РЕГІОНАЛЬНІ ТА ГЛОБАЛЬНІ ЕКОЛОГІЧНІ ПРОБЛЕМИ

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THE CONSTRUCTIVE ECOLOGY – THE THEORETICAL BASIS OF ECOLOGICAL SAFETY

The constructive environment – is a new scientific field of Earth's Sciences, which not only evaluates the environment, but also offers specific technology protection measures to optimize and improve the environment through the design of natural-technical systems which are used to change the biosphere, providing sustainable harmonious development of man-nature-technosphere.

The article considered environmentally and assess the main components of the environment – that are: lithosphere, geophysical fields geomorphosphera, hydro- and atmosphere, soil and vegetation, their changes under the influence of technosphere, the spatial distribution of the main pollutants in connection with landscapes creates qualitatively new formation – the geological structures. It opens the new method – zoning areas based on their different hierarchical levels of industrial enterprises, settlements, united local communities, administrative districts and regions states Ukraine, Carpathian Euroregion and the European Union that makes it possible to offer unified for all these hierarchical territorial levels computerized constructively-ecological system of environmental safety.

Keywords: constructive environment, natural and anthropogenic geosystem, environmental auditing, environmental impacts assessment, monitoring, modeling and forecasting of the environment, environmental risk, safety, geoinformational system.

Конструктивне середовище – це новий науковий напрям науки про Землю, який не тільки оцінює навколишнє середовище, але і пропонує конкретні заходи, щодо захисту технологій для оптимізації і поліпшення навколишнього середовища, шляхом розробки природно-технічних систем, які використовуються для зміни біосфери, забезпечуючи стійкий гармонійний розвиток людини і природи-техносфери.

У статті розглядаються екологічні оцінки основних компонентів навколишнього середовища: літосфери, геофізичні поля геоморфосфери, гідро- і атмосфери, грунту і рослинності, їх зміни під впливом техносфери, просторовий розподіл основних забруднюючих речовин з ландшафтами створюють якісно нове утворення – геологічну структуру. Це відкриває новий метод – зонування районів на основі їх різних ієрархічних рівнів промислових підприємств, населених пунктів, об'єднаних місцевих громад, адміністративних округів і регіонів держави Україна, Карпатського Єврорегіону та Європейського Союзу, що робить можливим пропозицію єдиної для всіх цих ієрархічні рівнів територіальну комп'ютеризовану конструктивно-екологічну систему екологічної безпеки.

Ключові слова: конструктивне середовище, природні та антропогенні геосистеми, екологічний аудит, оцінка впливу на навколишнє середовище, моніторинг, моделювання і прогнозування стану навколишнього середовища, екологічний ризик, безпека, геоінформаційна система.

Конструктивная среда – это новое научное направление науки про Землю, которая не только оценивает окружающую среду, но и предлагает конкретные меры по защите технологий для оптимизации и улучшения окружающей среды путем разработки природно-технических систем, которые используются для изменения биосферы, обеспечивая устойчивое гармоничное развитие человека и природы-техносферы.

В статье рассматриваются экологические оценки основных компонентов окружающей среды: литосферы, геофизические поля геоморфосферы, гидро- и атмосферы, почвы и растительности, их изменения под влиянием техносферы, пространственное распределение основных загрязняющих веществ вместе з ландшафтами создает качественно новое образование – геологические структуры. Это открывает новый метод – зонирование районов на основе их различных иерархических уровней промышленных предприятий, населенных пунктов, объединенных местных общин, административных округов и регионов государства Украина, Карпатского Еврорегиона и Европейского Союза, что делает возможным предложить единую для всех этих иерархических уровней территориальную компьютеризированную конструктивно-экологическую систему экологической безопасности.

Ключевые слова: конструктивная среда, природные и антропогенные геосистемы, экологический аудит, оценка влияния на окружающую среду, мониторинг, моделирование и прогнозирование состояния окружающей среды, экологический риск, безопасность, геоинформационная система.

The main problem. The search for a universal paradigm (concepts, methodology) that brings numerous approaches to determining environmental safety as areas and economic facilities led to determine the careful approach the accurate determination and identification of existing concepts and the limits of their unique use of both scientific and and in practical areas. As a result of a decade of research, we have found, we believe, the most acceptable form of interaction of these concepts came over reflected in the proposed model below constructive environment. We proceeded from the fact that "ecology – is the ability to live in his house" because the model will be similar to the schematic design of the building. But it will go lower on the units. Describing the problem of ecology and environmental safety in general, we note that today more than ever, it is important to ensure harmonious development of the economy, people and nature to technical intervention in the biosphere of Earth [4, 5] does not hurt the quality of the environment in which people live. We are witnessing not only active and controversial political battles, in which environmental information is used, but also displays a low ecological culture and ecological ignorance even as ordinary citizens and leaders of industry and employees of power structures. Figuratively speaking, not only lack of clean water and air, but also the basic ecological knowledge. This fact leads us to propose a new strategy for environmental safety and sustainable use of natural resources, which have already been discussed in previous publications [3, 7-9, 11, 15]. Analysis of recent research and publications in which a solution of the problem to which the author refers. The given researched were held by: O. Adamenko, Y. Adamenko, L. Mishchenko and D. Zorin [11, 38]. They designed a computerized system of environmental safety (KSES) using GIS, remote sensing and IT systems based on geoecological zoning of natural and anthropogenic geosystems (NAG). Environmental (natural and manmade) safety – is the definition and justification of the degree of compliance with existing or predicted environmental conditions to international standards of environmental quality, the task of preserving human health, protect and restore the environment. Environmental safety combine natural and technological components and should ensure the harmonious development of economic system Nature-Man (passport of the specialty 21.06.01 – ecological safety, the Department approved certification of highly qualified Ministry of Education and Science of Ukraine).Geo-ecological zoning areas [19] (natural and anthropogenic geosystems – NAG) – is a special kind of organizing, the essence of which is the division (partition) on the territory of studies or equivalent hierarchically subordinate NAG. Highlighted in the zoning taxa, on the one

hand, must meet the criteria of their specificity, the other – the criterion of unity, integrity. Natural and anthropogenic geosystem [1] – is a geoecological structure that combines the natural (landscape) framework and its changes under the influence of anthropogenic (man-made) loads. Bold unsolved before parts of the problem, which is dedicated to this article. Unresolved parts of the general problem discussed above, is to build a constructive and ecological models of ecological safety, which would be based on constructive ecology together all the above concepts: natural anthropogenic system, environmental audit, strategic environmental assessment, geo-ecological zoning, impact assessment about man-made objects in the environment, monitoring, modeling and forecasting of the environment, environmental risk, safety, computerized geographic information systems, environmental safety and others.

The results and discussion. The purpose of this work is the theoretical foundation of a new scientific field of Earth's Sciences that is – constructive environment. First of its allocation O. Adamenko wrote [4, p. 189-223] in the fourth chapter of "Constructive environment" as his fourth novel life science and love "Our future home – Ekoeurope" in 2007 in the monograph G.I. Rudko and O. Adamenko "Constructive geoecology" [28 p. 29-60] extended theoretical and practical study of this period, and in 2014 an academic publishing «Lambert» (Saarbrucken, Germany) published a monograph O. Adamenko [9, 122 pp.] "Constructive ecology". Under this name the new list of specialties of higher educational institutions appeared in 2015 a new specialty. This old name of "Ecology and Environment" remained in the list titled "Ecology". So it makes sense to use what it will go lower as justification specialty "Technology of Environmental Protection." On this subject O. Adamenko published in 2012 and 2013 articles in professional journals "Environmental security and sustainable resource using" – 2012, – number 1 (5), p. 14-19 [6] and 2013 – 1 (7), p. 5-9 [7] entitled "Technology Environmental Research" and spoke of the same name at the plenary session of the International Scientific and Practical Conference September 21, 2012 in Ivano-Frankivsk city. The article, which was published in Symfiropol [8] was posted on the Internet and attracted the attention of academic publishing «Lambert» (Saarbrucken, Germany), which also offered O. Adamenko prepare and publish a monograph "Constructive ecology" [9].

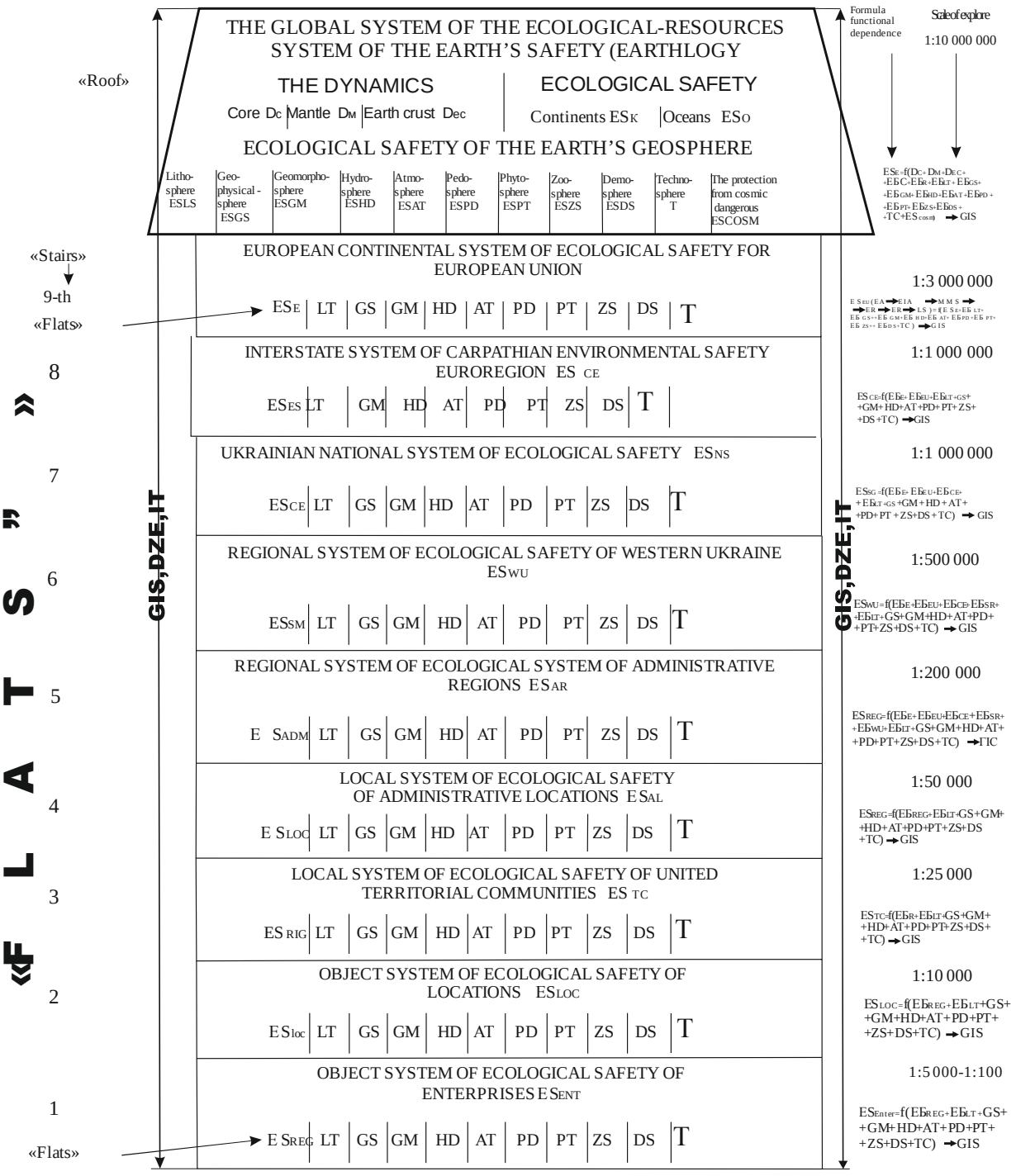
Briefly speaking tabular form "constructive environment" as "environmental technology" is shown in Pic. 1. Such a system grounded in the decisions of international conferences on the environment in Stockholm (1972), Nairobi (1974) and Riga (1978), which is written in the writings of J. Gerasimov [14], Y. Izrael [35], R. Mann [36] and others [37]. The disadvantage of the proposed global monitoring system is not complete consideration of all environmental components of the Earth, especially its interior geosphere – that is core, mantle and crust. The main targets are the Global Monitoring (*GM*) atmosphere (*AT*), hydrosphere (*HS*) and soil – pedosphere (*PD*). Not taken into account geophysical fields of Earth and Space – geophysical (*GF*), vegetation – fitoshere (*FT*) and fauna – zoosphere (*ZS*), the health of the population – demosfery (*DS*) and cosmic danger – protecting Earth from asteroids and meteorites (*EScos*), and to a lesser extent – the ecological status of the geological environment – lithosphere (*LT*) and exogenous and relief – geomorphosphere (*GM*). Therefore our suggested model (Pic. 1) Ecological building – is the house in which we should be able to live under its "roof" we place all the major features of the dynamics of Earth and its environmental safety. Details of this we wrote in the book G. Rudko and O. Adamenko "Earthlogy" [29, 512 pp.], which was published in 2009.

Key indicators structural calculations Ecology and Environmental Safety

$$ES=f(EA\rightarrow EIA\rightarrow MMF\rightarrow ER\rightarrow LS\rightarrow GIS, DZE, IT)$$

Ecological audit – strategic environmental assessment of the current status and the current environmental situation *EA-SEA*:

$$EA=SEA=f\ (E_{st},, E_{sit})$$



Pic 1. Structural and ecological model of environmental security and sustainable development of the Earth, Evropkyskoho Union Carpathian Euroregion, the State of Ukraine and its Western region, administrative regions and districts, united local communities, settlements and industrial, agricultural and other enterprises

Ecological condition (E_{con}) components of natural and anthropogenic geosystems (*NAGS*): lithosphere (geological surrounding) *LT*, geophysical sphere *GP*, geomorphosphere *GM*, hydrosphere *GD*, atmosphere *AT*, pedosphere *PD*, phytosphere *PT*, zoosphere *ZS*, demosphere *DM*, technosphere *T*:

$$E_{st} = \underset{\text{normal}}{TPI_1} = \underset{\text{strained}}{TPI_2} = \underset{\text{satis.}}{TPI_3} = \underset{\text{complex}}{TPI_4} = \underset{\text{unsatis.}}{TPI_5} = \underset{\text{pre-crisis}}{TPI_6} = \underset{\text{crisis}}{TPI_7} = \underset{\text{catastrophic}}{TPI_8}$$

Ecological situation (E_{sit}) – mosaic of E_{st}

TPI – total pollution index:

$$TPI = C_{i1}/C_{b1} = C_{i2}/C_{b2} = \ldots C_{in}/C_{bn}$$

C_{i1}, C_{i2}, C_{i3} …… C_{in} – contamination of pollution in specific points

C_{b1}, C_{b2}, C_{b3} …. C_{bn} – regional geochemical backgrounds pollutants

$C^T_b = C_{bn} - C^N_b$ technogenic component of the background C^T_b = general background (C_{bn}) minus component of natural background (C^N_b):

$$TPI = C_{i1}/C_{b1} + \ldots C_{in}/C_{ib}$$

$$EA_{ter} = SEA_{ter} = E_{sit} \rightarrow GIS_1$$

EA_{ter} – Environmental audit of the territory = $SEA_{ter} = GIS_1$

Geo-ecological zoning (GE_{ter})

GE_{ter} – set of environmental spatial structures of different ecological condition

GE_{ter} = mosaic that consist of TPI^{T1}, TPI^{T2}, TPI^{T3} ….. TPI^{Tn}

$GE_{ter} = TPI^{T1} / LS$ – geoecological structure: over zone, zone, subzone, stripes concentration, scattering strips, ellipses, ovals, source, etc.

$$GE_{ter} \rightarrow GIS_1$$

Environmental impact assessment of man-made objects (EIA) [38]:

$$EIA = f\,(T/LT, T/GP, T/GM, T/HS, T/AT, T/PS, T/PS, T/ZS, T/DS \rightarrow GIS_2)$$

$$T = f\,(TPI_{HM}, TPI_{RS}, TPI_{OP}, TPI_{MF}, TPI_P \ldots TPI_N)$$

HM – heavy metals, *RS* – radioactive substances, *OP* – oil products, *MF* – mineral fertilizers, *P* – pesticides, *N* – other pollutants.

Monitoring, modeling, and forecasting environmental (MMF):

$$EA_1 \rightarrow EA_2 \rightarrow EA_3 \ldots\ldots EA_N \rightarrow GIS_3$$

Environmental risks (ER)

$$ER_{Territory} = f\,(ER_{LT}, ER_{GP}, ER_{GM}, ER_{HS}, ER_{AS}, ER_{PS}, ER_{PS}, ER_{ZS}, ER_{DS}) \rightarrow GIS_4$$

Life Safety of the Population (LS)

$$ESEC \rightarrow LSP \rightarrow GIS_5$$

The example of the Environmentally safe limits of human

Environmentally safe concentration range-pollutants for normal development Geosystems (ESEC), so:

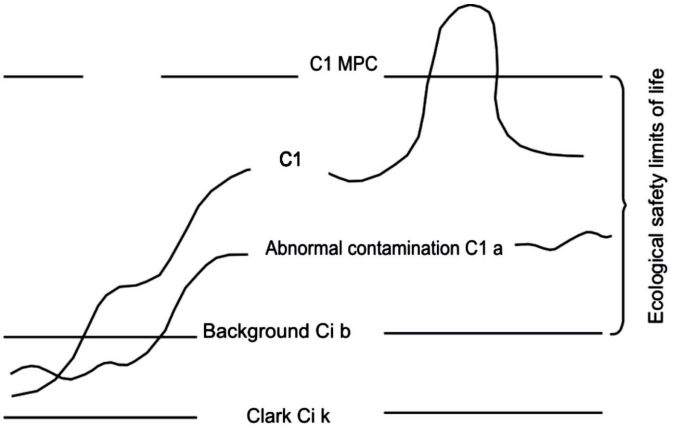
$$ESEC = \sum_{1}^{n} \frac{(TPI_b + 0{,}1TPI_b) - TPI_i}{TPI_b^i},$$

ESEC – environmentally safe existence concentrations by intervals;
n – the number of pollutants;
0,1TPIb – ten percent excess of the sum of background contamination, and the element (substance);
TPIi – total pollution index, and the element (substance);
TPIib – background pollution and the total figure, the element (substance);
TPIb calculated by the formula:

$$TPI_b = \sum_{i}^{n} \frac{C_i}{C_b}; \quad (1)$$

TPI_i by the formula:

$$TPI_i = \sum_{i}^{n} \frac{C_i}{n}. \quad (2)$$



Using databases and computer programs proposed new, we can calculate the forward indicators EC_{LS} and *ESEC* areas for placement of oil and gas fields and image results graphically.

Geographic information system of the study area for the assessment of environmental safety:

$$GIS_{ter} = GIS_1 + GIS_2 + GIS_3 + GIS_4 + GIS_5$$

Structurally-ecological model of territorial environmental security and sustainable development of Earth, European Union, Euro Carpathian region, State of Ukraine and its Western region, administrative regions and districts, united local communities, localities and enterprises:

$$ES_{ter} = f\ (ES_E + ES_{EU} + ES_{ECR} + ES_{SU} + ES_{WR} + ES_{AR} + ES_R + ES_{ULC} + ES_L + ES_E)$$

The importance of inclusion in the global system of environmental and resource security of the Earth (EB_E) its internal geosphere and space security (*EBcos*) based on the fact that the ecological status of surface Geosystems – is continents (*EBq*) and oceans (*EBo*) and endo- and ekzodynamic topography of the Earth's crust – the geomorphosphere depends on movements earth's core and its solid inner sphere which "floats" in half sparse external field. Physical-chemical and radioactive processes in both areas of nucleur can affect the speed of rotation

around the axis of the Earth's tilt axis to the orbital plane, that the surface of the planet manifested in migration poles, changes in magnetic, gravity, electromagnetic and other physical fields, magnetic inversion zones etc. On the other hand, some external displays endogeodynamical on Earth (Chilean earthquake with a magnitude of 8.5 tsunami December 24, 2004 in the eastern Indian Ocean, and others) gave measuring displacement of the earth's axis by several arcseconds. Space danger in recent years came from the care scientific fiction and became a member of fledged scientific organization and general security of our planet. It is the location of Earth orbiting in the solar system (150 mln. km from Sun), between the orbits of Venus (108.2 million km from Sun) and Mars (227.9 million km.). It guarantees the emergence of the biosphere and the safety of life on Earth, because our planet's surface pressure of 1 atmosphere and the average temperature slightly above 0^0C + increase it to 15^0C due to greenhouse effect in the surface layer of the atmosphere. Earth is protected from the harmful for all living hard ultraviolet radiation, so-called solar wind – is a stream of helium nuclei from the Sun – Earth's magnetic field. As a result of this protection are two radiation belts at a distance of 14 and 90 thousand. km of Earth and the solar wind flows around deviate from our planet's magnetic field. Radiation is at an altitude of 300 to 500 km up to thousands of X-rays as the International Space Station (ISS) do not fly above 300 kilometers from Earth, not to build them thicker protective walls that dramatically increase the weight and value of the ISS. And so, Earth, its position in orbit around Sun, and the magnetic field is protected from dangerous space. But this defense shield is not continuous, but rather a fragile membrane that connects us with the interplanetary space. And this protection can not operate at any time if the inner core – generator of earth's magnetic field – change the speed or other parameters of its rotation around the axis of the planet. Another danger – is the change in the parameters of Earth (eccentricity, "flicker" axis etc.) due process of Sun, or interference with the position of the Earth in orbit by collision with large meteorites, asteroids or comets, as once was in the geological history of Earth. What else cosmic dangers threaten us? Not only is the solar wind, and other ionizing radiation constantly cover Earth, and periodic or sporadic radiation arising in super-new stars and which have already been recorded in the annals repeatedly and historical observations of our ancestors and scientists last centuries. Meteorites can reach Earth from meteorit belt located between Mars and Jupiter, asteroids – from the Oorta cloud, which revolves around the sun in beyond the orbit of Pluton, at a distance of several billion. km of our star and comet – is from the Kuiper Belt, located at very distant solar systems of the periphery, in the hundreds of billions. km of Sun. Do not forget also about the "space debris" – a remnant of the ISS, satellites and missiles are not always burn in the atmosphere, closer to Earth, and often fall on its surface in unexpected places, as has happened many times with artificial space about 'the objects of the USSR and the USA. Thus, the danger of space is a major cause of global insecurity Earth (EB_E in Pic. 1) and it should be at the center of our attention. To do this under the auspices of the UN to create an interstate service identification, supervision and protection of Earth from dangerous space objects, not forgetting the terrestrial source of global physical fields super with a magnitude 7-8 earthquakes and tsunamis which may affect the stability of the core and facilities super giant technical objects on the surface of the crust – is the deep pits in the hundreds and thousands of meters of high-rise hydroelectric dams, metropolis with a population of 10-20 million. inhabitants etc. etc.).

European continental system of ecological security of European Union EB_{EU} (Pic 1) is proposed by the author of this article in 2011 [5] and justified several times [9, 11, 15]. Therefore there is no need to write about it in detail. It is based on quantitative measurement of contaminants in soil, air, surface water and vegetation and is function of the ecological state of not only these four, and all nine components of the environment (*BP, GF, GM, GC, AT, AP, FT, AP, DS*) and anthropogenic pressure (*T*) on them. This takes into account also the state of environmental and resource security EB_E Earth and environmental condition evaluated all components of a procedure for environmental safety, environmental auditing that *EIA* assessment of the impact of man-made objects in the environment *EIAs*, monitoring, modeling and forecasting environmental *MMF*, environmental risk *ER* and life *BC* (Pic. 1). General system

of continental security of the European Union is built using GIS, remote sensing and IT. Interstate system environmental safety of Carpathian Euro-region ES_{EU} (Pic. 1) was first developed back in 2003 in a thesis project D. Zorin and O. Adamenko published in 2008 [28]. It is built on the same principle as the EB_{EU}, that includes a system of environmental and resource security of Earth EB_E, ecological security of the European Union ES_{EU}, environmental status of all nine components of the environment (*LT, GF, GM, HS, AT, PS, FT, ZS, DS*, the impact on them technosphere *T*) and all procedures – the environmental safety components (*EA, EIA MMF, ER, LS*), "stitched" geographic information system (GIS, remote sensing, IT).

Ukrainian national system of environmental safety ES_{UN} (Fig. 1) the least developed, despite the fact that the publication for its rationale appeared in the works of A. Marynich and P. Shyshchenko [18], L. Rudenko [30], V. Baranovsky [12], O. Adamenko [9, 11, 15], G. Rudko [28] and others. The fact that these works provided the general characteristics of the ecological situation in Ukraine, without naming specific observation point – geo-environmental grounds, which would be determined environmental condition of the geosystem's components. Only on surface waters published their environmental monitoring system [21]. Therefore, the job of making space system ES_s should continue in accordance with structural and environmental model (Pic. 1). Regional system of ecological safety of Western Ukraine ES_{WU} (Pic. 1) developed by L. Mishchenko [19, 20] based on 1441 geoecological landfill – sampling points of soil, surface and groundwater, air and vegetation. Done several thousand analyzes the content of components of the next contaminants – heavy metals, radionuclides, pesticides, excess fertilizers, petrochemicals and others. As a result of computer processing of environmental information relevant built database, based on them – hundreds of unit component-wise and environmental-technogeochemical maps, geo proposed zoning of 172 new geo-structures – zones, subzones, stripes, ranges, ovals, ecological-geochemical barriers, sources, fires and others. For each geo-ecological complex structure developed by individual conservation measures. Rather important is separation procedure, that means separation from the natural technological component in the total index of pollution. Research results published by L. Mishchenko also in other work of O. Adamenko [4, 6, 8, 11] and the Department of Ecology IFNTUOG [15]. Regional systems of ecological safety ES_{ar} administrative regions (Pic. 1) elaborated O. Adamenko and D. Zorin examples of areas in the Ivano-Frankivsk region [15] using materials of M. Prykhodko [25] and Zacarpathian, Lviv and Ternopil regions [9] using materials of O. Pobigun [23], L. Mishchenko [19, 20], V. Trysnyuk [32], S. Popa [24] etc.

In ecological systems environmental security are widely used data monitoring studies of regional hierarchical level (from 120 to 200 points of observation changes the ecological state of soil and groundwater, sediments, air, precipitation of rain and snow, and others. The basis is for incremental (2001, 2006, 2012) the environmental situation maps serve landscape and landscape-geochemical maps, together with maps spread of pollutants up spatial geo-ecological zoning on which developed concrete recommendations for further environmental protection: long-term environmental program for five years, regular or urgent (urgent) action. Local systems of ecological safety of districts ES_d (Pic. 1) based on environmental studies, scale 1:50 000 to geo-ecological landfills guestrooms in the territories of districts ranges from 80 to 200, depending on the area of the district, which can vary from 700 to 1 500 km^2. EB_r first system developed in 2000 for Snyatyn district of Ivano-Frankivsk region led by L. Mishchenko and O. Adamenko [2]. Then the work continued by V. Trysnyuk [32] for Husyatyn region, A. Penderecky [22] for Galich region, V. Skrypnyk [31] for Nadvirna region, O. Adamenko, L. Mishchenko and D. Zorin [11] for Tysmenytzja, Monastyrsk, Buchats and Zalischyky regions, I. Trysnyuk [33] for Shumsky and Kremenets regions, L. Branch [13] for Chortkiv and Borshchiv regions. Most fully implemented, these studies K. Radlovska [26, 27] for the territories of Rohatyn and Bogorodchany regions in 2011-2015. In the district environmental safety system incorporated the same principles as in the past – region. Change is the scope of research – from 1:200 000 to 1:50 000 and their detail. Difficulties arise only when performing environmental monitoring, as requirements for local level monitoring national standards do not yet exist. Therefore, this work

is carried out or on the initiative of scientific institutions and universities, or on the initiative of individual researchers in the preparation of theses. Sometimes monitoring studies in the territories of districts funded from environmental funds areas, as it was in 1999-2001. Unfortunately no regional or district administrations have not yet realized the need to perform such studies.

Local systems of ecological safety of communities united EB_{lc} (Pic. 1) first proposed by K. Radlovska in 2015, first in her thesis, and in the book "Local environmental monitoring for administrative districts and local communities "[27]. This data, when starts in Ukraine administrative-territorial reform is especially important: rural communities voluntarily integrated into the local communities, who transferred from district councils, and most of the regional and the central government in Kiev many powers, including budget. There decentralization authorities at all levels. For example, in the Ivano-Frankivsk region, within the 14 administrative districts created voluntarily united 53 local communities. K. Radlovska performing geo-ecological zoning of Rohatyn and Bogorodchany regions ecologically substantiated excretion in the first three communities (Rohatyn, Nyzhnolypetsk and Bukachivsk) and five communities in the second (Bogorodchany, Starobogorodchany, Solotvyno, Starunja and Yablunza) areas. The area of these municipalities merged reflect the geo-structures – scattering geo stripes, stripes Geoecological concentrations that have been marked by K. Radlovska [26, 27] at geoecological zoning. That combined each local community has its own geo-ecological justification as its argument Natural selection, as stressed by O. Adamenko [10]. Object security system of ecological settlements ES_r (Pic. 1) developed by the example of Ivano-Frankivsk in 2001-2004. O. Adamenko, E. Kryzhanivsky, E. Neiko, G. Rusanov, L. Mishchenko, A. Zshyravel and N. Koltsov [3]. This work was one of 15 projects – winners, selected and funded by the World Bank with the submitted 2001 in Ukraine 462 innovative ideas. The authors created the computerized system of environmental safety (CSES). CSES includes:

- databases of different levels of morbidity in different neighborhoods of the city 28 diseases in accordance with applicable international classification of diseases (ICD);
- database on pollution of soil, surface and groundwater, air and vegetation, heavy metals, radionuclides, oil, etc .;
- computer maps the current state of the geological environment, geophysical fields, geomorphosphe, landscapes;
- 12 ingredients chemical electronic maps showing the contamination of soil, hydrosphere, atmosphere and phytosphere;
- map showing the current state of the technosphere city, where at that time were 80 enterprises;
- correlations between diseases and the degree of transformation of the environment.

The work was based on 248 points of samples using topographic maps of 1:10 000. In 2014 our materials were re-treated by M. Kryhivsky [17] using mathematical software that confirmed the high degree of correlation with morbidity environment. The same results were also obtained by N. Fomenko [34] at dissertation project. Object of ecological security system of the enterprises ES_e (Pic. 1) developed by L. Mishchenko [19, 20] under the direction of O. Adamenko [11, 15] in 2003-2005. such work it was made, for example for the enterprise "Ivano-Frankivskcement". It was chosen observation network, which includes 16 profiles 77 Geoecological polygons – that means the points where selected samples of soil, air, surface and groundwater and vegetation to determine the contamination by various chemicals. Research carried out on the basis of topographic maps of 1:10 000 and satellite images. As a result, the area of enterprise contains four environmental conditions: normal, solid, intense and complex. Built-element component-wise and environmental-technogeochemical maps that characterize the interaction of two components – natural landscapes and man-made pollution. In this form the new structures – geo-environmental and geo-environmental concentrations band dispersion, which is 1 order geoecotype structures that meet landscaped areas. On their background appear smaller geoecological structure 2 order – geoecological units and ellipses are not always

confined to the particular landscape structures, as is the case with bands, areas. Even less connection with the landscape geoecological units have sources of pollution that are geo-structures geoecotype of 3 order. They correspond to the contours of contamination of soil, air, groundwater and vegetation, which do not always coincide with each other. Therefore, the study of the ecological state in the territories of industrial enterprises must carry out their detailed assessment and design according to your unique set of environmental measures.The object of environmental safety of industrial, agricultural and other enterprises is lower link – lower "floor" of our proposed structural and ecological model of environmental safety.

The findings of this study and perspectives. Constructive ecology as a new scientific field research in Earth sciences only "gaining momentum", subject to the overall system analysis paradahmi Geosystems, which raised anthropogenic interference with the course of natural processes. With the proposed author structural and ecological model of environmental safety can be concluded that sustainable development in the containment of global development in a slow global warming above 2% for the twenty-first century as it was adopted in December 2015 in Paris, 198 countries, should based on the harmonization of relations in the triad nature-economy-man. This harmonization is scientifically sound management (environmental management) complex natural and economic-social system based on reasonable limit their needs to the environment restored, developed economy, and people feel comfortable and provide a similar development for future generations.

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ДО ІСТОРІЇ ПРИРОДНИЧИХ ТА ГЕОЕКОЛОГІЧНИХ ДОСЛІДЖЕНЬ ПОДІЛЬСЬКОГО ПРИДНІСТРОВ'Я У ЗОНІ МАГІСТРАЛЬНИХ ГАЗОПРОВОДІВ

Досліджено історію вивчення впливів магістральних газопроводів «Союз» та «Прогрес» на навколишнє середовище на ділянці від м. Гусятина Тернопільської області до м. Богородчани Івано-Франківської областей.

Ключові слова: геоекологічні дослідження, компресорні станції, магістральні газопроводи, грунти.

Исследовано историю изучения влияния магистральных газопроводов «Союз» и «Прогресс» на окружающую среду на участке от г.Гусятина Тернопольськой области до г. Богородчаны Ивано-Франковской областей.

Ключевые слова: геоэкологические исследования, компрессорные станции, магистральные газопроводы, почвы.

It explores the history of the study of the influence of the main gas pipelines "Soyuz" and "Progress" on the environment in the area from Gusyatina Ternopolskoj areas to the city Bohorodchany Ivano-Frankivsk regions.

Keywords: geo-ecological studies, compressor stations, gas transmission pipelines, soil.

Актуальність проблеми. Визначення впливу магістральних газопроводів на довкілля досліджено на території Гусятинського, Чортківського, Борщівського та Бучацького районів Тернопільської області та Тисменицького і Богородчанського районів Івано-Франківської області, тобто в межах Подільського Придністров'я та Прикарпаття. Такі дослідження важливі, тому що газопроводи – техногенно небезпечні об'єкти, особливо, в умовах досить густого заселення цих аграрних районів.

З історії досліджень. Ці терени були заселені нашими предками досить давно. Культура розвивались тут від палеоліту до епохи трипілля. Наукові дослідження розпочались з XVII ст. Проаналізувавши існуючу з цього питання літературу [25, 34, 39, 41-54], Л. П. Царик [36] розпочинає огляд природничих досліджень з XVII ст., з етапу