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CURRENT ISSUES IN ASSESSING THE EXPECTED PROFESSIONAL LONGEVITY OF EMPLOYEES

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Introduction. The task of maintaining the professional longevity of employees, particularly in technology-intensive and potentially hazardous industries, is becoming increasingly relevant in the context of aging populations and increasing life expectancy. Existing methods for assessing occupational health are in many cases fragmented and fail to account for the entire set of physical, psychological, and social factors. In this article, we address this issue by developing an integral group index of professional longevity (IGIPL).
Objective. The development and implementation of the IGIPL as a tool for quantitative assessment of the level of professional longevity among nuclear industry employees, taking into account morbidity, health status, results of medical examinations and psychophysiological testing, stress levels, and engagement.
Materials and methods. A retrospective study covering the period of 2023–2024 was conducted. The analysis was based on depersonalized data from employees of VNIITF (Snezhinsk) and the Kalinin NPP (Udomlya). The study included HR reports on morbidity with temporary disability (TD), final reports of periodic medical examinations (PME), annual reports of psychophysiological examinations (PPE), as well as the results of corporate surveys on stress levels (SL) and emotional burnout (EB). We present only relative summary data, without considering working conditions in the index calculation. Standardized methods were used to assess the parameters, including the Perceived Stress Scale-10, the Burnout Assessment Tool, and the E.L. Notkin method for analyzing TD.
Results. The calculation of the IGIPL showed a positive trend. Thus, the index increased by 2.6 points at the Kalinin NPP (a rise from 69.6 to 72.2 points) and decreased at VNIITF (from 67.2 to 65.8 points). The key factor that had the most pronounced negative impact was the high rate of morbidity with temporary disability (1914 days per 100 workers at VNIITF). At the Kalinin NPP, an improvement in the distribution of employees by health groups and a decrease in the proportion of individuals with a high level of emotional burnout were recorded, indicating the effectiveness of the preventive measures implemented by the organization.
Conclusions. The IGIPL has proven its effectiveness as a tool for monitoring professional longevity and identifying risk areas. The study results underscore the necessity for comprehensive programs aimed at reducing morbidity, managing stress, and increasing employee engagement. The IGIPL methodology can be adapted for other industries. Its further elaboration will enhance the accuracy of assessments. The data obtained hold practical significance for developing corporate programs aimed at preserving health and extending the professional longevity of employees.

Keywords: occupational health; professional longevity; morbidity; medical examination; psychophysiological examination; stress; engagement

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АКТУАЛЬНЫЕ ВОПРОСЫ ОЦЕНКИ ОЖИДАЕМОГО ПРОФЕССИОНАЛЬНОГО ДОЛГОЛЕТИЯ РАБОТНИКОВ

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Введение. В современных условиях старения населения и увеличения продолжительности жизни актуальной становится проблема сохранения профессионального долголетия работников, особенно в высокотехнологичных и потенциально опасных отраслях. Существующие методы оценки профессионального здоровья часто фрагментарны и не учитывают комплексное влияние физических, психологических и социальных факторов. Для решения этой проблемы предлагается разработка интегрального группового индекса профессионального долголетия (ИГИПД).
Цель. Разработка и внедрение ИГИПД как инструмента количественной оценки уровня профессионального долголетия коллектива работников атомной отрасли с учетом заболеваемости, состояния здоровья, результатов медосмотров и психофизиологического обследования, уровня стресса и вовлеченности.
Материалы и методы. Проведено ретроспективное исследование с периодом охвата 2023–2024 гг. Объектом анализа были деперсонифицированные данные работников ВНИИТФ (г. Снежинск) и Калининской АЭС (г. Удомля). В исследование включены кадровые отчеты о заболеваемости с временной утратой трудоспособности (ВУТ), заключительные акты периодических медицинских

осмотров (ПМО), годовые отчеты психофизиологических обследований (ПФО), а также результаты корпоративных анкетирований уровня стресса (УС) и эмоционального выгорания (УЭВ). В статье приведены только относительные сводные данные; условия труда в расчет индекса не включались. Для оценки параметров применялись стандартизированные методики: «Шкала воспринимаемого стресса-10», «Burnout Assessment Tool», а также методика Е.Л. Ноткина для анализа ВУТ.

Результаты. Расчет ИГИПД показал положительную динамику: индекс претерпел повышение на 2,6 балла на Калининской АЭС (рост с 69,6 до 72,2 балла) и снижение показателя во ВНИИТФ (с 67,2 до 65,8 балла). Ключевым фактором, оказавшим наиболее выраженное негативное влияние, явился высокий уровень заболеваемости с временной утратой трудоспособности (1914 дней на 100 работников во ВНИИТФ). На Калининской АЭС зафиксировано улучшение распределения работников по группам здоровья и снижение доли лиц с высоким уровнем эмоционального выгорания, что указывает на эффективность реализуемых организацией профилактических мероприятий.

Выводы. ИГИПД доказал свою эффективность как инструмент для мониторинга профессионального долголетия и выявления зон риска. Результаты исследования подчеркивают необходимость комплексных программ, направленных на снижение заболеваемости, управление стрессом и повышение вовлеченности работников. Методология ИГИПД может быть адаптирована для других отраслей, а ее дальнейшее совершенствование позволит повысить точность оценок. Полученные данные имеют практическую значимость для разработки корпоративных программ по сохранению здоровья и продлению профессионального долголетия работников.

Ключевые слова: профессиональное здоровье; профессиональное долголетие; заболеваемость; медицинский осмотр; психофизиологическое обследование; стресс; вовлеченность

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Финансирование: работа выполнена без спонсорской поддержки.

Соответствие принципам этики: исследование не требовало заключения биоэтического комитета, поскольку использовали деперсонифицированные данные работников двух предприятий атомной отрасли.

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INTRODUCTION

In the current demographic context of an aging society driven by increasing life expectancy in Russia, as well as the need to address humanitarian and economic challenges, the task of preserving the professional longevity of employees is acquiring particular relevance. The growth in the retirement age and rising demands on qualifications and working conditions require new approaches to assessing and managing the professional activity of employees throughout their careers. The issue of extending professional longevity is inextricably linked to ensuring timely and accessible medical care, including prevention, diagnosis, and rehabilitation. These tasks are set by the national project “Long and Active Life”, the implementation of which began on 01.01.2025.

According to the WHO definition, “health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.[1]

At the beginning of the 21st century, due to the growing life expectancy of the population in economically developed countries, the WHO launched a program for active longevity (in the original — active ageing) [1], focusing mainly on the quality of life and maintaining the health of older people.[2] However, in the 2015 edition, the program shifted attention to the employment of older people. This shift is explained by growing concerns among governmental and business structures that population aging would place an unsustainable burden on the budgets of enterprises and social support institutions, primarily pension funds. In order to counter these threats, a series of urgent measures [2] were proposed to improve the economic situation, including measures to retain specialists in the labor market beyond the retirement age.[3,4]

Thus, concern for the working individual, beyond its humanitarian significance, has acquired a pronounced macroeconomic meaning. As a result, the concepts of “occupational health” and “professional longevity” have become the focus of close attention for specialists in medicine, occupational psychology, and related disciplines. Occupational health is defined as an integral characteristic of the “functional state of the human body based on physical and mental parameters, aiming to assess its ability for specific professional activity with given efficiency and duration over a specified life period, as

[1] Preamble to the Charter (Constitution) of the World Health Organization. https://apps.who.int/gb/bd/PDF/bd48/basic-documents-48th-edition-ru.pdf?ua=1#page=9 (request date of 07.04.2025).

[2] Active ageing: a policy framework; 2002. WHO reference number: WHO/NMH/NPH/02.8. https://extranet.who.int/agefriendlyworld/wp-content/uploads/2014/06/WHO-Active-Ageing-Framework.pdf (request date of 02.05.2025).

[3] World Health Organization (WHO). Project 1: Global Strategy and Action Plan on Ageing and Health. 2015. https://www.who.int/ageing/ageing-global-strategy-draft1-ru.pdf (request date of 15.08.2020).

[4] Multisectoral action for healthy ageing based on a life-cycle approach: draft global strategy and action plan on ageing and health. Report of the Secretariat of the Sixty-ninth session of the WHO World Health Assembly, 22 April 2016. https://apps.who.int/iris/bitstream/handle/10665/253277/A69_17-ru.pdf?sequence=1&isAllowed=y (request date of 05.02.2022).

well as its resistance to adverse factors accompanying this activity."[5]

The aforementioned WHO definition of health, which includes mental and social well-being, should be extended by the concept of occupational health, i.e., a person's ability to fully realize themselves as a qualified specialist, experience a sense of self-worth and engagement in the life of the team and the work process, acceptance and support from colleagues, as well as to feel cared by management.

Professional longevity is the "ability of a person to solve professional tasks at a high level throughout the entire period of labor activity allotted by society,"[6] "that is, to maintain occupational capacity [4, 8, 9]." Given the demographic situation, the importance of preserving this ability and the desire to continue working after reaching retirement age should be emphasized. Human health is influenced by a large number of social and economic factors, with the living and working conditions of citizens being of particular importance. Surveys of the working population have revealed that "more than a third lead a sedentary lifestyle, 56% regularly face overtime work, 54% of Russians report periodic stress at work, 10% report constant stress, and 45% say they have experienced professional burnout."[7]

The Russian government has developed a number of regulatory legal acts and national projects aiming to improve the health and increase the life expectancy of the country's population, as well as to overcome difficulties related to the demographic situation. Decree of the President of the Russian Federation No. 309[8] specifies national development goals for the period up to 2030 and with a perspective to 2036, among which the foremost are preserving the population, strengthening health, improving people's well-being, and supporting the family.

The current stage involves the implementation of the national projects for the next six years. Among them, the National Project[9] is aimed at increasing the population's life expectancy to 78 years by 2030. The plans include modernization of the primary healthcare system in Russia, development of measures for the prevention and early diagnosis of cancer, creation of a national digital platform "Health," and development of a medical rehabilitation system.

In order to ensure early and timely detection of chronic non-communicable diseases, which are the main cause of mortality (cardiovascular, oncological, and respiratory diseases, diabetes, etc.), preventive medical examinations and population health checkups are being carried out [4, 5].

Decree of the President of the Russian Federation No. 145[10] has declared a transition to personalized, predictive, and preventive medicine, high-tech healthcare, and health preservation technologies, including for the working population. Directive No. 830-r[11] outlines strategies for extending active healthy longevity, creating conditions for realizing the personal potential of elderly citizens, and expanding their participation in the society. Federal Law No. 311-FZ[12] has introduced comprehensive amendments to the Labor Code of the Russian Federation aimed at transforming approaches in the field of labor protection, implementing and developing a system for the prevention of occupational injuries and diseases, and improving mechanisms to incentivize employers to enhance working conditions.

Labor protection has become one of the priority areas of the Russian state policy, with the goal of creating a prosperous and safe environment for the citizens. There is a raising awareness among employers about the economic feasibility of promoting a healthy lifestyle among employees and encouraging regular preventive medical examinations and health checkups, as well as the importance of implementing special comprehensive programs to create appropriate conditions for employees to maintain a healthy lifestyle [7].

Directive of the Government of the Russian Federation No. 833-r[13] has approved a set of measures to incentivize employers and employees to improve working conditions and preserve the health of workers, as well as to motivate citizens to adopt a healthy lifestyle. These measures provide for the creation and replication of best corporate and regional practices for encouraging employers to enhance working conditions and preserve the health of workers.

While acknowledging the importance of the measures implemented by the Russian state to improve public policy in healthcare and labor protection for preserving the health of the working population, attention should be drawn to the persistently high mortality rate from non-communicable diseases, the prevalence of smoking and

[5] Health Psychology: Textbook for Universities / Edited by GS Nikiforov. — St. Petersburg: Peter, 2006.
[6] L.V. Mardakhaev Social Pedagogy: Textbook. Moscow: Gardariki, 2005.
[7] Federation Council of the Federal Assembly of the Russian Federation. Transcript of parliamentary hearings on the topic "Protecting the Health of the Working Population" dated 24.10.2024. http://council.gov.ru/activity/activities/parliamentary/161497/ (request date of 05.05.2025).
[8] Decree of the President of the Russian Federation No. 309 "On the National Development Goals of the Russian Federation for the Period until 2036" dated 07.05.2024. http://government.ru/docs/all/155078/
[9] National project "Long and Active Life". https://национальныепроекты.рф/new-projects/prodolzhitelnaya-i-aktivnaya-zhizn/
[10] Decree of the President of the Russian Federation No. 145 "On the Strategy for Scientific and Technological Development of the Russian Federation" dated 28.02.2024. http://www.kremlin.ru/acts/bank/50358
[11] Decree of the Government of the Russian Federation No. 830-r dated 07.04.2025, on the approval of the "Strategy for Action in the Interests of Older Citizens in Russia until 2030." http://government.ru/docs/54753/
[12] Federal Law No. 311-FZ "On Amendments to the Labor Code of the Russian Federation" dated 02.07.2021. http://www.kremlin.ru/acts/bank/46959
[13] Decree of the Government of the Russian Federation No. 833-r dated 26.04.2019, on the approval of the "Set of Measures to Stimulate Employers and Employees to Improve Working Conditions and Preserve the Health of Workers, as well as to Motivate Citizens to Lead a Healthy Lifestyle.". http://static.government.ru/media/files/ElHhjehSWOoZSfE4OuOTqJuF5mr7e7P7.pdf

alcohol consumption among the population, poor nutrition, insufficient physical activity, a formalistic attitude and low level of trust in health checkups. Psychosomatic diseases are becoming widespread, to a large extent being influenced by psychological factors, insufficient stress resistance, and prolonged psychoemotional tension.

In the context of demographic challenges and increasing demands to preserve labor potential, objective tools capable of assessing the health status of employees and their level of professional longevity are becoming particularly important. In order to address this task, we set out to develop a methodology for calculating an Integral Group Index of Professional Longevity (IGIPL) based on a set of medical, psychophysiological, and social parameters. The index enables the planning and monitoring of corporate and state programs aimed at extending professional activity, allows for tracking the dynamics of key parameters, and facilitates comparative analysis across different enterprises.

In this study, we aim to develop an IGIPL for use as a tool for quantitative assessment of the level of professional longevity among nuclear industry employees, taking into account morbidity, health status, results of medical examinations and psychophysiological testing, stress levels, and engagement.

To that end, we set the following objectives:

- to justify the IGIPL calculation methodology, including the selection of parameters and determination of their weight significance based on expert assessments;
- to calculate an IGIPL and carry out a comparative analysis of its values using the example of two nuclear industry enterprises for 2023 and 2024, with an assessment of parameter dynamics;
- to determine general approaches to developing corrective measures based on the IGIPL, aimed at increasing the level of professional longevity of employees.

MATERIALS AND METHODS

We carried out a retrospective and observational study covering the period of 2023–2024. The analysis was based on anonymized data from employees of two nuclear industry enterprises: VNIITF (Snezhinsk) and the Kalinin NPP (Udomlya).

The following information sources were used:

- Human Resources (HR) reports on morbidity with temporary disability (TD);
- final reports on the results of periodic medical examinations (PME) indicating the distribution of employees by health groups;
- annual reports of psychophysiological examinations (PPE);
- materials from corporate surveys assessing stress levels (SL) and emotional burnout (EB).

In this article, we present exclusively relative values based on aggregated, anonymized data. It should be noted that working conditions were not considered in the calculation of the IGIPL; therefore, their detailed analysis was beyond the scope of this study.

Standardized methodologies were used to assess specific parameters:

- SL was assessed using the “Perceived Stress Scale-10.” The maximum score on this scale is 50 points. To normalize the data (i.e., to convert the scale to a 100-point dimension), the obtained values were multiplied by two;
- EB level[14] was assessed using the “Burnout Assessment Tool (BAT),” specifically its version for working individuals. A short Russian-language version provided by the developer of the methodology was used [3];
- The E.L. Notkin method[15] was used to assess morbidity with TD, calculated as the number of days per 100 employees.

Thus, the combination of the above sources and methods enabled a comprehensive analysis of professional health parameters and the calculation of the IGIPL.

Weight coefficients (W) were established based on an expert assessment method aimed at determining the relative significance of various parameters for the professional longevity of employees. The study involved 20 experts in the fields of occupational medicine, psychophysiology, and human resource management. Data collection was carried out using standardized questionnaires followed by their statistical processing for the determination of valid weight coefficients (Table 1).

The assigned coefficients reflect the contribution of each parameter to the overall value of IGIPL. Experts attributed the greatest significance (coefficients of 0.20–0.15) to the following parameters: temporary disability (TD), health group (HG), stress level (SL), emotional burnout level (EB), and work engagement (E). According to specialists, these parameters most significantly determine the current state and dynamics of professional longevity, being directly linked to the risks of lost work capacity, decreased motivation, and premature departure from the profession.

Lower weight coefficients (0.10 each) were assigned to the parameters of fitness for work based on medical examinations (PME) and psychophysiological resilience (PPR). Despite their undeniable importance, experts considered these factors to play more of a supportive rather than a determining role in shaping professional

[14] Burnout Assessment Tool: version for working individuals. https://burnoutassessmenttool.be/wp-content/uploads/2020/11/BAT_Russian.pdf (request date of 03.05.2025).

[15] Methodological Guidelines MR 2.2.9.0375-25 “Analysis of the causes of temporary disability to identify priority professional groups for the development of medical and preventive measures”.

Table 1. Weight coefficients determined by experts

No.	Parameter	Abbreviation	Weighting coefficients (W)
1.	Temporary Disability	TD	0.20
2.	Health Group	HG	0.15
3.	Periodic Medical Examination	PME	0.10
4.	Psychophysiological Examination	PPE	0.10
5.	Stress Level	SL	0.15
6.	Emotional Burnout Level	EB	0.15
7.	Engagement	E	0.15

Table compiled by the authors based on their own data

Table 2. Temporary disability assessment scale (S_TD)

Temporary disability in days per 100 workers according to E.L. Notkin	Points on the S_TD assessment scale*
< 500	100
500–599	85
600–799	70
800–999	55
1000–1199	40
1200–1499	25
> 1500	10

Table compiled by the authors based on data from source MR 2.2.9.0375-25[16]

Note: * — the S_TD scale step is designed such that for every increase of 200–300 days of TD per 100 employees, the index value sequentially decreases by 15 points.

longevity, especially in the presence of other critical deviations.

The integration of the TD parameter was carried out through the S_TD assessment scale (Table 2). This approach normalizes the parameter to a 0–100 scale, reflects the generally accepted expert assessment according to the E.L. Notkin scale, and eliminates mathematical distortions at extreme values.

Therefore, the formula for calculating the Integral Group Index of Professional Longevity (IGIPL) takes the following form:

$$IGIPL = W\_TD \times S\_TD + W\_HG \times HG + \\ + W\_PME \times PME + W\_PPE \times PPE + + W\_E \times E + \\ + W\_SL \times (100 - SL) + W\_EB \times (100 - EB), \quad (1)$$

wherein:
W — the weight coefficient of the parameter;
S_TD — the score for morbidity with temporary disability;
HG — the proportion of employees in health groups I–II (%);
PME — the proportion of employees deemed fit for work without restrictions based on the results of periodic medical examinations (%);
PPE — the proportion of employees deemed fit based on the results of psychophysiological examinations (%);
E — the level of work engagement (%);
SL — the stress level according to the scale (points);
EB — the level of emotional burnout (%).

The IGIPL calculation was conducted using the example of enterprises of the State Corporation "Rosatom," which operate in technology-intensive and potentially hazardous industries: nuclear power and the defense-industrial complex.

The objects under analysis were the All-Russian Research Institute of Technical Physics (VNIITF, Snezhinsk) and the Kalinin Nuclear Power Plant

[16] Methodological Guidelines MR 2.2.9.0375-25 "Analysis of the Causes of Temporary Disability to Identify Priority Professional Groups for the Development of Medical and Preventive Measures".

Table 3. Interpretation of IGIPL values

Scores	Level	Interpretation of IGIPL Values
80–100	High	High level of professional longevity. Supportive measures for health protection, strengthening psychological well-being, and employee engagement are sufficient
60–79	Medium	Medium level of professional longevity. The implementation of regular preventive programs for stress management and maintaining employee motivation is required
40–59	Low	Low level of professional longevity. Targeted health-improvement and organizational measures aimed at improving the physical and psycho-emotional state of workers are necessary
< 40	Critical	Critical level of professional longevity. The implementation of comprehensive programs for health protection, workload reduction, and fostering a favorable work environment is required

Table compiled by the authors based on their own data

(Udomlya). These enterprises are characterized by a high degree of responsibility, complex technological processes, and stringent requirements for the health and psychophysiological resilience of their employees.

RESULTS AND DISCUSSION

The IGIPL is formed based on a set of various parameters. When growing, these parameters either contribute to the growth of professional longevity or, conversely, lead to its decrease. The key parameters influencing the IGIPL are presented below.

Factors whose growth has a positive effect on the IGIPL:

- Health Group (HG): The more employees belong to Health Groups I and II, the higher the overall level of resilience and physical readiness of the team to perform professional tasks.
- Fitness for Work based on Medical Examinations (PME): A high proportion of workers without medical restrictions reflects good overall health of the personnel and contributes to stable labor activity.
- Psychophysiological Resilience (PPE): The ability to maintain performance under difficult conditions is a crucial component for sustaining professional longevity.
- Work Engagement (E): A high level of engagement promotes professional stability, reduces the likelihood of burnout, and increases motivation.

Factors whose growth has a negative effect on the IGIPL:

- Temporary Disability (TD, days): An increase in the number of disability days indicates a decline in the overall health level of the team and negatively impacts the index value.
- Stress Level (SL): An elevated stress level leads to decreased performance, reduced psychological resilience, and a decline in the quality of professional duties.
- Emotional Burnout (EB): A high level of burnout is one of the primary factors for premature termination of employment.

The IGIPL was developed as a practical tool for employers to assess the level of professional longevity among employees at the enterprise level. The index can be used to formulate, implement, and subsequently evaluate the effectiveness of programs aimed at protecting employee health, increasing motivation, and improving the psychological climate within the team.

We performed IGIPL calculations based on the parameters of physical, psychological, and social well-being for the period of 2023–2024 in accordance with the developed methodology (Table 4).

According to the results obtained, the IGIPL values at VNIITF decreased over the year by 1.4 points (from 67.2 to 65.8 points). However, at the Kalinin NPP, the index increased by 2.6 points (from 69.6 as of 2023 to 72.2 points in 2024). Both organizations were characterized by an average level of IGIPL (60–79 points), which reflects a satisfactory but insufficiently stable state of the professional longevity level of employees. A slight decrease in the parameter was noted at VNIITF, while a positive trend was observed at the Kalinin NPP, likely associated with the effectiveness of the implemented measures to strengthen occupational health and improve working conditions.

Our analysis identified key parameters that determine the value of IGIPL. The most significant factor was morbidity with temporary disability (TD). The VNIITF enterprise exhibited a critically high level of morbidity with TD: 1914 days per 100 workers in 2023 and 1912 days in 2024. According to the E.L. Notkin scale, this corresponds to the minimum score (10 points) and indicates an area of chronic overload and unfavorable health status of personnel, requiring immediate corrective measures.

Table 4. Calculation of IGIPL for each enterprise for 2023–2024

Organization	Year	S_TD	W_TD × S_TD	W_HG × _HG	W_PME × PME	W_PPE × PPE	W_SL × (100 – SL)	W_EB × (100 – EB)	W_E × E	IGIPL
VNIITF	2023	10	2.0	3.3	9.92	10.0	13.9	13.9	14.1	67.2
VNIITF	2024	10	2.0	4.05	9.88	10.0	13.2	13.2	13.5	65.8
Kalinin NPP	2023	25	5.0	4.5	8.84	10.0	13.6	13.3	14.2	69.6
Kalinin NPP	2024	25	5.0	6.88	9.18	10.0	13.6	13.9	13.5	72.2

Table compiled by the authors based on their own data

Note: W — the weight coefficient of the parameter; TD — temporary disability; HG — health groups; PME — periodic medical examination; PPE — psychophysiological examinations; SL — stress levels; EB — emotional burnout.

At the Kalinin NPP, this parameter was somewhat lower (1321 and 1222 days per 100 workers in 2023 and 2024, respectively), which corresponds to 25 points and also indicates a significant loss of working capacity.

The second most significant factor is the distribution of employees by health groups. At the VNIITF enterprise, a moderate increase in the proportion of employees with Health Groups I–II was observed over time (from 22% in 2023 to 27% in 2024); however, the baseline level remains low. At the Kalinin NPP, a pronounced positive shift was observed: from 30% in 2023 to 45.9% in 2024, reflecting a more effective implementation of preventive and health-improvement measures.

The results of PME showed high values at both enterprises. For instance, at VNIITF, over 98% of employees were cleared for work without restrictions, indicating strict control of professional suitability. At the Kalinin NPP, this parameter was somewhat lower (88–91%), although remaining within acceptable standards.

Psychophysiological examination (PPE) at both enterprises showed a 100% clearance of employees for further work. This result indicates the low informativeness of the parameter "proportion of employees suspended based on PPE results." However, the signs of strain and impaired psychophysiological adaptation identified during the examination are significant predictors of somatic ill-health and require consideration when planning preventive measures. In the future, it is advisable to use an integral assessment of psychophysiological adaptation, e.g., by indicating the proportion of employees with pronounced impairments.

The conducted analysis of psychoemotional factors revealed differences between the organizations. The stress level among workers at VNIITF was elevated, ranging 7–12 points, which should be considered an alarming signal and a prerequisite for developing targeted preventive measures. At the Kalinin NPP, this parameter remained stable (around 9 points), corresponding to a moderate level requiring regular monitoring.

The dynamics of emotional burnout also differed. At VNIITF, its prevalence increased from 7% to 12%, which, combined with rising stress levels, indicated a growing risk of deterioration in the psychoemotional state of workers. Conversely, at the Kalinin NPP, a decrease in the proportion of workers with a high level of burnout was recorded, from 11% to 7%, reflecting positive trends and the need to maintain them further.

The engagement index remained high at both enterprises (VNIITF: 94% → 90%; Kalinin NPP: 95% → 90%), which is a factor of resilience to stress and the likelihood of staff turnover. The slight decrease in engagement at VNIITF in the setting of increasing stress and burnout can be considered an early sign of professional exhaustion among the workforce.

As a result of the conducted research, a comprehensive assessment of professional longevity at two enterprises of the State Corporation "Rosatom" was obtained. We established that both organizations are within the stable range of IGIPL, indicating the stability of labor potential despite the presence of risk factors.

However, differences in dynamics were identified. Positive shifts were recorded at the Kalinin NPP, driven by a decrease in morbidity with temporary disability, a reduction in the prevalence of emotional burnout, and a significant increase in the proportion of employees with Health Groups I–II according to medical checkup data. Conversely, at the VNIITF enterprise, a critically high level of morbidity with temporary disability persisted, which is a key limiting factor for professional longevity. Furthermore, unfavorable changes in the psychoemotional state of the workforce were noted, including an increase in stress levels, a rise in the proportion of employees showing signs of burnout, and a decrease in engagement.

The obtained results underscore the necessity for long-term observation (at least 4–5 years) to confirm the identified trends and to form sustainable management strategies. At the same time, the IGIPL has proven its scientific and practical significance as an integral parameter. It demonstrates high sensitivity to key risks in the occupational environment and enables an objective assessment of the effectiveness of corporate and state programs aimed at preserving health and extending the professional longevity of personnel.

CONCLUSION

The Integral Group Index of Professional Longevity serves as a tool for monitoring the effectiveness of measures aimed at preserving the health of the working population and extending professional longevity. Its application will enhance the objectivity of assessing programs implemented by enterprises and facilitate the development of more targeted preventive measures against key risk factors.

The implementation of IGIPL-based targeted measures may contribute to extending the active working life of employees, reducing morbidity and professional burnout, and increasing labor productivity. Undoubtedly, a competent personnel policy must account for the negative impact of biological aging on psychophysiological functions.

The proposed algorithm for IGIPL calculation is a dynamic model that can be refined with new accumulated data on the influence of various factors on professional longevity.

Effective use of the IGIPL requires a comprehensive approach, including studying successful experience of other organizations, analyzing domestic and international scientific research in the field of occupational health, developing methodological recommendations tailored to industry specifics, assessing necessary resources, and creating a system for monitoring the effectiveness of implemented measures. The conducted research and the proposed algorithm can serve as a basis for forming a program aimed at enhancing the professional longevity of employees, reducing losses associated with temporary disability, and increasing motivation and job satisfaction. Companies that invest in employee health, adaptation, and psychological support see a 5–10% increase in efficiency and reduced costs associated with staff turnover. Thus, professional longevity is not merely the length of a career but a strategic factor for productivity growth in the context of labor shortage.

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