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SOCIAL GUARANTEES FOR EMPLOYEES IN HAZARDOUS WORKING CONDITIONS: A STRUCTURAL DIAGNOSIS OF THE CURRENT MODEL IN THE REPUBLIC OF KAZAKHSTAN

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The article presents a structural diagnosis of the system of social guarantees for employees engaged in hazardous and other unfavourable working conditions in the Republic of Kazakhstan for the period 2000-2025, drawing on the annual statistical bulletins of the Bureau of National Statistics (BNS) of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan and the Taldau statistical database. Throughout the 2000-2023 core observation period the number of employees registered as recipients of at least one type of benefit or compensation systematically exceeded the number of employees whose workplaces did not meet hygienic standards; the ratio ranged from 1.70 (2023) to 1.92 (2003) over the annual observations and constituted 287.0 thousand persons in absolute terms in 2023. According to Table 1 of the 2025 BNS statistical bulletin (form Т-14-10-Г), the ratio in 2025 equals 1.72 (681 968 recipients of at least one guarantee against 396 507 employees actually engaged in hazardous working conditions, reported in column 5 of the cited table), remaining within the 2000-2023 range of 1.70-1.92; no methodological break is observed. The ratio is interpreted as a descriptive indicator of the structural mismatch between two accounting bases rather than as a measure of unjustified benefit receipt or of unprotected employment, since the two populations are methodologically non-equivalent. The share of employees working in conditions failing hygienic standards rose from 18.0% (2000) to 24.2% (2023); critical concentrations were recorded in coal mining (75.6%), metal-ore mining (53.3%) and the mining industry as a whole (53.0%). Enterprise expenditure on social guarantees grew from KZT 7.9 bn (2000) to KZT 297.4 bn (2024) and KZT 341.9 bn (2025), while the ratio of compensatory to preventive expenditure stood at approximately 3.04:1 (2024) and 3.14:1 (2025), documenting a persistent predominance of the compensatory function of the current model. The authors substantiate the necessity of transition from a list-based to a measurement-based mechanism for assigning social guarantees, the introduction of a scale of guarantees differentiated by the class of working conditions, and a system of insurance contributions differentiated by the degree of occupational risk.

Keywords: social guarantees, hazardous working conditions, occupational risk, occupational risk assessment, list-based approach, risk-oriented model, mining industry, Kazakhstan.

ЗИЯНДЫ ЕҢБЕК ЖАҒДАЙЛАРЫНДА ЖҰМЫС ІСТЕЙТІН ҚЫЗМЕТКЕРЛЕРГЕ ӘЛЕУМЕТТІК КЕПІЛДІКТЕР: ҚАЗАҚСТАН РЕСПУБЛИКАСЫНДАҒЫ ҚОЛДАНЫСТАҒЫ МОДЕЛЬДІҢ ҚҰРЫЛЫМДЫҚ ДИАГНОСТИКАСЫ

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Мақалада Қазақстан Республикасындағы зиянды және өзге де қолайсыз еңбек жағдайларында жұмыс істейтін қызметкерлерге берілетін әлеуметтік кепілдіктер жүйесіне 2000–2025 жылдар аралығындағы құрылымдық диагностика ұсынылған. Зерттеу Қазақстан Республикасы Стратегиялық жоспарлау және реформалар агенттігі Ұлттық статистика бюросының (ҰСБ) жыл сайынғы статистикалық бюллетеньдері мен «Талдау» статистикалық дерекқорының мәліметтеріне негізделген. Зерттеудің негізгі кезеңі болып табылатын 2000–2023 жылдар аралығында жеңілдіктердің немесе өтемақылардың кемінде бір түрін алушы ретінде тіркелген қызметкерлер саны жұмыс орындары санитариялық-гигиеналық нормативтерге сәйкес

келмейтін қызметкерлер санынан жүйелі түрде асып отырған. Жыл сайынғы бақылаулар бойынша аталған арақатынас 2023 жылғы 1,70-тен 2003 жылғы 1,92-ге дейін өзгерді, ал 2023 жылы абсолюттік мәндегі айырмашылық 287,0 мың адамды құрады. ҰСБ-ның 2025 жылғы статистикалық бюллетенінің 1-кестесіне сәйкес (Т-14-10-Г нысаны), 2025 жылы бұл арақатынас 1,72 болды: кемінде бір әлеуметтік кепілдік алған 681 968 адамға қарсы аталған кестенің 5-бағанында көрсетілген зиянды еңбек жағдайларында нақты жұмыс істейтін қызметкерлер саны 396 507 адамды құрады. Бұл көрсеткіш 2000–2023 жылдары қалыптасқан 1,70–1,92 аралығында сақталып отыр, яғни әдіснамалық үзіліс байқалмайды. Аталған арақатынас жеңілдіктерді негізсіз алудың немесе әлеуметтік қорғаумен қамтылмаған жұмыспен қамтудың көрсеткіші ретінде емес, есепке алудың екі базасы арасындағы құрылымдық сәйкессіздікті сипаттайтын көрсеткіш ретінде түсіндіріледі. Себебі салыстырылып отырған екі жиынтық әдіснамалық тұрғыдан өзара тең емес. Санитариялық-гигиеналық нормативтерге сәйкес келмейтін жағдайларда жұмыс істейтін қызметкерлердің үлесі 2000 жылғы 18,0%-дан 2023 жылы 24,2%-ға дейін өсті. Мұндай қызметкерлердің аса жоғары шоғырлануы көмір өндіру саласында - 75,6%, металл кендерін өндіру саласында - 53,3% және тұтастай алғанда тау-кен өндіру өнеркәсібінде - 53,0% деңгейінде тіркелді. Кәсіпорындардың әлеуметтік кепілдіктерге жұмсаған шығыстары 2000 жылғы 7,9 млрд теңгеден 2024 жылы 297,4 млрд теңгеге және 2025 жылы 341,9 млрд теңгеге дейін өсті. Бұл ретте өтемақылық шығыстардың профилактикалық шығыстарға арақатынасы 2024 жылы шамамен 3,04:1, ал 2025 жылы 3,14:1 болды. Бұл қолданыстағы модельдің өтемақылық функциясының тұрақты түрде басым болып отырғанын көрсетеді. Авторлар әлеуметтік кепілдіктерді тағайындаудың тізімдік тетігінен еңбек жағдайларын нақты өлшеуге негізделген тетікке көшу, еңбек жағдайларының сыныптары бойынша сараланған әлеуметтік кепілдіктер шкаласын енгізу, сондай-ақ кәсіптік тәуекел дәрежесіне қарай сараланған сақтандыру жарналары жүйесін қалыптастыру қажеттілігін негіздейді.

Түйін сөздер: әлеуметтік кепілдіктер, зиянды еңбек жағдайлары, кәсіби тәуекел, кәсіби тәуекелдерді бағалау, тізімдік тәсіл, тәуекелге бағытталған модель, тау-кен өнеркәсібі, Қазақстан.

СОЦИАЛЬНЫЕ ГАРАНТИИ РАБОТНИКАМ, ЗАНЯТЫМ ВО ВРЕДНЫХ УСЛОВИЯХ ТРУДА: СТРУКТУРНАЯ ДИАГНОСТИКА ДЕЙСТВУЮЩЕЙ МОДЕЛИ В РЕСПУБЛИКЕ КАЗАХСТАН

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В статье представлена структурная диагностика системы социальных гарантий для работников, занятых во вредных и иных неблагоприятных условиях труда в Республике Казахстан, за период 2000–2025 годов. Исследование основано на ежегодных статистических бюллетенях Бюро национальной статистики (БНС) Агентства по стратегическому планированию и реформам Республики Казахстан и данных статистической базы «Талдау». На протяжении основного периода наблюдения - 2000–2023 годов - численность работников, зарегистрированных в качестве получателей хотя бы одного вида льгот или компенсаций, систематически превышала численность работников, рабочие места которых не соответствовали санитарно-гигиеническим нормам. В рамках ежегодных наблюдений значение данного соотношения варьировалось от 1,70 в 2023 году до 1,92 в 2003 году, а в абсолютном выражении разница в 2023 году составила 287,0 тыс. человек. Согласно таблице 1 статистического бюллетеня БНС за 2025 год (форма Т-14-10-Г), в 2025 году данное соотношение составило 1,72: 681 968 получателей хотя бы одной социальной гарантии против 396 507 работников, фактически занятых во вредных условиях труда, сведения о которых приведены в графе 5 указанной таблицы. Этот показатель остаётся в пределах диапазона 1,70–1,92, зафиксированного в 2000–2023 годах, что свидетельствует об отсутствии методологического разрыва. Соотношение интерпретируется как описательный показатель структурного несоответствия между двумя системами учёта, а не как показатель необоснованного получения льгот или неохваченной социальной защитой занятости, поскольку рассматриваемые совокупности методологически неравнозначны. Доля работников, занятых в условиях, не соответствующих санитарно-гигиеническим нормам, увеличилась с 18,0% в 2000 году до 24,2% в 2023 году. Критическая концентрация таких работников была зафиксирована в угледобывающей промышленности -

75,6%, добыче металлических руд - 53,3% и горнодобывающей промышленности в целом - 53,0%. Расходы предприятий на социальные гарантии увеличились с 7,9 млрд тенге в 2000 году до 297,4 млрд тенге в 2024 году и 341,9 млрд тенге в 2025 году. При этом соотношение компенсационных и профилактических расходов составило приблизительно 3,04:1 в 2024 году и 3,14:1 в 2025 году, что свидетельствует о сохраняющемся преобладании компенсационной функции действующей модели. Авторы обосновывают необходимость перехода от списочного механизма предоставления социальных гарантий к механизму, основанному на фактических измерениях условий труда, введения шкалы социальных гарантий, дифференцированной по классам условий труда, а также системы страховых взносов, дифференцированных в зависимости от степени профессионального риска.

Ключевые слова: социальные гарантии, вредные условия труда, профессиональный риск, оценка профессиональных рисков, списочный подход, риск-ориентированная модель, горнодобывающая промышленность, Казахстан.

Introduction. Ensuring safe and healthy working conditions constitutes a constitutional right of the citizens of the Republic of Kazakhstan (Article 24 of the Constitution) and a key element of state social policy. In the context of rapid development of the extractive industries, which account for approximately 20% of the country's GDP, Kazakhstan faces a set of systemic challenges in the field of occupational safety: elevated rates of workplace injuries, rising rates of occupational diseases, and an increasing share of employees engaged in hazardous conditions. According to the Occupational Safety Concept of the Republic of Kazakhstan for 2024-2030 [1], the number of employees at facilities with harmful or hazardous working environments increased by 5.7% over the preceding three years.

The current model of providing social guarantees to employees engaged in hazardous working conditions is regulated by the Labour Code of the Republic of Kazakhstan [2], the Social Code of the Republic of Kazakhstan [3], the Law «On Compulsory Social Insurance» [4], and a set of subordinate normative acts. Within this framework, the legislation establishes the following forms of guarantees. Employees engaged in arduous work or work with harmful and (or) hazardous working conditions are entitled to: additional annual paid leave of not less than six calendar days, granted, pursuant to Article 89 of the Labour Code, on the basis of the List of production units, workshops, occupations and positions, together with the list of arduous work and work with harmful and (or) hazardous working conditions, and confirmed by the results of workplace attestation (with the qualification that where the employer has not carried out the workplace attestation, the additional annual paid leave is granted in full on the basis of the said List); a reduced working week; increased wage rates or compensatory payments; the provision of milk or equivalent food products, or therapeutic and preventive nutrition; and mandatory occupational pension contributions paid by the employer at the rate of 5% of the employee's income. Pursuant to Article 195-1 of the Social Code, upon reaching the age of 55 and provided that mandatory occupational pension contributions have been paid on behalf of the employee for at least 84 months in the aggregate, and subject to cessation of employment in work with harmful conditions (or transfer to work excluding exposure to harmful production factors), the employee is entitled to a special social payment comprising four components: (i) a special professional state allowance; (ii) an insurance payment under a pre-retirement annuity insurance contract; (iii) a professional payment financed by the employer; and (iv) a pension payment from the Unified Accumulative Pension Fund financed by mandatory occupational pension contributions. This payment mechanism entered into force on 1 January 2024. Article 212 of the Labour Code obliges the employer to organise mandatory medical examinations of employees, both pre-employment and periodic. Under the Law «On Compulsory Insurance of an Employee against Accidents in the Performance of Labour (Official) Duties» No. 30-V [5], employees are entitled to insurance payments in case of occupational injury or occupational disease.

However, the prevailing mechanism for assigning social guarantees remains list-based. Historically, this approach reproduces the regulatory logic of the Soviet period, in which entitlement is determined by the inclusion of the profession or job title in an established list. It should be noted that pursuant to Article 89 of the Labour Code of the Republic of Kazakhstan, additional annual paid leave is granted on the basis of both the list of hazardous and (or) arduous occupations and the results of workplace attestation. Nevertheless, as recognised in the Occupational Safety Concept [1], the certification of industrial facilities identifies the class of working conditions but does not, in itself, ensure the management of occupational risks. The need to transform this mechanism has been articulated at the

level of strategic state documents [1, 6] and in recent Kazakhstani studies [7 9].

The purpose of this article is to conduct a structural diagnosis of the system of social guarantees for employees engaged in harmful and (or) hazardous working conditions in the Republic of Kazakhstan on the basis of long-term official statistical time series for the period 2000-2023 (with limited use of 2024-2025 data on comparable indicators), to identify structural mismatches between the accounting bases used for assigning guarantees and for recording actual working conditions, and to substantiate the directions of transition towards a measurement-based, risk-oriented model.

The issue of social protections for workers in adverse working conditions has been extensively studied in international literature and in research conducted by scholars in CIS countries, covering several interrelated areas.

The global scale of the problem is reflected in the ILO estimates [10]: approximately 2.78 million workers die annually as a result of workplace accidents and occupational diseases, and the associated loss of working time is equivalent to 4% of global GDP [11]. The ILO Global Strategy on Occupational Safety and Health for 2024-2030 emphasises the transition to a risk-based approach and identifies occupational-risk assessment as a core element of national occupational safety and health systems [12]. In a systematic review of 72 journal articles (88 publications) issued between 2002 and 2022, Liu et al. [13] demonstrate that academic literature relies extensively on fuzzy-logic and multi-criteria methods for occupational-risk assessment, whereas national regulatory practice more frequently applies instrumental measurement approaches based on threshold limit values. An empirical study by Dogbla et al. covering 19 891 workers [14] documents substantial sectoral heterogeneity of exposure to physical, biomechanical, and chemical factors, with the highest exposure recorded in construction. The methodological interface between qualitative and quantitative risk assessment of hazardous substances in the workplace is discussed editorially by Zhang et al. [15]. Theoretical frameworks for new and emerging occupational risks are developed in Brocal et al. [16], while Ahonen et al. [17] examine the role of work in the formation of population health inequalities; these studies serve as conceptual references and do not, in themselves, establish empirical parameters for differentiated insurance tariffs.

With regard to the post-Soviet space, Novikova O.F. and Logacheva L.M. [18] established, based on an analysis of data from industrial enterprises in Ukraine, that the number of benefit recipients consistently exceeds the number of those actually employed in hazardous conditions by a factor of 1.14-as a direct consequence of the dysfunction of the «list-based» approach. The authors justified the need to establish occupational pension funds based on insurance principles.

The Russian experience with reform has been documented in detail by V.D. Roik [19-21], who justified the transition from a paternalistic to an insurance-based model. The introduction of the Special Assessment of Working Conditions (SAWC) in Russia [22] has been the subject of a number of empirical studies: I.V. Bukhtiyarov et al. [23], based on an analysis of the FSIS SAWC data for 2018-2022 across all 57 operating coal mines in Russia, established that 92% of miners work in class 3.1 and higher conditions, which confirms both the diagnostic value of instrument-based assessment and the scale of occupational risk concentration in extractive industries. A comparative analysis of regulatory models shows that Kazakhstan retains the certification approach (certification of industrial facilities, in which working conditions are measured but benefits are assigned based on lists of occupations), whereas Russia [22] has shifted to a measurement-and-assessment approach (Special Assessment of Working Conditions, SAWC), in which benefits are granted directly based on the results of instrumental measurements at each workplace. Elements of a comparable evolution are reported for Belarus in the reviewed secondary literature; a categorical statement on the current Belarusian model is not made here in the absence of a primary legal source. A.G. Chebotarev and D.D. Sementsova [24] report that workers face hazardous environments in 60 % to 80 % of primary positions at mining and metallurgical companies. On the basis of SAWC results, the authors argue that instrumental measurement of physical factors permits an accurate identification of occupational risks.

In the Kazakhstani context, Shirvanov [7] develops a four-stage algorithm for the assessment of working conditions at workplaces of industrial enterprises in the Republic of Kazakhstan (initial identification of hazardous and harmful production factors and drawing up of the workplace-conditions map; instrumental measurement of factor parameters; assessment of results with assignment of hazard classes 1-4 in accordance with Guidance R 2.2.2006-05, including subclasses 3.1-3.4; and development of practical

measures to prevent or localise identified factors), and substantiates the need for occupational-risk assessment methodologies that meet contemporary requirements of quantitative estimation of the actual level of risk at the individual workplace. Shayakhmetova, Bekmagambetov and Koval [8] provide a comprehensive analysis of the modern mechanisms of social guarantees and occupational safety for employees engaged in hazardous and arduous working conditions in Kazakhstan; they document the national transition from a list-based system to a risk-oriented regulation model implemented from 2024 onward, and report a formal reduction in the number of hazardous workplaces from approximately 1.6 million in 2022 to 445 thousand in 2024 as a consequence of this methodological transition - a datum whose substantive interpretation, on the basis of methodologically comparable 2025 indicators, is developed in the Results and Discussion section of the present study. Aktayeva, Bekmagambetov, Yedilbayeva et al. [9] develop and validate an integrated methodological approach for ranking occupations based on professional risk levels and sectoral economic activity characteristics, introducing a sectoral coefficient (kEDA) and a composite ranking index (IRI = R × kEDA) applied to 19 pilot enterprises with 24 434 employees; they demonstrate that highest and critical risk levels concentrate in mining, metallurgical and chemical industries. The present study is positioned in relation to [7-9] as a systematic long-term statistical diagnosis of the structural mismatch between the two accounting bases at the national level: it complements the workplace-level algorithm of [7], the institutional analysis of [8], and the enterprise-level ranking methodology of [9] by providing a longitudinal (2000-2025) diagnostic instrument at the aggregate national level.

Despite the accumulated body of research, the Kazakhstani literature has not to date offered a systematic long-term comparison of the two accounting bases under consideration - the numbers of recipients of social guarantees and the numbers of employees engaged in conditions that do not meet hygienic standards - for a comparable time interval and on a uniform set of official sources. The present study addresses this gap by conducting such a comparison for the period 2000-2023 (with limited use of 2024-2025 data on comparable indicators), while explicitly stating the methodological non-equivalence of the two populations and refraining from causal inferences that cannot be validated on aggregate series.

Materials and Methods. The empirical basis of the study consists of official statistical data of the Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan (hereinafter - BNS RK), retrieved in April 2026. Aggregate annual time series for 2000-2024 were obtained from the Taldau statistical database of the BNS RK (section «Labour and employment», subsection «Working conditions») [25] disaggregated data by type of social guarantee and by economic activity for the reference years 2021-2025 were extracted from the annual statistical bulletins «Working Conditions in the Republic of Kazakhstan» published by the BNS RK [26] data on injuries related to labour activity were obtained from the BNS bulletin form Т-20-06-Г. The statistical population comprises surveyed enterprises of selected economic sectors and excludes small entrepreneurial enterprises. The longitudinal analysis was performed for 2000-2023 as the principal analytical horizon, with an extension to 2024-2025 for those indicators whose methodological comparability with the earlier series has been verified. For enterprise expenditure, comparability across 2000-2025 was ensured by uniform application of the homogeneous BNS category «social guarantees», as distinguished from the broader category of «total occupational-safety expenditure.

The methodological framework of the study combines longitudinal, structural, and comparative-legal approaches. The structural mismatch between two accounting bases - list-based eligibility under the Labour Code and subordinate acts and the instrumental recording of workplaces failing sanitary and hygienic norms - is characterised by the ratio of the number of recipients of at least one guarantee to the number of employees actually engaged in conditions failing sanitary and hygienic standards (formula 1):

$$K(t) = \frac{R(t)}{N(t)} \tag{1}$$

where $K(t)$ is the structural mismatch ratio in year t; $R(t)$ is the number of employees who have been granted at least one type of benefit or compensation in year t; $N(t)$ is the number of employees actually engaged in conditions failing sanitary and hygienic standards in year t. The absolute difference between the two accounting bases is computed in accordance with formula (2):

$$D(t) = R(t) - N(t) \tag{2}$$

Enterprise expenditure per recipient is computed in accordance with formula (3):

$$\frac{E(t)}{R(t)} \tag{3}$$

where $E(t)$ denotes enterprise expenditure on social guarantees in year t (in nominal tenge). The compensatory-to-preventive expenditure ratio is computed in accordance with formula (4):

$$\frac{C}{P} = \frac{E_{leave} + E_{wage} + E_{milk}}{E_{reducedtime} + E_{therapeutic}} \quad (4)$$

where the numerator aggregates enterprise expenditure on additional annual paid leave, increased wage rates and milk or equivalent food products, and the denominator aggregates enterprise expenditure on reduced working time and therapeutic-preventive nutrition. The compound average annual growth rate of enterprise expenditure over the observation period is computed in accordance with formula (5):

$$\mathrm{CAGR} = \left(\frac{E(t_1)}{E(t_0)}\right)^{\frac{1}{n}} - 1 \quad (5)$$

The ratio $K(t)$ is treated exclusively as a descriptive indicator of the divergence between two accounting bases and is not interpreted as a direct measure of unjustified benefit receipt or of unprotected employment, since its numerator and denominator refer to methodologically non-equivalent populations. To assess the direction and strength of joint co-movement of the principal annual series over 2000-2023, pairwise Spearman rank correlation coefficients were computed for the twenty-four annual observations available in the Taldau statistical database (indicators КСП 251415, 251407 and 252202) for the complete period 2000-2023. The Spearman coefficient was selected over the Pearson coefficient in view of the non-normal distribution of the series and their non-stationary character. The coefficients are interpreted exclusively as descriptive indicators of monotonic co-movement between aggregate time series and are not treated as evidence of causal relationships, given (i) the moderate number of annual observations (n = 24), (ii) the methodological break in the underlying indicator on employees engaged in hazardous conditions after 2023, (iii) the non-stationary nature of all three series over the observation period, and (iv) the aggregate character of the data, which does not permit individual-level linkage between benefit recipients and the class of working conditions at the specific workplace. Formal inferential testing of causal hypotheses on aggregate series is not undertaken and is identified as a direction of further research on the basis of enterprise-level microdata. The comparative-legal component of the analysis draws on published scientific studies of models for the provision of social guarantees in selected EAEU and CIS countries [22-27] the reference to the Belarusian model is presented at the level of the general regulatory logic reported in the reviewed secondary literature.

The study is subject to the following methodological reservations. The available aggregate statistics do not enable individual-level linkage between the recipient of a specific guarantee and the class of working conditions at the specific workplace; the data cover only the formal sector of employment; all financial series are reported in nominal tenge without adjustment for the consumer price index or wage indexation; and the substantive conclusions concerning the ratio of compensatory to preventive expenditure are formulated in terms of relative shares within a single reference year and are therefore invariant to the choice of deflator.

Results and Discussion. An analysis of official data from the National Statistics Bureau of the Republic of Kazakhstan [25, 26] for the period 2000-2024 reveals a steady long-term trend of growth in the number of workers actually employed in conditions that do not meet health and safety standards. Over the period 2000-2023 (24 annual observations), this figure rose from 219 200 to 410 300 persons, representing an increase of 87.2%. Summary data on the trends of key indicators are presented in (Table 1).

The period under review may be divided into two qualitatively distinct phases. From 2000 to 2014, growth was virtually uninterrupted: the number of employees actually engaged in conditions failing hygienic standards increased by 78.5% (from 219.2 to 391.2 thousand persons), which is temporally associated with the rapid expansion of the mining and oil-and-gas sectors during a period of elevated global commodity prices. From 2015 to 2020, the indicator stabilised in the range of 367-373 thousand persons; a renewed increase was recorded thereafter, reaching 410.3 thousand persons in 2023. The specific weight of the individual factors underlying these phase transitions (commodity-price cycles, changes in enterprise composition, methodological adjustments) cannot be established from the aggregate series and requires a dedicated study.

The share of employees engaged in conditions that do not meet hygienic standards rose from 18.0% in 2000 to 24.2% in 2023 relative to the number of employees at surveyed enterprises. The dynamics were non-monotonic: local declines were recorded during periods of macroeconomic downturn (2009 and 2012-2013), which is temporally consistent with cyclical fluctuations in export-oriented industries.

Short-term reductions in individual years should be interpreted with caution: they reflect variations in

the composition of surveyed employment rather than a sustained improvement in the underlying working conditions.

The data reveal a persistent structural mismatch between two accounting bases. According to Taldau [25], throughout the entire period under analysis the number of employees receiving at least one benefit or compensation for work in hazardous conditions systematically exceeds the number of employees whose workplaces do not meet hygienic standards (Table 1). As explained in the Materials and Methods section, this excess is not, in itself, evidence of unjustified benefit receipt, since the two populations are constructed on different methodological bases; it does, however, evidence a structural mismatch between the list-based eligibility framework and the instrumental classification of working conditions.

Table 1 - Trends in key indicators of the social protection system for employees engaged in hazardous working conditions, Republic of Kazakhstan, 2000-2025 (surveyed enterprises)

Year	Employees in hazardous conditions, thousand persons	Recipients of at least one guarantee, thousand persons	Ratio (recipients / hazardous)	Enterprise expenditure on social guarantees, KZT bn
2000	219.2	378.2	1.73	7.9
2001	244.4	443.8	1.82	9.6
2002	247.9	461.6	1.86	11.3
2003	254.9	490.4	1.92	12.5
2004	263.8	497.8	1.89	14.6
2005	284.8	522.0	1.83	17.7
2006	314.2	547.5	1.74	25.5
2007	314.2	578.8	1.84	33.1
2008	329.4	603.5	1.83	38.0
2009	324.9	580.7	1.79	40.5
2010	323.2	609.8	1.89	52.1
2011	346.6	632.3	1.82	63.8
2012	368.8	665.8	1.81	78.4
2013	376.4	696.2	1.85	85.7
2014	391.2	704.2	1.80	95.7
2015	367.8	675.6	1.84	103.6
2016	368.8	670.4	1.82	99.7
2017	370.1	672.9	1.82	107.8
2018	373.1	676.1	1.81	116.4
2019	370.3	676.2	1.83	128.5
2020	366.9	672.3	1.83	141.5
2021	375.0	681.9	1.82	167.9
2022	386.3	680.2	1.76	207.6
2023	410.3	697.3	1.70	255.2
2024	n/a	679.1	n/a	297.4
2025	396.5	682.0	1.72	341.9

Note: «n/a» - the 2024 value of the employees-engaged-in-hazardous-conditions indicator has not been published; the 2024 expenditure figure refers to the narrow «social guarantees» component (Table 5, column 3 of the BNS bulletin, form Т-14-10-Г; equivalent to the sub-line «предоставление социальных гарантий» of

Taldau KCII 252202); the same category is applied throughout the series for methodological consistency. Ratio is computed as the number of recipients of at least one guarantee divided by the number of employees actually engaged in hazardous working conditions and observed to range from 1.70 (2023) to 1.92 (2003) over 2000-2023, with the value of 1.72 in 2025. Source: Bureau of National Statistics of the Republic of Kazakhstan; Taldau statistical database (KCII 251415, 251407, 252202); BNS bulletin form T-14-10-Г for reference years 2024-2025.

In 2000, the ratio was 1.73 (378.3 thousand recipients of guarantees against 219.2 thousand employees engaged in conditions failing hygienic standards); by 2010, it had risen to 1.89. Across the annual observations of Table 1 for 2000-2023, the ratio ranged from 1.70 (2023) to 1.92 (2003). In 2020-2021 the ratio stood at 1.82-1.83, and by 2023 it declined to 1.70, driven predominantly by the increase in the denominator (employment in conditions failing hygienic standards) rather than by a reduction in the numerator. In 2023, the absolute difference between 697.3 thousand recipients and 410.3 thousand employees engaged in conditions failing hygienic standards amounted to 287.0 thousand persons.

The persistence of the ratio at values not lower than 1.70 across the entire observation period, without a discernible sustained downward trend, indicates that the observed mismatch is neither a statistical artefact nor a transient effect but a structural property of the coexistence of two accounting bases. Its principal underlying mechanism is the assignment of the majority of guarantees on a list basis (by profession or by category of work), independently of the results of instrumental measurement at the individual workplace. On the basis of aggregate statistical series alone, it is not possible to identify either the share of recipients whose workplace does not meet the criteria of instrumental hazard confirmation, or the share of employees engaged in hazardous but non-listed jobs who do not receive guarantees; individually linked worker- and workplace-level data are required for such estimation, and the corresponding directions are indicated among the promising areas of further research.

An analysis of the proportion of workers employed in hazardous working conditions by economic activity in 2021-2023 reveals a high degree of sectoral concentration of occupational risks (Table 2).

Table 2 - Share of employees engaged in conditions that do not meet hygienic standards, by economic sector, % of employees at surveyed enterprises, 2021-2023

Type of economic activity	2021	2022	2023	Δ 2021→2023, percentage points
Total (surveyed enterprises)	22,8	23,1	24,2	+1,4
Industry	39,3	40,5	41,0	+1,7
Mining and quarrying	49,5	51,0	53,0	+3,5
including coal mining	75,2	75,6	75,6	0,0
extraction of crude petroleum and natural gas	44,7	47,0	45,3	+0,6
Mining of metal ores	48,5	49,3	53,3	+4,8
Manufacturing	35,6	36,4	36,3	+0,7
Construction	20,8	21,3	22,1	+1,3
Transportation and storage	18,4	19,1	20,3	+1,9
Agriculture	5,2	5,3	6,7	+1,5

Note: Compiled using data from the National Statistics Bureau of the Republic of Kazakhstan [26].

The coal industry demonstrates the highest values of the indicator: the share of employees engaged in conditions that do not meet hygienic standards remained in the range 75.2%-75.6% throughout the period under review. This is consistent with the objective characteristics of underground mining operations (elevated dust load, exposure to gases, physical exertion, vibration), which cannot be fully compensated by engineering measures within the currently deployed technologies at the Karaganda

and Ekibastuz mining basins. The stabilisation of the indicator at this level suggests that within the existing technological configuration further reduction is constrained, and it justifies the elaboration of sector-specific regulatory requirements and correspondingly differentiated insurance instruments.

Metal-ore mining demonstrates the most pronounced upward trend: the indicator rose from 48.5% in 2021 to 53.3% in 2023, an increase of 4.8 percentage points, coinciding with production expansion at the Zhairem, Zhezkazgan and Sokolovsk-Sarbay deposits. Extrapolation of a three-point trend does not permit a formal forecast; nevertheless, the observed direction of change indicates the need for enhanced regulatory attention to this sector, taking into account the latency period of occupational diseases characteristic of it (in particular, pneumoconioses and disorders of the auditory and nervous systems).

In the extraction of crude petroleum and natural gas, the indicator stabilised at approximately 45%, which may reflect the implementation of preventive measures at enterprises of this sub-sector; nevertheless, this value is approximately twice the average across surveyed enterprises (24.2%). In manufacturing, the aggregate value of 36.3% conceals substantial intra-sectoral heterogeneity: the highest values are recorded in metallurgy, oil refining, and chemical production, where the diversity of technologies and combinations of harmful factors makes a list-based regulatory approach insufficient.

In 2025, the total number of employees receiving at least one form of social guarantee constituted 681 968 persons. The distribution of these recipients by type of guarantee reveals a substantial structural imbalance in the composition of protective measures (Table 3).

Table 3 - Structure of social guarantees for employees engaged in hazardous working conditions, Republic of Kazakhstan, 2025

Type of social guarantee	Number of recipients, persons	Share of total recipients, %
Total recipients (at least one guarantee)	681 968	100.0
Additional annual paid leave	559 145	82.0
Increased wage rate	338 237	49.6
Milk or equivalent food products	325 429	47.7
Therapeutic and preventive nutrition	96 990	14.2
Reduced working hours	47 501	7.0
Eligibility for state special allowance	9 831	1.4

Note: Shares refer to the proportion of each type of guarantee within the total number of recipients of at least one guarantee (681 968 persons in 2025). Categories partially overlap, since one employee may simultaneously receive several types of guarantees; the column therefore does not constitute a coverage rate relative to the population of employees engaged in conditions failing hygienic standards. Compiled from data of the Bureau of National Statistics of the Republic of Kazakhstan (BNS bulletin, form T-14-10-Г, 2025) [25; 26].

The predominant form of social protection is additional annual paid leave: 559 145 recipients (82.0% of all recipients of at least one guarantee). It should be noted that the categories of guarantees presented in Table 3 partially overlap, since one employee may simultaneously receive several types of guarantees; the shares reported in Table 3 therefore refer to the share of each guarantee within the total number of recipients of at least one guarantee and are not a coverage indicator relative to the population of employees engaged in conditions failing hygienic standards. A coverage rate in the latter sense would require individually linked worker- and workplace-level data, which lie beyond the coverage of aggregate statistics. The high relative prevalence of additional leave is consistent with the list-based mechanism of its assignment: entitlement to additional leave is determined, inter alia, by occupation and by the results of workplace attestation (Article 89 of the Labour Code). Increased wage rates are received by 338 237 employees (49.6% of recipients); the number of recipients of this benefit rose from 191.7 thousand in 2000 to 419.4 thousand in 2023 and declined to 333.5 thousand in 2024, which is likely attributable to a change in the accounting methodology rather than to an improvement in actual working conditions.

The prevalence of measures whose preventive potential is documented in the occupational-health literature is markedly lower: reduced working hours are

received by 47 501 employees (7.0% of recipients), and eligibility for the special state social payment is confirmed for 9 831 employees (1.4% of recipients). It is precisely the reduction of working hours that directly limits the aggregate exposure of the employee to harmful factors of the working environment, whereas therapeutic and preventive nutrition (14.2% of recipients) performs an ancillary function of physiological support. The observed structure - under which the most prevalent forms of guarantees have limited preventive effect, while the guarantees with documented preventive potential remain marginal - is consistent with the general logic of the list-based model of guarantees assignment, in which the entitlement is determined by the belonging of the workplace to an established list, rather than by the actual level of exposure at the specific workplace.

Enterprise expenditure on social guarantees for employees engaged in hazardous working conditions demonstrates sustained growth in nominal terms (Table 4). A methodological clarification is required at this point. Over 2000-2023, the BNS statistical series on enterprise expenditure on benefits and compensations for work in hazardous conditions (Taldau КСП 252202, «Всего») reports the aggregate expenditure on the five traditional categories of social guarantees only additional leave, reduced working time, therapeutic-preventive nutrition, milk or equivalent food products, and increased wage rates. From the 2024 reference year the classification of the same series was extended to include expenditure on wider occupational-safety items (individual and collective protective equipment, training, sanitary-hygienic facilities, integral occupational-risk assessment, and periodic medical examinations), and the narrow «social guarantees» component was introduced as a separate line. For the 2024 reference year the BNS release reports total enterprise expenditure on occupational safety in the amount of KZT 434 541.2 million, of which KZT 297 422.3 million was directed specifically to social guarantees. The 2025 release confirms the corresponding figures at KZT 518 011.5 million (total occupational-safety expenditure) and KZT 341 916.4 million (social guarantees). All calculations for 2024-2025 reported below are based on the narrow «social guarantees» component only, thereby preserving methodological continuity with the 2000-2023 series. On this basis, enterprise expenditure on social guarantees rose from KZT 7.9 bn in 2000 to KZT 297.4 bn in 2024 and further to KZT 341.9 bn in 2025. The corresponding nominal magnitude over 2000-2025 (an approximately 43-fold increase; compound average annual growth rate of 16.3%) is reported in current prices and therefore reflects, in a substantial part, the operation of consumer-price and wage inflation over the twenty-five-year interval; a real-terms decomposition would require the application of a separate deflator and is not undertaken within the coverage of the aggregate statistics used here.

Table 4 - Enterprise expenditure on social guarantees, Republic of Kazakhstan, 2020-2025

Indicator	2020	2021	2022	2023	2024	2025
Expenditures, billion tenge	141,5	167,9	207,6	255,2	297,4	341,9
Year-on-year growth, %	-	+18,6	+23,7	+22,9	+16,5	+15,0
Expenditures per recipient, thousand tenge	210,5	246,2	305,3	366,0	437,9	501,4
Growth in expenditures per recipient compared to 2020, %	-	+16,9	+44,9	+73,8	+108,0	+138,2

Note: Compiled using data from the National Statistics Bureau of the Republic of Kazakhstan [25; 26].

Expenditure on social guarantees increased throughout 2020-2025, with the annual growth rate peaking in 2022 and subsequently decelerating. In 2021, expenditure increased by 18.6%; year-on-year growth reached 23.7% in 2022 and 22.9% in 2023. On the corrected «social guarantees» category, the 2024 year-on-year increase amounted to 16.5% (from KZT 255.2 bn to KZT 297.4 bn), and in 2025 the increase was 15.0% (from KZT 297.4 bn to KZT 341.9 bn), rather than the +70.3% originally reported for 2024 on the basis of misclassified data. Expenditure per recipient rose from KZT 210.5 thousand in 2020 to KZT 437.9 thousand in 2024 (a factor of 2.08 over four years) and further to KZT 501.4 thousand in 2025 (calculated as KZT 341 916.4 million ÷ 681 968 recipients). This dynamic reflects, to a substantial extent, the automatic indexation of guarantees linked to average wages, rather

than an expansion of the population of recipients or an improvement in the quality of social protection.

Over 2020-2025, expenditure on social guarantees increased approximately 2.4-fold (from KZT 141.5 bn to KZT 341.9 bn) while the number of recipients remained within the narrow range of 672-697 thousand persons in 2020-2023 and constituted 681 968 in 2025. The disproportion between the growth in monetary expenditure and the substantial stability of the number of recipients is consistent with the hypothesis that the increment reflects wage indexation rather than an expansion of the actual scope of protection; a formal quantitative test of this hypothesis is possible only on the basis of an individual-level dataset that links compensation payments to the wage base, which lies beyond the coverage of the available aggregate statistics.

Pairwise Spearman rank correlations, computed over the twenty-four annual observations of the Taldau series for 2000-2023 (n = 24), provide additional descriptive evidence consistent with the qualitative interpretation of the observed dynamics (Table 5). The very strong monotonic co-movement between the number of recipients and the number of employees engaged in conditions failing hygienic standards ($\rho = 0.983$, $p < 0.001$) is consistent with the interpretation of the ratio K(t) as a structurally stable characteristic of the coexistence of the two accounting bases rather than a transient effect. The correspondingly strong monotonic co-movement of nominal enterprise expenditure with both the number of employees engaged in hazardous conditions ($\rho = 0.907$, $p < 0.001$) and the number of benefit recipients ($\rho = 0.911$, $p < 0.001$) is expected on a nominal series reported in current prices over a period of sustained wage indexation: the disproportionate growth of nominal enterprise expenditure over the sample period reflects predominantly the indexation of guarantees linked to the wage base rather than an expansion of the population of recipients or a qualitative change in the composition of protective measures. These coefficients are treated as descriptive indicators of directional co-movement between aggregate series and do not, in themselves, permit causal inferences; the methodological reservations articulated in the Materials and Methods section apply.

Table 5 - Pairwise Spearman rank correlations between principal indicators of the social guarantees system, Republic of Kazakhstan, 2000-2023 (n = 24)

Pair of variables	ρ (Spearman)	p-value	Direction of co-movement
R(t) - Number of benefit recipients ↔ N(t) - Number of employees in conditions failing hygienic standards	**0.983**	< 0.001	Very strong positive
N(t) - Number of employees in conditions failing hygienic standards ↔ E(t) - Enterprise expenditure on social guarantees	**0.907**	< 0.001	Very strong positive
R(t) - Number of benefit recipients ↔ E(t) - Enterprise expenditure on social guarantees	**0.911**	< 0.001	Very strong positive

Note: Spearman rank correlations computed on the twenty-four annual observations available in the Taldau database for the complete period 2000-2023 (indicators KCII 251415, 251407, 252202). The coefficients are interpreted as descriptive indicators of monotonic co-movement between aggregate time series; formal inferential testing of causal relationships on aggregate series is not undertaken. Compiled and calculated based on data from the National Statistics Bureau of the Republic of Kazakhstan [25; 26].

The identified body of empirical evidence permits characterisation of the current system of social guarantees in the field of occupational safety and health in the Republic of Kazakhstan as exhibiting a persistent structural divergence between two accounting frameworks that is consistent with differences in the principles of eligibility and workplace classification of guarantee assignment. Under this mechanism, entitlement to benefits and compensation is determined not by the actual conditions at the specific workplace, but by the inclusion of the occupation or position in an established list of hazardous and (or) arduous work. This regulatory logic reproduces the normative approach inherited from the Soviet period and generates a systematic divergence between the formally recognised class of working conditions and the level of exposure established by instrumental measurement.

Over the 24 annual observations of the 23-year period (2000-2023), the ratio of the number of guarantee recipients to the number of employees engaged in

conditions failing hygienic standards remained in the range 1.70-1.92. On the basis of Table 1 of the BNS statistical bulletin for 2025 (form Т-14-10-Г) [26], the ratio in 2025 equals 1.72 (681 968 recipients against 396 507 employees actually engaged in hazardous working conditions, as reported in column 5 of the cited table). This value falls within the range recorded over 2000-2023 (1.70-1.92) and does not, on the basis of a single reference year, permit any conclusion about a methodological break relative to the earlier period. The number of employees engaged in conditions failing hygienic standards moved from 410.3 thousand in 2023 to 396.5 thousand in 2025 (a decrease of 3.4%), while the number of recipients moved from 697.3 thousand to 682.0 thousand over the same interval. The interpretation of these movements as evidence of a convergence between the list-based eligibility framework and the instrumental classification of working conditions is not warranted on the basis of aggregate data for a single new reference year and is identified as a subject of continued monitoring on methodologically comparable annual data. As noted above, the ratio itself remains a descriptive indicator of the mismatch between two accounting bases and does not, in itself, permit conclusions either about the share of recipients whose workplace is not confirmed instrumentally as hazardous, or about the share of employees engaged in hazardous but non-listed workplaces who lack coverage. Both categories of concern require validation on individually linked worker- and workplace-level data, the collection of which is identified as a priority direction of further research.

For comparative reference, Novikova and Logacheva [18] report a ratio of 1.14 for Ukrainian industrial enterprises, which they interpret as evidence of a structural dysfunction of the list-based model. In the case of Kazakhstan, the ratio calculated on aggregate national statistics stably exceeds 1.70. Direct cross-country comparison of these two magnitudes is constrained by differences in the sectoral composition of employment, in the coverage of statistical observation, and in the specific legal grounds on which guarantees are assigned; nevertheless, the substantial gap between the two ratios warrants further comparative investigation.

Enterprise expenditure on social guarantees rose from KZT 7.9 bn in 2000 to KZT 297.4 bn in 2024 (in the homogeneous «social guarantees» category, after the correction described in the Results section), while the number of recipients remained within a narrow range in the second half of the period. Roik [19; 20; 21] documents that, in compensation-oriented models, an increase in the volume of benefit payments does not, in itself, produce a reduction in occupational morbidity, since resources are channelled towards compensating for consequences rather than towards eliminating causes. The empirical dynamics observed in Kazakhstan are consistent with this diagnosis, although a formal test would require decomposition of expenditure into compensatory and preventive components at the enterprise level.

Nominal expenditure per recipient rose from approximately KZT 20.9 thousand in 2000 to approximately KZT 437.9 thousand in 2024 and KZT 501.4 thousand in 2025, reflecting predominantly the indexation of guarantees linked to the wage base rather than a qualitative expansion of the composition of protective measures. A component-level decomposition of enterprise expenditure on social guarantees for 2024, based on the primary data of Table 9 of the BNS bulletin «Working Conditions in the Republic of Kazakhstan, 2024» [26], permits a direct quantitative comparison of the two functional categories of guarantees. Compensatory measures - additional annual paid leave (KZT 102.7 bn), increased wage rates (KZT 95.9 bn) and the provision of milk or equivalent food products (KZT 13.4 bn) - jointly account for KZT 212.0 bn, or 71.3% of enterprise expenditure on social guarantees. Preventive measures with the greatest documented capacity to reduce cumulative exposure to harmful factors - reduced working time (KZT 30.9 bn) and therapeutic-preventive nutrition (KZT 38.7 bn) - jointly account for KZT 69.6 bn, or 23.4% of the total. The remaining 5.3% (KZT 15.8 bn) is attributable to other guarantees not separately identified in Table 9. On this basis, the ratio of compensatory to preventive expenditure amounts to approximately 3.04 to 1 for 2024. The «compensatory» and «preventive» categories are used here as the authors' functional classification, based on the direction of impact on the working environment; they do not eliminate the underlying hazard source and cannot be equated with a reduction in exposure at the source. The corresponding decomposition for 2025 (Table 5 of the 2025 BNS bulletin, form Т-14-10-Г) confirms the direction of the imbalance: compensatory measures amount to KZT 235.8 bn (additional leave 115.5 + increased wage rates 105.3 + milk and equivalents 14.9), preventive measures amount to KZT 75.2 bn (reduced working time 32.3 + therapeutic-preventive nutrition 42.9), yielding a compensatory-to-preventive ratio of approximately 3.14 to 1 - a slight deepening relative to 2024. The remaining approximately KZT 31.0 bn (9.1% of the 2025 total) is attributable to other categories of enterprise expenditure on social

guarantees not separately identified in Table 5 of the 2025 BNS bulletin; the increase in this residual share relative to 2024 (5.3%) reflects the ongoing methodological reclassification of the underlying series. Both ratios are calculated at the level of aggregate enterprise expenditure by category of guarantee; the methodological reservation is that «compensatory» and «preventive» categories are defined here in accordance with the functional criterion of impact on the level of exposure at the workplace, not by the categorisation of the BNS report itself, and that further decomposition at the workplace-class level requires enterprise-level microdata.

The indicator of the share of employees engaged in conditions failing hygienic standards exhibits a wide inter-sectoral dispersion: from 5.2% in agriculture to 75.6% in the coal industry, i.e. a 14.5-fold difference between the extreme sectoral values. This heterogeneity indicates the limited applicability of a single regulatory template to sectors that differ so substantially in the nature and intensity of exposure.

In the coal industry, the stabilisation of the indicator at 75.2%-75.6% is consistent with the interpretation that under the existing technological configuration and mining-geological conditions of the Karaganda and Ekibastuz basins, further material reduction of the share of employees engaged in conditions failing hygienic standards is constrained without deeper technological modernisation. Application of the same regulatory template to such enterprises as to organisations of the service sector produces a systematic underestimation of protection requirements. The observed increase in the corresponding indicator in metal-ore mining (from 48.5% in 2021 to 53.3% in 2023, i.e. +4.8 percentage points) warrants separate regulatory attention. The available aggregate data do not permit identification of the factors underlying this pattern (technological configuration, changes in the reporting perimeter of enterprises, methodological revisions to the classification of workplaces, or the operation of preventive measures), which must be assessed on the basis of enterprise-level microdata.

The regional distribution of enterprise expenditure on social guarantees for work in hazardous conditions in 2025 is presented in Table 6, computed from Table 6 of the BNS statistical bulletin (form Т-14-10-Г). Six regions jointly account for KZT 192.2 bn, or 56.2% of the national total of KZT 341.9 bn.

Table 6 - Regional concentration of enterprise expenditure on social guarantees for work in hazardous conditions, Republic of Kazakhstan, 2025

Region	Enterprise expenditure on social guarantees, KZT bn	Share of national total, %
Mangistau	37.6	11.0
Karaganda	35.0	10.2
Pavlodar	33.4	9.8
Aktobe	32.9	9.6
East Kazakhstan	30.9	9.0
Turkestan	22.4	6.6
Top-6 total	**192.2**	**56.2**
Other regions	149.7	43.8
Kazakhstan, total	**341.9**	**100.0**

Note: Compiled from Table 6 of the BNS statistical bulletin «Numbers of employees engaged in hazardous and other unfavourable working conditions in the Republic of Kazakhstan, 2025» (form Т-14-10-Г). Regions are ranked by absolute expenditure on social guarantees in descending order; the top six regions accounting for the largest cumulative share are reported. Shares are computed as percentage of the national total (KZT 341.9 bn).

This regional concentration is consistent with the sectoral profile of the corresponding regions - mining and quarrying, metallurgy, oil-and-gas processing, and heavy manufacturing - which host the majority of workplaces classified as hazardous under both the list-based and the instrumental criteria. The concentration of enterprise expenditure in the six listed regions substantiates the analytical relevance of a sector- and region-specific regulatory perspective, developed further in the recommendations section of this study.

The interpretation of the observed dynamics of enterprise expenditure on social guarantees may be

complemented by parallel evidence on occupational injury and morbidity. According to the BNS statistical bulletin on injuries related to labour activity («Численность пострадавших при несчастных случаях, связанных с трудовой деятельностью», BNS Т-20-06-Г), the total number of employees who suffered injuries with loss of working capacity of one day or more amounted to 2 328 persons for the reference period, of whom 408 persons (17.5%) were registered in connection with occupational diseases. The regional distribution of injuries concentrates in the same regions that dominate enterprise expenditure on social guarantees (Karaganda, Aktobe, East Kazakhstan, Pavlodar and the Mangistau-Atyrau oil-and-gas basin), which supports the sectoral hypothesis about the mining, metallurgical and oil-and-gas industries as the principal loci of occupational risk. A formal quantitative test of the association between compensatory expenditure, preventive expenditure and occupational-morbidity outcomes at the enterprise level lies beyond the coverage of the aggregate statistics used in this study and is identified as a priority direction of further research on the basis of primary microdata (individually linked worker-, workplace-, and outcome-level records from the Ministry of Health of the Republic of Kazakhstan and the corresponding BNS bulletins). Taken together, the identified findings - the structural mismatch between the two accounting bases, the predominance of compensatory forms over preventive ones, the pronounced inter-sectoral heterogeneity of risks against a uniform regulatory template, and the disproportionate growth of nominal expenditure without a commensurate expansion of coverage - support a systemic argument in favour of transition to a risk-based model of assigning social guarantees. The underlying regulatory principle is articulated at the level of the EU Framework Directive 89/391/EEC [27] with respect to the assessment and prevention of occupational risks, and it has been operationalised in the Russian Federation in the framework of the Special Assessment of Working Conditions (SAWC) [22] Directive 89/391/EEC itself does not, however, prescribe that entitlement to social guarantees must arise exclusively from instrumental workplace measurement, and the present study therefore refers to the general logic of risk-based regulation rather than to a strict legal transfer.

For Kazakhstan, the transition to such a model entails three interrelated shifts. The first is a shift from a list-based approach to a measurement-based one: the allocation of benefits based on the results of a special assessment of working conditions, depending on the degree of occupational risk at a specific workplace. The second is a shift from a uniform scale of guarantees to a differentiated one: the scope and composition of protective measures must correspond to the established class of working conditions, rather than the employee's formal position. The third is a shift from a compensatory approach to a preventive one: the introduction of differentiated insurance rates based on the degree of occupational risk creates a direct economic incentive for employers to invest in improving the work environment. It is precisely the combination of these three elements that ensures the systemic nature of the reform, rather than simply replacing one list with another.

Conclusion. As part of the conducted research, the following results were obtained:

1. Between 2000 and 2023, the number of employees actually engaged in conditions that do not meet hygienic standards rose from 219.2 thousand to 410.3 thousand (an increase of 87.2%), and their share of employees at surveyed enterprises increased from 18.0% to 24.2%. The 2025 BNS release records the corresponding number of employees actually engaged in hazardous working conditions at 396.5 thousand persons (Table 1, column 5, form Т-14-10-Г), a decrease of 3.4% relative to 2023. The dynamics of employment in extractive industries has historically constrained the pace of improvement of working conditions during the period under review.

2. Across 24 annual observations of the 23-year period (2000-2023), the number of employees receiving at least one benefit or compensation for work in hazardous conditions systematically exceeded the number of employees engaged in conditions that do not meet hygienic standards; the ratio remained in the range 1.70-1.92 in the observed years, and in 2023 the absolute difference amounted to 287.0 thousand persons. According to Table 1 of the BNS statistical bulletin for 2025 (form Т-14-10-Г) [26], the ratio in 2025 equals 1.72 (681 968 recipients against 396 507 employees actually engaged in hazardous working conditions, column 5 of the cited table), remaining within the 2000-2023 range of 1.70-1.92. On the basis of a single new reference year, no conclusion about a convergence between the list-based eligibility framework and the instrumental classification of working conditions is warranted; continued monitoring on methodologically comparable annual data is required. The ratio is interpreted as a descriptive indicator of the structural mismatch between the two accounting bases and does not, in itself, permit conclusions about the share of recipients whose entitlement is not confirmed instrumentally, or about the share of employees engaged in hazardous but non-listed

jobs who lack coverage, since such statements require individually linked worker- and workplace-level data. This structural stability is additionally supported by the very strong monotonic co-movement between the two series over 2000-2023 (Spearman $\rho = 0.983$, $p < 0.001$).

3. The highest values of the share of employees engaged in conditions failing hygienic standards are recorded in coal mining (75.2%-75.6%), metal-ore mining (48.5%-53.3%, with an upward trend over 2021-2023) and mining and quarrying as a whole (49.5%-53.0%). In such sectors the application of a uniform regulatory template is insufficient, given the objective nature and intensity of exposure.

4. Enterprise expenditure on social guarantees rose from KZT 7.9 billion in 2000 to KZT 297.4 billion in 2024 and KZT 341.9 billion in 2025 (in the homogeneous «social guarantees» category as reported by BNS, distinct from total occupational-safety expenditure). Over 2020-2025, expenditure grew approximately 2.4-fold, while the number of recipients remained substantially stable within the range of 672-697 thousand persons in 2020-2023 and constituted 682 thousand in 2025. A component-level decomposition of the 2024 data documents a functional imbalance of enterprise expenditure on social guarantees: compensatory forms (additional annual paid leave, increased wage rates, milk and equivalent food products) jointly account for 71.3% of enterprise expenditure, while preventive forms with the highest documented capacity to reduce exposure to harmful factors (reduced working time and therapeutic-preventive nutrition) account for 23.4%. The resulting compensatory-to-preventive ratio of approximately 3.04 to 1 for 2024 and 3.14 to 1 for 2025 confirms, on the basis of primary statistical data, the empirical predominance of the compensatory function of the current model over its preventive function, together with a slight further deepening of this imbalance in the most recent reporting year. The strong Spearman rank correlations between enterprise expenditure and both the number of employees engaged in hazardous conditions ($\rho = 0.907$) and the number of benefit recipients ($\rho = 0.911$) support the interpretation that the growth of nominal expenditure over the period reflects predominantly wage-linked indexation rather than an expansion of protection coverage.

5. The structure of the guarantees provided is unbalanced with respect to the preventive potential of individual instruments: additional annual paid leave is the most prevalent form (82.0% of recipients of at least one guarantee), while the forms with the highest documented preventive value - reduced working time (7.0%) and the special state social payment (1.4%) - remain marginal in their coverage. This structure is consistent with the general logic of the list-based model, in which the entitlement is determined by inclusion in the corresponding list rather than by the class of working conditions established instrumentally.

6. The regional distribution of enterprise expenditure on social guarantees, computed from Table 6 of the 2025 BNS bulletin (form Т-14-10-Г), is concentrated in six regions that jointly account for 56.2% of the national total of KZT 341.9 bn: Mangistau (KZT 37.6 bn, 11.0%), Karaganda (KZT 35.0 bn, 10.2%), Pavlodar (KZT 33.4 bn, 9.8%), Aktobe (KZT 32.9 bn, 9.6%), East Kazakhstan (KZT 30.9 bn, 9.0%) and Turkestan (KZT 22.4 bn, 6.6%). This concentration is consistent with the sectoral profile of the corresponding regions (mining and quarrying, metallurgy, oil-and-gas processing, and heavy manufacturing) and confirms the substantive relevance of sector-specific regulatory instruments substantiated in this study. Regional and factor-specific analysis at the individual-workplace level is identified as a promising direction of further research on the basis of Tables 2 and 8 of the BNS annual bulletins, together with the labour-injury and occupational-morbidity statistics of the BNS bulletin «Т-20-06-Г».

Recommendations. Based on the findings of this study, the following recommendation is proposed:

1. Develop and legislatively consolidate a system of special assessment of working conditions providing for mandatory instrumental classification of each workplace by the degree of occupational risk. The transition from a list-based to a measurement-based basis for assigning social guarantees is a necessary structural condition for the resolution of the mismatch documented in this study.

2. Introduce, within the framework of the compulsory social insurance system, insurance tariffs differentiated by the degree of occupational risk, with the possibility of reduced tariffs for employers who improve working conditions. Such a design generates a direct economic incentive for the employer to invest in the improvement of the working environment.

3. Develop and adopt sector-specific standards for working conditions in the coal, mining and oil-and-gas sectors, with enhanced requirements for collective protection measures, taking into account the specific mining-geological conditions and the accumulated evidence on occupational morbidity.

4. Revise the structure of social guarantees in favour of instruments with the highest documented preventive value: raise the statutory minimum reduction of working

time for high-hazard categories of employees; broaden the coverage of periodic medical examinations; and introduce job-rotation schemes.

5. Establish mandatory public disclosure of the results of the assessment of working conditions by means of a public registry of enterprises containing the outcomes of the corresponding measurements, together with a mechanism of independent audit of accredited measurement laboratories.

6. Introduce mandatory monitoring and public reporting of occupational-morbidity indicators disaggregated by classes of working conditions, in order to establish an evidence base for regulatory decision-making.

Algorithm for the phased implementation of the risk-oriented model. The transition to the risk-oriented model of assigning social guarantees is proposed to be implemented in six sequential stages with an explicit distribution of responsibilities among the actors involved.

Stage 1 - Regulatory foundation. State: development and adoption of a national standard for the special assessment of working conditions (SAWC), technical requirements for measurement, and rules for the classification of workplaces by class of working conditions.

Stage 2 - Instrumental assessment. State: accreditation of measurement laboratories and adoption of methodologies for instrumental measurement. Employer: engagement of accredited laboratories and organisation of measurements at each workplace. Employee (through elected representatives): participation in the assessment procedure with a right to comment on the results.

Stage 3 - Classification of workplaces. State: approval of the classes of working conditions and the criteria of their assignment. Employer: assignment of the class of working conditions to each workplace on the basis of the SAWC results, with mandatory registration in a unified information system.

Stage 4 - Assignment of guarantees. State: legislative introduction of a scale of guarantees differentiated by class of working conditions. Employer: provision of the corresponding guarantees on the basis of the assigned class. Employee: exercise of the entitlement to the guarantees corresponding to the class of the workplace.

Stage 5 - Financial mechanism. State: introduction of insurance tariffs differentiated by the degree of occupational risk, with a mechanism of tariff reduction for enterprises that improve working conditions. Employer: payment of insurance contributions in accordance with the class of the workplace and investment in the improvement of the working environment as an economically incentivised alternative.

Stage 6 - Monitoring and public control. State: maintenance of a public registry of enterprises with SAWC results and independent audit of accredited laboratories. Employer: disclosure of the SAWC results at the level of the enterprise. Employee and civil society: public control on the basis of published information.

The practical significance of the study lies in the possibility of directly applying its results in the development of the regulatory framework for reforming the working conditions assessment system, the National Action Plan on Occupational Safety and Health, and the system of indicators for state monitoring. The proposed structural ratio coefficient of the number of benefit recipients to those actually employed in hazardous conditions can be used as a regular diagnostic tool for assessing the integrity of the social security system.

Promising areas for further research include: developing a model of the relationship between the level of occupational morbidity and the class of working conditions at the level of individual enterprises; a quantitative assessment of the long-term fiscal obligations of the compulsory social insurance system resulting from occupational risks in extractive industries; and a comparative analysis of the effectiveness of financial incentives for employers to improve working conditions.

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