult situation, including personnel of the nuclear power units and population, which have been affected by the Chernobyl disaster

- Product and fields of its application

- Socio-psychological services, which supports population attached by the Chernobyl disaster

- Conception of radiation risk perception by the population and the professionals working in fields of nuclear power engineering and radioactive hygiene

- Methods of giving an appreciation to the psychological impact of the information given by mass media and of information flow from the regional administration on population

Fields of the work results application of ORC "Prognoz" – nuclear power energetic and industry, regional services of social support and protection of population (mainly being affected by the Chernobyl disaster and the participants of its liquidation). ORC "Prognoz" supports the organizations and citizens with the psychological and psycho-pedagogical consulting.