# HEALTH RISK MANAGEMENT

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## HEALTH RISK MANAGEMENT FOR POPULATION IN ORDER TO SECURE SANITATION AND EPIDEMIOLOGIC WELL-BEING OF THE POPULATION OF MUNICIPAL ENTITIES (EXPERIENCE OF SVERDLOVSK REGION)

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*In Sverdlovsk region there is a system of measures on risk-management for the population health from influence of social-economic, sanitation-hygienic risk factors which is being implemented. Within the system of social-hygienic monitoring there is a program-goal-oriented planning, elaboration of standard unified goals and tasks for the management subjects on securing sanitation-epidemiologic well-being and risk management for the population health. There is also shown economic and social efficiency from implementing the measures and there are elaborated scientifically justified suggestions for further development of regional SHM (sanitation-hygienic monitoring) system.*

***Key words:*** *social-hygienic monitoring, population health risk assessment and management, economic efficiency, sanitation-epidemiologic well-being of the population.*

Population health risk management, being an integral part of risk analysis, is a multilevel system embracing various management subjects (regional, municipal management, business units, state supervision authorities and municipal control, population), methods of risk management (prevention, reduction, compensation and risk transfer) and risk management objects (risk factors, territories, supervision objects, population categories). This is the system the functioning of which is aimed at achieving the unified goal of securing sanitation-epidemiologic well-being of population [1,2].

Technologies and methods of population health risk management conditioned by adverse influence of social-economic, sanitation-hygienic and behavioral factors and realized


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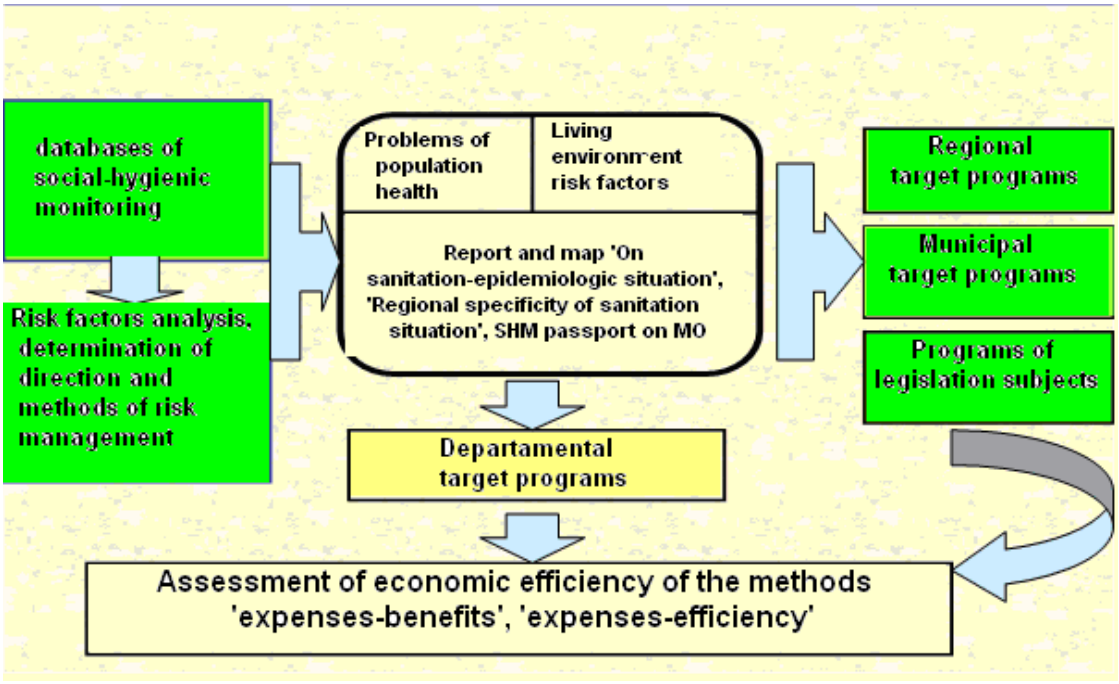
on the basis of risk theory and system approach are one of the most effective and useful methodologies in the sphere of securing sanitation-epidemiologic well-being of the population at all the levels of management subjects [3].

In Sverdlovsk region the basis for information-analytic implementation of assessment methodology, management and informing about population health risks is a system of social-hygienic monitoring which was created in 1991 and had been developed in the following decades [4]. The general scheme of information support on decision-making in the sphere of risk-management for the population health is depicted in picture 1.




Pic. 1. Information system supporting decision-making on risk management for the population of Sverdlovsk region

Development of integrated multi-level system of risk management for population health is based on the unity of goals and tasks (activity assessment indicators) of securing sanitation-epidemiologic well-being and protection of population health for all the risk management units and implementation of the module principle in the framework of which there are various information-analytic measures and technologies used (pic. 2).

Levels of applying risk management modules in Sverdlovsk region

| Risk management subject | Management module | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| Russian Federation subject | * | * | | | |
| Municipal entity | | * | * | * | |
| Business unit | | | * | * | |
| Control (supervisory) institutions | | | | | * |

Pic. 2. Modules of health risk management securing the measures and control (supervision) of sanitation-epidemiologic well-being of the population

The system includes five main modules which can and are used both independently and interdependently.

Module division provides the most effective solution of tasks on health risk management from the point of view of various resources spent on their adoption including achieving the targets of optimizing control (supervision) activity in the sphere of securing sanitation-epidemiologic well-being of population.

*The first module*. Determination of priority problems on securing sanitation-epidemiologic well-being of the population (and accordingly, control) and setting tasks on population health risk management at the level of the subjects of the Russian Federation. There are databases of regional information fund of social-hygienic monitoring (condition of population health and living environment) used as well as supervision and additional optimized monitoring on social-economic, sanitation-hygienic and behavioral risk factors and priority illnesses which determine the achievement of final result of regional medical-demographic policy – increase of life expectancy up to 75 years.

As the basis of information-analytic methods used in this module there is chosen factor-typological analysis and elements of geo-information technologies. The main result of this module application of hygienic diagnostics can be considered listing and ranging the problems of securing sanitation-epidemiologic well-being at the municipal level with account of their differentiation by levels of social-economic development (or by the number of population).

*The second module*. Assessment and predicting the development of problems on securing sanitation-epidemiologic well-being of the population. Based on integrated evaluations, factor-typologic analysis, certain risk territories and factor groups influencing the health and sanitation-epidemiologic well-being of the population and subject to control and supervision are defined.

In the course of this module realization the objects of study are, as a rule, the territories of risk chosen in the course of the first module implementation at the level of municipal entities. The basis for implementation of this hygienic diagnostics module is statistic methods of studying the influence of living environment factors on the health of the population according to priority illnesses (first of all, infectious, socially significant, ecologically determined and professional illnesses).

There are main (basic) cause-and-effect relationships of influencing living environment factors on morbidity and mortality in various groups of population, their quantitative as-

sessment with creating regression and other analytic models on the basis of correlation dependence analysis and time-series analysis.

*The third module*. Assessment and predicting multi-factor and multi-media (as well as separate media – aerogenic risk, water risk and others) risks for the population health as the basis of a more detailed (in comparison with the second module) forecast and control over the development of sanitation-epidemiologic well-being problems (and accordingly, the supervision activity planning) at the territory and entity levels. These information-analytic technologies in the practice of Sverdlovsk region are used primarily in the assessment and control of professionally- and ecologically-conditioned risks, and in the future it is planned to continue their development for assessing the risks of technical regulation objects, quality and safety of goods, works and services.

According to the results of ecologic-epidemiologic research and health risk assessment, there are defined adverse influences of certain factors of living environment including their effects under their influence on various levels not exceeding the defined hygienic standards for separate media.

This practice of using the data of social-hygienic monitoring in Sverdlovsk region is applied in the assessment of strategic development and technical re-equipment of enterprises, first of all, metallurgic branch, on the basis of health risk management methodology using adapted and internationally recognized economic instruments.

New technologies of intensive monitoring are being developed and implemented. This concerns also the monitoring of atmospheric air pollution with particulate matter of PM10 and PM2.5 in size as well as the assessment of personal exposure of the population to polluting substances (monitoring of the dosage). Using geo-information technologies there are new digital city maps created and topographic layers are formed based on the results of monitoring the living environment pollution and population health condition indicators.

Special attention is paid to the implementation of a biomonitoring system which monitors the amount of metals, organic compositions in bio-media. Technologies of population diet and chemical load received with food assessment are developed and implemented. Address technologies of medical-preventive and rehabilitation support to the population living in the zones of industrial risk are being implemented currently.

*The third module*. Assessment and justification of measures on population health risk management as well as their monitoring. There is a ‘classifier’ of potential measures including supervision ones on all priority problems of securing sanitation-epidemiologic well-being. Scenarios of population health risk management are elaborated with the account of the necessity and possibility of implementing those measures (complex of measures) for certain territories and every priority supervision entity.

The economic assessment of choice of measures on risk management allows to range the scenarios (complex of measures) from the point of view of both: efficiency assessment calculation of expenses per health risk reduction unit and increase of benefits (mitigation of damage) and estimation of additional expenses per unit of additional benefits and risk mitigation in comparison with other scenarios. While preparing a pivot data on risk management for people in charge of taking decisions it is recommended to use multi-criteria economic-managerial assessment on integrated and differentiated criteria of ‘expenses-benefits’ and ‘expenses-efficiency’ methods. In order to confirm the authenticity and completeness of information with account of adopted limitations and uncertainties it is recommended to perform evaluation under different indicators characterizing ‘efficiency’ of management measures both on the results of hygienic regulation and on the risk assessment, benefits evaluation in monetary terms, possibility and efficiency of the control (supervision).

The fifth module. Securing activity of supervision in the sphere of sanitation-epidemiologic well-being of the population. The results of classification, assessment, forecast and control of measures on risk management as well as the measures on risk infor-

mation are used in planning and assessment of the activities of territory entities and institutions of Federal Service on Surveillance for Consumer Rights Protection and Human Well-being in Sverdlovsk region. Besides, those results are used in optimization of activities (including organization structure) of entities and institutions of Federal Service on Surveillance for Consumer Rights Protection and Human Well-being at regional, municipal and object levels.

In order to assess the efficiency of budget and program goal-oriented planning and the results of risk management activity for the population health there are used unified approaches and economic methods of 'expenses-efficiency' and 'expenses-benefits' (MR 5.1.0029-11 'Methodological recommendations on economic assessment of risks for the population health under the influence of living environment factors' and MR 5.1.0030-11 'Methodological recommendations on economic assessment and decision justification in the sphere of population health risk management under the influence of living environment factors' taking into account the order of the Ministry of Healthcare and Social Development of the Russian Federation dated 10.04.2012 # 323n 'On adoption of methodology of calculating economic losses from mortality, morbidity and disability of population' (registered in the Ministry of Justice on 28.04.2012 # 23983).

Within the framework of each system module of risk management there is a unified step-by-step approach to implementation of the algorithm supporting managerial decision-making with several types of feedback allowing to correct the activity of the risk management subject taking into account a constantly changing situation.

There is implementation of the following stages planned:

S t a g e 1. Identification of risk factors conditioning population health (detecting living environment risk factors inherent in the management object, assessing interconnection between various risk factors, determining priority risk factors for management; assessing reliability and sufficiency of the data on risk factors and their influence on population health).

S t a g e 2. Population health risk assessment (description of priority risk factors for the management object, determination of the risk level for the population health as a result of living environment factors influence; formation of risk territories and groups among the population, determination of target permissible risk level, assessment of uncertainties while determining the risk level for the population health).

S t a g e 3. Planning activities on population health risk management (elaboration of scenarios (alternative options) of risk management using various methods and technologies of risk management, assessment and choice of the risk management scenario in order to achieve the maximum effect and benefits including economic ones, implementation of the mechanism for the chosen scenario).

S t a g e 4. Forecast of the health risk for the population as a result of implementing the chosen scenario of risk management (population health risk assessment under the realization of the chosen scenario, determination of the level of the residual risk).

S t a g e 5. Control of the activity on risk management (determination of the necessary and sufficient measures on risk control and monitoring, risk control program realization (types of control: supervisory, background, optimized), optimization of supervisory measures in the sphere of securing sanitation-epidemiologic well-being of the population, preparation and implementation of the measures on correcting (if necessary) the risk management scenarios).

S t a g e 6. Development of databases on objects, subjects and methods of risk management under the implemented scenario (formation of databases for social-hygienic monitoring, evaluation of effects and results of provision of sanitation-epidemiologic well-being and population health risk management, comparison of the obtained results with the planned ones).

The tasks of information-analytical support for decision-making being solved within the framework of risk management for health of the population of municipal entities include but are not limited by:

· optimization of budget and program goal-oriented planning of activities on securing sanitation-epidemiologic well-being of the population by local government bodies in municipal entities;

· assessment of economic efficiency and usefulness of local government bodies' activities on solving priority tasks securing sanitation-epidemiologic well-being of the population.

Integrated system of population health risk management at the level of municipal entities has been implemented since 2008 through resolutions of Sverdlovsk region government 'On sanitation-epidemiologic situation, risk management and securing sanitation-epidemiologic well-being of the population' (including description of priority problems of sanitation-epidemiologic situation, assessment of economic efficiency of municipal entities activities on population health risk management and suggestions on risk management measures for the population) as well as sanitation-epidemiologic passports of municipal entities. As regulatory-methodological basis for implementing such a system served Methodological recommendations 'Systemic approach to population health risk management in municipal entities' adopted at the meeting of Scientific Council of Federal Budget Institution of Science (FBIS) "Ekaterinburg Medical Scientific Center of Preventive Healthcare and health protection of workers from industrial enterprises" Federal Service for Supervision of Consumer Rights Protection and Human Welfare in October, 2011.

Within the framework of stages 1 and 2 implementation there are realized works on assessment of influence of combinations of risk factors on the population health. This concerns sanitation-hygienic (chemical, biological, physical factors) and social-economic (industrial and economic development, social welfare, social tension) risk factors. The share of the latter in population health of municipal entities in Sverdlovsk region in the last decade has been declining steadily and the share of sanitation-hygienic factors is increasing. In 2012 about 82.2% of the population (3.57 bn. people) were exposed to the risk from influence of sanitation-hygienic factors (in 2011 – 79.9%, in 2010 – 78.4%, for the Russian Federation this indicator in 2012 was 72.9%) and 32,1 % (1.38 bn. people) – social-economic factors (in 2011 – 35.7 %, in 2010 – 25.9 %, for the Russian Federation this indicator in 2012 was 55.1 %). This trend was reached (not after all the others) by maintaining, including the recession period of 2009 to 2012, of high motivation for work of able-to-work population. The solution of the problems of sanitation-hygienic character still remains of low efficiency.

The assessment of multi-media chemical risk for the health of the population living in all major industrial centers of Sverdlovsk region with the population more than 75% of the total population of the region has been conducted for the first time in Russia.

The predicted risks for the health of the population living in 13 municipal entities created by influence of priority pollutants of chemical nature are ranged in the following order:

· risk of additional cases of mortality from particulate matter – forecast 2,941 cases every year;

· risk of early mortality in connection with multi-media lead pollution is 1,258 cases each two years;

· risk of 654 cases of mental retardation among children 0-7 years accounted for multi-media lead pollution;

· carcinogenic risk is 7,254 cases of oncologic diseases throughout life which is non-permissible for health;

· risk of nephropathy is 142 thousand cases among the population throughout life accounted for cadmium influence.

In 2011 economic damage for the population health resulting from living environment pollution was 13.2 bn. Roubles (in 2009 – 12.2 bn. Roubles, in 2010– 11.9 bn. Roubles).

Scenarios of population health risk management (within the framework of planning realization at the 3rd stage) are worked out with account of implementing measures on all significant (priority) risk factors taking into account the results of their assessment. There is a target individual complex of measures (scenarios) for each municipal entity. It describes the risk management for the population health and securing sanitation-epidemiologic well-being of the population from the general list of recommended standard measures as well as addenda to it which reflect typical problems of population health condition and living environment condition in the municipal entity. From the point of view of taken managerial decisions, each of the possible scenarios includes different types of measures: regulatory-controlling, organizational-managerial, technico-technological, financial-economic, medical-preventive and rehabilitation, supervisory and others. Sanitation-epidemiologic passports are formed under implementation of the system of social-hygienic monitoring for almost all municipal entities on the territory of Sverdlovsk region (more than 70 municipal entities).

One of the criteria for determining priority of solving problems of sanitation-epidemiologic well-being of the population in municipal entities is comparison of economic assessment of risks. For example, this indicator for Ekaterinburg is 470.1 thousand Roubles a year per one person, Verkhnyaya Pyshma – 510.9 thousand Roubles, Serov– 543.0 thousand Roubles, Krasnoturjinsk – 568.0 thousand Roubles, Asbest– 570.1 thousand Roubles, Pervouralsk – 573.1 thousand Roubles, Kamensk-Uralskiy – 578.9 thousand Roubles, Nizhniy Tagil – 582.8 thousand Roubles, Polevskiy – 614.7 thousand Roubles, Revda – 649.7 thousand Roubles, Krasnouralsk – 663.9 thousand Roubles, Kirovgrad – 671.1 thousand Roubles.

Forecast estimations (under stage 4 implementation) while analyzing the trend for mitigation of risks resulting from the influence of social-economic factors are based on calculating the number of additional cases of early mortality of the population, including the population of working age:

- at reduction of unemployment level by 1% the mortality of work able population decreases by 11.4 cases per 10,000 people;
- at increase of welfare indicators (plumbing, canalization, proportion of roads with hard surface) by 1% percent, the mortality of the population decreases by 10.0-20.0 cases per 10,000 people;
- at increase of the number of doctors by 1 specialist (for 10,000 people) the mortality indicator of the population decreases up to 3.0 cases per 10,000 people.

The result of stage 4 implementation is the assessment of risk management activities efficiency of different management subjects on the territory of municipal entities. In particular, during the last four years (bearing in mind significant inertia of medical-demographic changes for risk management efficiency assessment) in Sverdlovsk region there has been assessed the economic efficiency of implementation of measures on population health risk management in municipal entities (upon implementation of 46 priority tasks on securing sanitation-epidemiologic well-being of the population). Total amount of expenses in 2011 was 19 bn. 192 m. Roubles (in 2010 it was 23 bn. 140 m. Roubles, in 2009 it was 13 bn. 36 m. Roubles), 78% of expenses were streamed for solving priority tasks connected with improvement of the atmospheric air quality, quality of soil, drinking water, prevention of diseases for working population and improvement of conditions of children and teenagers upbringing and education.

The amount of the prevented damage to the population health in 2011 was 58 bn. 308 m. Roubles (or 3.0 Roubles for each Rouble of expenses which is 1.5 times less than in 2010). The share of the prevented damage for the population health was 3.8 % from the amount of gross regional product of Sverdlovsk region. Only stable and long-term organization and financial support of implementing the measures on population health risk management could lead to the development of the achieved level of

stabilization and improvement of medical-demographic situation in Sverdlovsk region, in particular, in the course of implementing the programs of economy modernization and increasing the efficiency of resource management.

Integral estimation of economic efficiency from implementing the measures on population health risk management in municipal entities in Sverdlovsk region is conducted with observation of the following criteria:

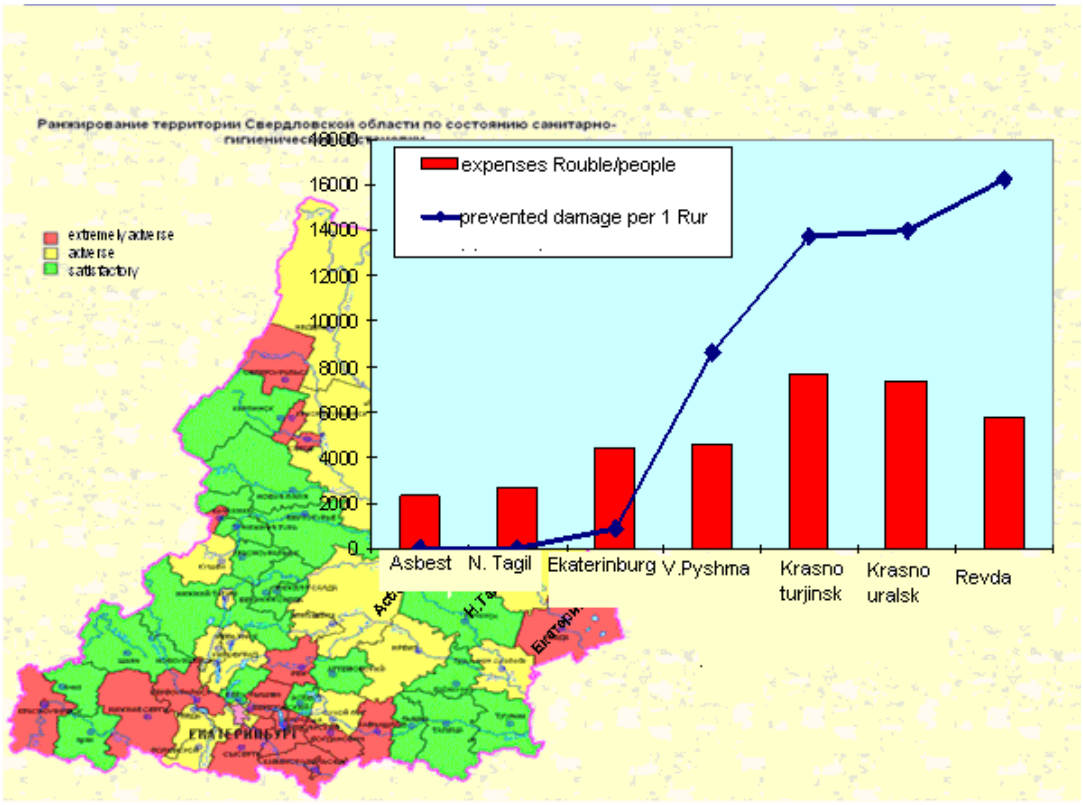
1) maximum difference between the amount of prevented damage (as a result of mortality and morbidity levels reduction) for the population health and expenses on implementation of the measures on population health risk management;

2) maximum difference between the amount of the prevented health damage and expenses on implementation of the measure on population health risk management;

3) minimum cost per unit expenses on implementation of the measures on population health risk management in order to prevent one case of early mortality or morbidity and improvement of indicators of the living environment quality per relative unit (1%);

4) maximum difference of cost per unit and marginal expenditures on implementation of the measures on population health risk management in order to prevent one case of early mortality or morbidity and improvement of the indicators of living environment quality per a relative unit (1%).

The example of the assessment results of some municipal entities (ranged according to the degree of influence of sanitation-hygienic factors on the indicators of population health condition) on their population health risk management is given in picture 3.




Pic. 3. Assessment of the results of municipal entities activities on population health risk management in Sverdlovsk region

Based on the results of the conducted analysis, the planned results of implementing the measures on population health risk management have not been achieved in any municipal entity

in Sverdlovsk region. Key indicators of final result on population health risk management are achieved in municipal entities having up to 80% of the population of Sverdlovsk region. Reduction of the early mortality rate in 2011 was achieved in 46 municipal entities in Sverdlovsk region (out of 70 municipal entities (on the data of which the analysis has been conducted)) with the number of population 3,276.3 thousand people (reduction was from 0.004 to 5.96 cases per 1,000 people in various municipal entities). Mortality rate of work-able population reduced in 44 municipal entities in Sverdlovsk region with the population number of 3,292.9 thousand people (reduction was from 0.1 to 8.4 cases per 1,000 people in various municipal entities). Total morbidity rate of the population reduced in 51 municipal entities in Sverdlovsk region with the population number of 3,675.5 thousand people (reduction made from 5.9 cases to 397.6 cases per 1,000 people in various municipal entities). The reduction of children morbidity rate was reached in 49 municipal entities in Sverdlovsk region (reduction made from 6.59 to 724.55 cases per 1,000 people in various municipal entities).

The calculated rate of relative average regional monetary assets streamed for solving the tasks on population health risk management for the account of all the financing sources (calculated per one person in municipal entities) in 2011 was 4,691.7 Roubles per one resident (in 2010 – 5,521.3 Roubles, in 2009 – 2,966.4 Roubles, in 2008 – 5,689.2 Roubles). At the same time, the calculated rate is not less than 15,000 Roubles per one person.

Works on stage 5 of information-analytic system of decision making support are aimed at the risk management activity control. At this stage in order to solve the tasks of population health risk control there is performed planning and assessment of supervisory activity of territorial departments of Federal Service for Supervision of Consumer Rights Protection and Human Well-being in Sverdlovsk region on securing sanitation-epidemiologic well-being.

Under the power of Federal Service for Supervision of Consumer Rights Protection and Human Well-being in Sverdlovsk region, supervisory measures are one of the basic elements in the system of population health risk management. On the one hand their implementation demands insignificant (in comparison with other measures on health risk management) resources and expenses and there is a real threat of extreme ‘administrative load’ on business units operating on the territory of the region. But on the other hand, at the extreme minimization of administrative state regulatory (supervisory) measures there is a possibility to lose control over sanitation-epidemiologic situation and existing risks for the population health. Based on the data on population health risk management for each municipal entity, there is the necessary and sufficient amount of supervisory measures defined, first of all on priority supervision objects. As a result of supervisory activity optimization on priority objects, the amount of administrative measures for 1 inspection with breaches is growing (in 1.2 time) and makes 2.3; detected breaches on 1 object are 8.7; relative share of inspections of breaches increased by 9% and made 63%; the amount of fines increased by 12% for one administrative official and made 125,543 Roubles.

According to 9 department target programs of Federal Service for Supervision of Consumer Rights Protection and Human Well-being in Sverdlovsk region, the indicators of assessment of their achievement are tightly connected with the results and efficiency of population health risk management in subordinate municipal entities (achieved by 70.5%). Thus, there has increased the number of decisions taken by executive power bodies. Those decisions are aimed at securing sanitation-epidemiologic well-being of the population (by 3.1 times); the number of adopted regional target programs has increased as well (by 9.3%); the total share of the objects related to group III of sanitation-epidemiologic well-being (by 11.1%); the amount of school children with hot meals has increased as well (by 4.3%); the amount of consumer right breaches settled down in out-of-court order has increased (by 1.3 times); the number of events on informing population about means and methods of consumer rights protection (by 1.5 times); total

share of satisfied sues in favour unlimited range of people has increased (by 1.2 times).

Final stage (stage 6) of information-analytic system of population health risk management in municipal entities of Sverdlovsk region is assessment of the results and effects of securing sanitation-epidemiologic well-being and population health risk management, comparison of the obtained results with the planned ones. We use all the available information and analytic materials obtained as a result of implementation of all the previous stages. Development and actualization of databases on social-hygienic monitoring is provided and it comprises all the components – supervisory, background, additional optimized monitoring.

Results of population health risk management with estimation of efficiency and effectiveness of municipal entities activities are annually considered at the meetings of Sverdlovsk region government. By 2012 there have been created fundamentals of integrated (unifying activity of regional and municipal management authorities, business units, institutions and bodies of Federal Service for Supervision of Consumer Rights Protection and Human Well-being in Sverdlovsk region) system of population health risk management on securing sanitation-epidemiologic well-being and population health protection.

The development of regional system of social-hygienic monitoring is aimed at the future prospective of full-scale implementation of population health risk management methodology at regional and municipal levels, level of business unit, development and maintenance of integrated and differentiated databases characterizing influence of complex of measures or separate living environment factors on the population health, in particular:

· development of the system of basic assessment criteria for living environment quality management and population health condition with account of a complex of sanitation-epidemiologic, social-economic and behavioral risk factors;

· scientific-methodological support of optimization of activity of Federal Service for Supervision of Consumer Rights Protection and Human Well-being agencies and institutions;

· elaboration of scientific-methodological fundamental principles and implementation of assessment of social-economic risk factors influence on health condition of the population living in industrially-developed cities;

· providing planning and assessment of efficiency of the measures on population health risk management in municipal entities and industrial enterprises;

· complex assessment of multi-factor and multi-media risks for the population health, development of the system of social-hygienic monitoring using the results of such assessment at regional and municipal levels;

Thus, the population health risk management system can and is to be used when planning and assessing activities of Federal Service for Supervision of Consumer Rights Protection and Human Well-being agencies and institutions performing supervisory activity on the territory of municipal entities within the framework of implementation of budgeting principle which is result-oriented.

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