

## ПРОБЛЕМНІ АСПЕКТИ ДЕРЖАВНОЇ СТАНДАРТИЗАЦІЇ СУЧАСНИХ ЖИТЛОВИХ БУДИНКІВ З КВАРТИРАМИ ТИПУ «СМАРТ-КВАРТИРА»: УКРАЇНСЬКИЙ СТАН ТА ЗАРУБІЖНИЙ ДОСВІД

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## PROBLEM ASPECTS OF THE STATE STANDARDIZATION OF MODERN DWELLING-HOUSES WITH THE FLATS OF «SMART» TYPE: STATE IN UKRAINE AND FOREIGN EXPERIENCE

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**Keywords: projects for construction, modern residential buildings, flat of «smart» type, national and foreign state standards, sanitary and epidemiological living conditions.**

In the last 5-10 years, due to the complicated economic circumstances and events in the South-East of Ukraine, the need of design and construction of dwelling-houses to satisfy the requirements of the population in housing, including provision of the migrants from the above-mentioned region, has been growing. One-room flats of small area are very popular among population (students, migrants, labour migrants, single people) at the market of new dwellings. These flats are economically attractive and they need sanitary-and-hygienic assessment.

According to the international hygienic criteria for the assessment of the air quality in dwelling premises, it is envisaged to carry out a risk assessment for the health of the population from chemical contamination with the following substances: xylene – registration number 1330-20-7 in the International Chemical Base CAS (Chemical Abstracts Service), styrene – № 100-42-5 by CAS, phenol – № 108-95-2 by CAS, formaldehyde № 50-00-0 by CAS, ammonia – № 7664-41-7 by CAS, acetone – № 67-64-1 by CAS, and many other substances that are classified as hazard classes I-IV and have inhalation-directed carcinogenic

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**Мета дослідження.** Провести гігієнічну оцінку проектування багатоквартирних житлових будинків з однокімнатними квартирами для проживання однієї особи на відповідність вітчизняним та зарубіжним нормам санітарного та житлового законодавства.

**Методи дослідження.** У роботі використано такі методи: теоретичні, аналітичні, санітарно-епідеміологічної експертизи проектів будівництва.

**Результати.** У ході дослідження проаналізовано чинне вітчизняне санітарне та містобудівне законодавство і зарубіжний досвід стосовно будівництва сучасних житлових будинків з однокімнатними квартирами типу «смайт-квартира» для проживання однієї особи.

Показано, що в Україні відсутня практика та відповідні нормативні документи для проектування однокімнатних квартир невеликої площі для проживання однієї особи.

За результатами досліджень розроблено гігієнічні рекомендації щодо забезпечення оптимальних

умов проживання, зокрема щодо дотримання вітчизняних чинних гігієнічних нормативів (тривалість інсоляції і природного освітлення, допустимі концентрації хімічних речовин у повітрі, допустимі рівні температури, швидкості, вологості та іонізації повітря, рівні шуму та вібрації, іонізуючого і неіонізуючого випромінювання, вмісту у повітрі приміщень радону, аерозолі, у тому числі біологічного походження, допустимі рівні бактеріально забруднення повітря і поверхонь та інших факторів); забезпечення дотримання нормативних параметрів мікроклімату та якості повітря у житловій кімнаті шляхом відмежування у ній кухонної зони від житлової з облаштуванням «кухонь-ніш» з централізованою механічною приливно-втяжною вентиляцією і обладнанням виключно електроплитами; забезпечення об'єму житлового простору на рівні вітчизняних нормативів – 75 м<sup>3</sup> за висоти житлового приміщення не менше 2,75 м; забезпечення необхідного набору приміщень такою площею: житлова кімната – 18 м<sup>2</sup>, коридор – 3,9 м<sup>2</sup>, санвузол – 3,4 м<sup>2</sup>, балкон/лоджія – 4,5 м<sup>2</sup> для підвищення рівня комфорту.

**Висновки.** За результатами наукових досліджень розроблено санітарно-епідеміологічну складову до проектування однокімнатних квартир типу «смайт-квартира» та попередньо обґрунтовано можливість унормування площі однокімнатних квартир для проживання однієї особи.

**Ключові слова:** проекти будівництва, сучасні житлові будинки, однокімнатні квартири типу «смайт-квартира», вітчизняні та зарубіжні державні стандарти, санітарно-епідеміологічні умови проживання.

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effect on critical organs and organ systems of the man, first of all, respiratory, central nervous, cardiovascular, immune, and other systems. The aforesaid is not provided for by the current domestic town-planning legislation. The state sanitary-and-epidemiological supervision over designing, construction, and commissioning has been withdrawn from the sanitary legislation by the Law of Ukraine «On the regulation of town-planning activity». It is unacceptable for Ukraine and determines the relevance of this study [1].

**Objective and methods.** We conducted a hygienic assessment of the design of the blocks of flats with one-room flats for one person's residence on a compliance with domestic and foreign norms of sanitary and housing legislation for the determination of possible negative impact of the factors of chemical, physical, and biological origin of the internal housing environment on the health of the residents of one-room flats of «smart» flat type and developed

preventive measures to minimize it. We applied theoretical method and method of sanitary-and-epidemiological examination of the projects for construction.

#### Results and discussion.

According to sanitary and town-planning legislation on the planning and construction of the settlements of the post-Soviet and European countries, the requirements of the SanNR 2.1.2.1002-00 «Sanitary-and-epidemiological requirements to dwelling-houses and premises», SanNR 31-02-2001 «Construction norms and regulations. Residential single-family houses», TKR 45-3.02-230-230-2010 «Residential single-blocked houses and blocked houses», SanNR RK 3.02-27-2004 «Construction norms and regulations. One-room dwelling-houses» are in force there. By these norms, the height of premises (from floor to ceiling) of living rooms is 2.5 m, the minimum area of a living (general) room in one-room flats is 18-19 m<sup>2</sup> [2-5]. Table 1 shows the minimum area of premises in one-room flat in accordance

with the standard documents of Ukraine, the Republic of Belarus (RB), the Republic of Kazakhstan (RK), and the Russian Federation (RF).

The experience of design and building of dwelling-houses with the small area flats began in the middle of the last century.

When comparing the norms of 1967 and 1974, the residential areas of space of one-room flats in different European countries, listed in table 2, the following was established. The standard norms for the areas of one-room flats had variational limits (from minimum to maximum) in 60% of the cases of the studied European countries. The highest minimum standards for the areas of one-room flats were adopted in Switzerland in 1967 – 40 m<sup>2</sup>, Norway – 32 m<sup>2</sup>, and the UK – 30 m<sup>2</sup>, which was 1.6-2.2 times higher than the same parameter figure in the USSR (18 m<sup>2</sup>) [6].

At the comparison of the norms of 1959 and 1974 in the Republic of Poland, a significant increase in the standard limits of the area of one-room flat from

Table 1

**Standards (norms) for minimum areas of the premises in one-room flat in Ukraine, the Republics of Kazakhstan and Belarus, and the Russian Federation**

Premise's area, m <sup>2</sup>	Standard documents				
	SCN.2.2-15-2005 (Ukraine)	SCN B.2.2-X-20XX (Ukraine)	TKR 45-3.02-230-2010 (RB)	SanNR 3.02-27-2004 (RK)	SanNR 31-02-2001 (RF)
Area of living (general) room in one-room flat	15.0	18.0	18.0	14.0	12.0
Minimum area of bed-room for one person	10.0	9.0	9.0	8.0	8.0
Minimum area of kitchen in one-room flat	7.0	9.0	9.0	8.0	6.0
Area of sanitary unit (equipped with bath, wash-stand, place for washing machine)	3.3	3.2	3.2	1.8	1.8
Toilet (equipped with toilet and wash-stand)	1.2 – 1.5	1.1	1.1	0.96 – 1.2	0.96
Combined bathroom (equipped with bath, wash-stand, place for washing machine)	3.8	3.8	3.8	-	-

Table 2

**Comparative data of the standards (norms) of the sizes of one-room flats in different countries of Europe**

Countries	Year of standards' (norms') adoption	Areas, m <sup>2</sup>
Belgium	1967	25
Bulgaria	1976	24-30
Czechoslovakia	1976	28
Finland	1967	22-30
France	1964	25-33
Norway	1967	32-42
Poland	1974	25-28
Great Britain	1967	30
Switzerland	1967	40
USSR	1975	18-36

17-20 m<sup>2</sup> (1959) to 25-28 m<sup>2</sup> in 1974 [7] was noted. However, taking into account a considerable demand for one-room flats of a small area for one person (the so-called «Kavalerki» in the Republic of Poland in the 90-s) the minimum floor area of one-room flat was normalized at the level of 18 m<sup>2</sup> [6]. In Denmark, the legislation does not regulate the specific minimum norms (standards) for one-room flat but they are determined by the local self-government bodies.

In Ukraine, in the postwar period (Kyiv, 1954), the pilot projects

for the construction of small-family houses with one-room flats with a small area (total area – 27.82 m<sup>2</sup>, residential – 18.48 m<sup>2</sup>) were developed. In the 1960-1970's the construction of dwelling-houses with small-size flats and hotel-type rooms for the residence of single citizens (one person) began throughout the territory of the former USSR.

The main differences of the houses with small-size flats and hotel-type rooms from ordinary dwelling-houses are as follows: the replacement of the kitchen area into a kitchen-niche (with the installation of electric cookers) and cooking facilities for several flats on the floor; a sanitary unit with a complete set of sanitary equipment (shower or bath, wash-stand, toilet) and incomplete one, including sanitary units for sharing, which are designed for several flats on the floor.

The houses for small families were equipped with centralized water supply, sewerage, central heating, electricity, and forced ventilation systems.

At present stage, new buildings with one-room flats of a reduced area for one person's residence are located predominantly in the structure of city centers or near them (metropolises).

A scientific sanitary and epidemiological assessment of design materials for the construction of modern 12-section (6-17-storeyed) residential complex was carried out at the Laboratory of Sanitary and Epidemiological Assessment of Human Settlements, besides the traditional one-room flats one-room, the flats of «smart» type for the residence of one person were designed in that complex. By the results of the evaluation of the project materials, the following was established: according the town-planning design, the area of the development was 7980 ml, design number of the residents – 2,297 people.

The density of the development in the block at the placement of mentioned building, taking into account those types of the flats, complied with the requirements of SBN 360-92\*\* «Town-planning and building of urban and rural settlements»



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(paragraph 2.7, paragraph 2.13) and made up 475 people per hectare at the admissible norm not more than 500 people/ha [8].

According to the design materials, one-, two-, three-room flats, as well as one-room flats of a small area of the «smart» type for the residence of one person were designed in the residential sections of the residential complex.

The total designed number of the flats is 1,375, including 902 one-room flats, 295 of them are one-room «smart» flats for one person's residence; 445 two-room flats; 28 three-rooms room flats. In a 12-sectional residen-

tial complex, 295 one-room flats of «smart» type for one-person residence were designed in the 2-12-th sections that made up 21.45% of the total number of the flats and 33% of the total number of one-room flats of the traditional type of the residential complex. Diagram shows the distribution of the flats in a designed residential complex.

The area of one-room «smart» flats for one person's residence was designed 24.1-29.2 m<sup>2</sup> at the premise's height of 2.85 m, the area of one-room flats of the traditional type for family residence (two adults and one child) was within current norms – 30-40 m<sup>2</sup>.

Diagram

**Distribution of the flats in a designed residential complex**

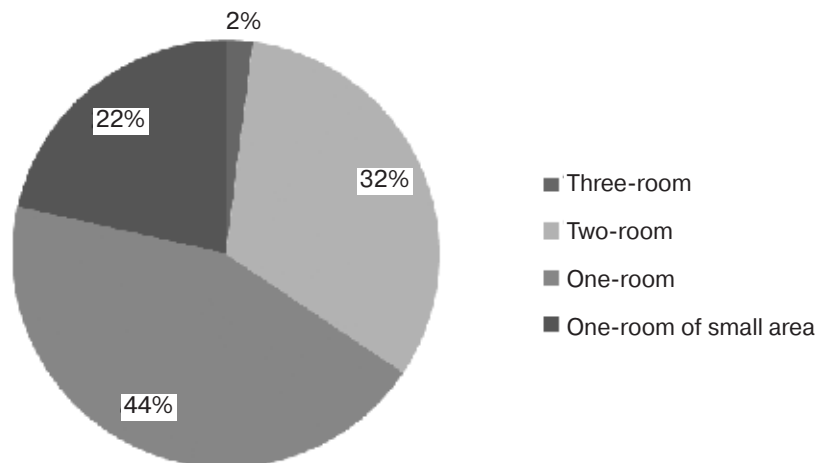


Table 3

**Descriptions of one-room «smart» flats for the residence of one person by an area and a set of premises**

Area of flat, m <sup>2</sup>	Type and area of premises			
	room, m <sup>2</sup>	bathroom, m <sup>2</sup>	balcony/loggia, m <sup>2</sup>	corridor, m <sup>2</sup>
25	16.7	3.8	4.5	-
24.1	16.2	3.0	4.9	-
24.7	16.8	3.8	4.1	-
24.8	16.0	3.7	5.1	-
27.4	18.4	3.7	5.3	-
29.2	16.0	3.9	5.4	3.9

There are no national standards (norms) for a design of one-room flats of a small area for one person's residence in Ukraine.

At present, the specialists of the basic design institute of the Ministry of Regional Development of Ukraine – the State Enterprise «Ukrainian Research and Design Institute of Civil Construction» (hereinafter – UkrRDI civil construction) have developed a draft of SBN B.2.2-X-20XX «Buildings and structures.

One-flat houses» [9] where the normalization of the minimum area of the living (general) room has been substantiated at the level of 18 m<sup>2</sup>.

According to the Housing Code of Ukraine, the «sanitary» norm of a residence area per one person is 9 m<sup>2</sup> and «social» one – 13.65 m<sup>2</sup> [10].

According to SSTC-N B V.1.2-16: 2013 «Determination of the class of consequences (amenability) and the category of the complexity of the construction objects» (Paragraph 5.1), the norm of 21 m<sup>2</sup> of the total area per person is used at the determination of the class of consequences and category of the complexity of the construction objects [11].

According to SBN V.2.2-18: 2007 «Buildings and structures. Establishments of social protection of the population» (subsection 6.1, paragraph 6.1.1.2), the area for the residence of one person in one-room flat is not less than 10 m<sup>2</sup> [12].

According to the main standard document of town-planning legislation – SBN, V.2.2-15-2005 «State building regulations of Ukraine. Buildings and structures. Residential buildings. Basic regulations», in Ukraine, the standard of the area has

been established only for one-room flats for the family residence (two adults and one child) within the limits of 30-40 m<sup>2</sup> [13].

Consequently, mismatching of the national standards for the design of one-room flats of different types requires a scientific-and-hygienic substantiation. According to the sanitary legislation of Ukraine, the requirements for the arrangement of residential premises are in the compliance with the sanitary-and-hygienic norms by the factors of chemical, physical, and biological origin, i.e. standard insolation and natural lighting, permissible concentrations of chemicals in the air, permissible levels of temperature, velocity, humidity, and ionization of the air, noise, vibration, ionizing and non-ionizing radiation, the content of radon in the indoor air and subsidiary products of its decomposition in the premises, aerosols, including aerosols of biological origin, bacterial pollution of air and surfaces, etc.

According to the design decisions, six types of one-room «smart» flats for one person residence of 2.85 meters height have been designed in the 12-sectional residential complex which differ in the size of the total area and the set of the premises. Descriptions of one-room «smart» flats are presented in table 3.

According to the requirements of SBN, V.2.2-15-2005, the standard of the living space for one-room flat for a family (at least, for two adults) is 75 m<sup>3</sup> [14]. The volume of residence space of studied one-room «smart» flats for one person's residence at the residential premises' height of 2.85 m made up 68.685-83.22 m<sup>3</sup>, that is sufficient in hygienic terms.

By the architectural-and-planning decisions of the project of the «smart» flats for the residence of one person, they consist of the following premises: a living room where several main functional areas are concentrated: for sleep, rest, reception of the guests and communication, cooking and eating, storage of things; a combined bathroom (with ordinary or seated bath or with a shower instead of it). All

designed «smart» flats were equipped with balconies or loggias. The functional areas of the living room are partially or fully superimposed and used by the resident (one person) in turn with time distribution. As a rule, there is no hall in the planning decisions of one-room «smart» flats for the residence of one person: the entrance in the room is arranged through the corridor. The loggia/balcony in each one-room «smart» flat for the residence of one person increases the level of comfort for the resident of this flat.

According to the produced design materials, a corridor with an area of 3.9 m<sup>2</sup> was provided for one-room «smart» flat with a total area of 29.2 m<sup>2</sup> only.

The reduction of the standard area of one-room flats by the considered design decisions is due to the abandonment of the kitchens and partially of the corridors which does not contradict the requirements of the paragraph 2.26 of the SBN B.2.2-15-2005 [13].

When comparing the planned limits of the total area of one-room «smart» flats designed for one person's residence at the level of 25-29.2 m<sup>2</sup> with the current norm of the minimum border of the area of one-room flats of 30 m<sup>2</sup> for two adults and one child, the insignificant difference 0.8-5.0 m<sup>2</sup> has been determined, at the height of designed premises of 2.75 m, it ensures a compliance with the hygienic standards of living space.

Detailed consideration of the plans of these one-room «smart» flats for one person's residence shows that the areas of general living rooms with kitchen (kitchen area with minimum equipment) make up 16.0-18.4 m<sup>2</sup>, respectively, without separating of the niche from the kitchen.

In order to prevent the spreading of pollutants and odors in the process of cooking throughout the area of the living room and prevention of the negative effects of those substances on the health of the resident of «smart» flat it was recommended to introduce a separation of the kitchen area from the living area of the room, as a compensating preventive measure, by

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**Objective:** We carried out a hygienic assessment of the design of the blocks of flats with one-room flats for one person's residence on a compliance with the domestic and foreign norms of sanitary and town-planning legislation.

**Methods:** In the work, we applied theoretical and analytical methods and method of sanitary-and-epidemiological examination of construction designs.

**Results:** The current sanitary and town-planning legislation of Ukraine and foreign experience, concerning the construction of modern dwelling-houses with one-room flat of «smart» type for the residence of one person, were analyzed in the course of research.

There is no practice and relevant regulatory documents for a design of one-room flats of a small area for one person's residence in Ukraine.

According to the results of research, hygienic re-

commendations were developed to ensure optimum living conditions, including: a compliance with the domestic hygienic standards: the duration of insolation and natural light; the allowable concentrations of the chemicals in the air; the allowable levels of temperature, humidity, air ionization, noise, vibration, ionizing, and non-ionizing radiation; the content of radon, aerosol, including aerosols of biological origin, in the indoor air; the allowable levels of the bacterial pollution of air and surfaces; ensuring the compliance with the regulatory parameters of microclimate and air quality in the living room by the delimitation of the kitchen area from the living area with a kitchen-niches device with a mechanical plenum-exhaust ventilation and only with electric stoves; ensuring the volume of living space at the level of domestic standards – 75 m<sup>3</sup>, while the height of the room should be at least 2.75 m; the provision of a necessary set of the rooms with an area of the living room – 18 m<sup>2</sup>, the corridor – 3.9 m<sup>2</sup>, the bathroom – 3.4 m<sup>2</sup>, the balcony/loggia – 4.5 m<sup>2</sup> to increase the level of comfort.

**Conclusions:** According to the results of scientific research, a sanitary-and-epidemiological component was developed for a design of «smart» flat, and a possibility for the standardization (normalization) of the area of one-room flats for the residence of one person was preliminary substantiated.

**Keywords:** construction designs, modern residential buildings, flat of «smart» type, national and foreign state standards, sanitary-and-epidemiological living conditions.

the arrangement of the special kitchen niches in all one-room «smart» flats by separate architectural-and-planning decisions.

In order to reduce the probable negative influence of pollutants and odors on the health of the resident and to prevent the incidences at home (due to malfunction of the cookers) it was recommended to fit out the kitchen-niches of all one-room «smart» flats with the electric cookers. In order to remove the harmful substances from the living space in the process of cooking it was recommended to fit out all niches with the centralized mechanical plenum-exhaust ventilation.

According to the design decisions, the areas of the combined bathrooms (bath or shower, a wash-stand, a toilet, a place for a washing machine or without it) in all «smart» flat were 3.0-3.7 m<sup>2</sup> and 3.9 m<sup>2</sup>. By the project the area of the combined bathrooms (equipped with a bath, a wash-stand, a toilet, a place for a washing machine) were 3.7-3.9 m<sup>2</sup> that, in general, complied with the norm of 3.8

m<sup>2</sup> by the requirements of the SBN B.2.2-15-2005 (paragraph 2.27) [13]. The area of the combined bathroom, equipped with a wash-stand, a toilet – 3.0 m<sup>2</sup>, and an angular shower cabin, is acceptable and meets the requirements of SBN B.2.2-15-2005 (paragraph 2.27) [13]. There is a deficiency of the area for the placement of washing machine in the mentioned one-room «smart» flats with combined bathrooms with an area of 3.0 m<sup>2</sup>. Therefore, the equipment of the special places for washing machines in the kitchen-niche with a connection to centralized water supply and sewage systems was offered as a compensatory measure.

The natural lighting of the residential premises and the duration of insolation of designed one-room «smart» flats made up 2.5 hours and corresponded to the hygienic standards in accordance with «State sanitary regulations of planning and building of settlements. DSP № 173-96» [14] and SBN 360-92\*\* [8].

An increase of the height of the premises up to 2.85 m was a compensatory architectural-

and-construction measure for one-room «smart» flats that ensured a compliance with the standards of living space and was acceptable from the sanitary-and-epidemiological point of view.

Designed ventilation system in all residential premises provides with the parameters of the microclimate in all climatic seasons in accordance with the requirements of the paragraph 5.1 of SBN V.2.5-67: 2013 «State building regulations. Engineering equipment of buildings and structures. Heating, ventilation, and air conditioning» [15].

The influx of fresh air through the transom of the windows of balconies / loggias of one-room «smart» flats was proposed for the ventilation of the residential area of those flats.

Eco-friendly, high-quality materials, which had positive certificates of the State Sanitary and Epidemiological Inspection of the Ministry of Health of Ukraine, were used in the construction of dwelling-houses in accordance with the requirements of the SSanNR 8.2.1-

181-2012 «State sanitary norms and regulations used for interior decoration of the residential complex premises. Polymeric and polymer-based materials, products, and structures used in the construction and manufacture of furniture. Hygienic requirements» [16].

According to the project design, the ventilation and heating systems of the premises ensured compliance with the requirements for providing with air quality by DSP № 173-96 (paragraph 8.3), SSanRN 8.2.1-181-2012 [14, 16]. The parameters of the microclimate in the premises, taking into account the purpose of the premises and the climatic period of the year (cold and warm periods), air exchange in the residential areas (including the kitchen area) and combined bathrooms complied with the requirements of SBN, V.2.2-15-2005, SBN V 2.5-67: 2013 [13, 15].

According to the project design, the operation of engineering systems did not create the excessive levels of noise, vibration, and air pollution.

By the project design, the noise levels in the premises of one-room «smart» flats for one person's residence, created by ventilation systems and other engineering equipment (elevators, pumps, electric motors, transformers, etc.), conformed to the hygienic norms for day and night time according to DSP №173-96 (Appendix № 16) [14]. By the project, the levels of vibration from internal and external sources in the premises of the complex did not exceed the regulated hygienic values in accordance with the DSP № 173-96 (Appendix № 17 and № 17a) [14]. According to the design, the levels of density of a

static electric field at a distance of 0.2 m from the floor and walls did not exceed 15 kV/m (with relative humidity within 30-60%). Voltage levels of the electric field of 50 Hz from the surfaces, enclosing the premises at a distance of 0.2 m, did not exceed 500 V/m, the levels of electromagnetic radiation from the external sources in the middle of the residential and public premises of the complex at the height of 1.5 m from the floor did not exceed the hygienic norms by «State sanitary norms and regularities for the of protection of the population from the impact of electromagnetic radiation. SSanRN 239-96» [17].

The quality of building materials and raw materials that will be used for the construction of the complex by the specific effective activity of natural radionuclides should not exceed 370 Bq/kg, that is consistent with the requirements of SBN B.1.4-1.01-97 «System of norms and regularities for the reduction of the level of ionizing radiation of natural radionuclides in construction. Regulated radiation parameters. Permitted levels» and SBN B.1.4-2.01-97 «System of norms and regularities for the reduction of the level of ionizing radiation of natural radionuclides in construction. Radiation control of building materials and construction objects» [18, 19].

The systems of cold and hot water supply, household-and-domestic sewage were provided by the project in the residential premises of one-room «smart» flats for the residence of one person.

Improvement of the adjacent territory and technology of management with solid household waste (cleaning of the total adjoining territory of the houses, organization of collection, storage, and removal of solid waste) has been designed in accordance with the requirements of «State sanitary norms and regularities of the maintenance of territories of the settlements. SSanRN № 145-2012» [20].

After commissioning of designed house, for the ensurance of radiation safety for the residents, the recommendations on the study of the power of doses

of gamma radiation in the premises of the residential complex for compliance with the sanitary norm – 122 pGy/sec (50 µR/h) absorbed in the air and the determination of the the compliance of average annual equivalent equilibrium activity of radon-222 in the air of the premises for a hygienic norm is 50 Bq/m<sup>3</sup> with the requirements of SBN B.2.2-15-2005 [13], have been developed.

### Conclusions

On the basis of performed hygienic research of the design of modern dwelling-houses with one-room flats of «smart» type for the residence of one person, taking into account domestic and foreign experience in terms of the normalization of the minimum area of one-room flats (SRN 2.1.2.1002-00, SRN 31-02-2001, SP 55.13330.2011, TKR 45-3.02-230-230-2010, SNR RK 3.02-27-2004), it is possible to state the following:

1. There is no practice and relevant regulatory documents for the design of one-room flats of a small area for one person's residence in Ukraine;

2. The minimum limit of the area of one-room flat per one person at the level of 18 m<sup>2</sup>, coinciding with the current norms (standards) in the European and the post-Soviet countries, has been proposed for the normalization in Ukraine by the basic project institute of the Ministry of Regional Development of Ukraine – the State Enterprise «Ukrainian Research and Design Institute of Civil Construction»;

3. The following sanitary-and-epidemiological component has been developed for the design of «smart» flat in modern dwelling-houses:

□ for the prevention of the infectious diseases and accumulation of the population, the standards of density of development should not exceed the parameter of 500 people per hectare;

□ in order to ensure compliance with the regulatory parameters of the microclimate and the air quality in the living room, it is recommended to separate the kitchen area in the living rooms by the fitting out of the kitchen-niches with the electric cookers only and the equipment

for centralized mechanical plenum-exhaust ventilation;

□ in order to ensure the volume of living space at the level of domestic norms of 75 m<sup>3</sup> it is recommended to accept the height of residential premises of 2.75 m;

□ to provide a set of premises with an area of living room – 18 m<sup>2</sup>, corridor – 3.9 m<sup>2</sup>, bathroom – 3.4 m<sup>2</sup>, balcony/loggia – 4.5 m<sup>2</sup> for the increase of the level of comfort;

□ to ensure optimum living conditions it is necessary to observe domestic hygienic standards: the duration of insolation and natural light, the permissible concentrations of chemicals in the air, the permissible levels of temperature, velocity, humidity, ionization of air, noise, vibration, ionizing and non-ionizing radiation, aerosols in the indoor air, including aerosols of biological origin, bacterial air pollution and surfaces, and others.

The introduction of designed residential flats for one person is performed with the obligatory carrying out of field studies of all parameters of the biological, chemical, and physical factors of the internal living environment for the compliance with the requirements of the current sanitary legislation of Ukraine.

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Надійшла до редакції 16.12.2018