

*Materials of Conferences***GEOECOLOGICAL ASSESSMENT  
OF MODIFIED GEOSYSTEMS  
OF BUILDING MATERIALS QUARRIES  
IN WESTERN SIBERIA**<sup>1</sup>Grebenyuk G.N., <sup>2</sup>Chernyavskiy E.A.,<sup>1</sup>Lugovskoy A.M.<sup>1</sup>*Tyumen research and planning institution of oil  
and gas, Tyumen, e-mail: grebenuk@tnipi.ru;*<sup>2</sup>*Moscow State Teachers' Training University, Moscow,  
e-mail: alug1961@yandex.ru*

Remediation of sandpits in Russian northern taiga and forest tundra is considered as a process of modified geosystems formation caused by combination of natural self-regeneration and anthropogenic introduction. Results of physical and chemical monitoring show intensity of geochemical processes in sandpits of different age. Methods of bio-indication were used to find out technological scheme of reclamation that allows to reduce time lag and costs of natural-technogenic geosystems formation. The results of research are recommended for use at the municipal level of territorial administration in case of remediation process formation and environmental planning. The reclaiming of anthropogenic geomorphological areas are directed to the formation of manageable artificial intrazonal geosystems, different from the initial succession stage.

Development of oil and gas bearing industry, building of settlements in Western Siberia has brought a great number of sandpits and demanded exploration of new ones. The result of violent extracting of sandpits is a problem of mined-land reclamation. In this way an actual line for research is a comparative analysis of reclamation efficiency for anthropogenic geomorphic landforms of oil-production such as dredged and dry-excavated quarries, well pads and sludge pits. The main term of mining is to return to land-owner the disturbed area recovered up to assigned conditions according to the land-use category. Working regulations and methods of reclamation are broad-based and do not consider specific character of the explored area nature. Whatever, particular features of North's environment requires close scientific study of succession processes in land reclamation.

Practical basis for theoretical statements of geosystematic approach in technogenic ecosystems management is formed with investigation of modern technological diversity of different-aged sandpits, which considered in diverse natural, climate and geoecological patterns of geodynamic system formation associated with impact of natural and anthropogenic factors in changing conditions of temperature and hydrological balance. It may help to avoid a great negative impact of industrial activity on the environment, enhance the efficiency of manufacturing process, reach a new quality level of area management due to optimization of natural processes, and create conditions for harmonizing a number of elements of industrial geosystem with the help of implementing differential technical methods in sandpit exploration at a realignment stage [1, 2, 4].

The aim of our research was to work out technological methods optimizing the reclaiming pro-

cess and increasing the environment comfort based on a complex geological analysis of soil condition and functioning of model sandpit areas for projects managing geosystem functioning.

The tasks stated to reach the aim were as follows: to reveal the stages of succession processes and objective geosystemic properties (disentropy, dissipation, organization, complexity, productivity, emergency, stability) basing on the dynamics to optimize the reclaiming process; to carry out a joined analysis of the results of the complex methods used to estimate the conditions of sandpits in order to rate the effect of anthropological processes, together with the natural process of regeneration; to estimate the thermal, hydrological, geochemical, and succession processes in multi-aged sandpits employing different renovating technologies; to work out a mechanism of prognostic modeling of anti-genetic complexes and methods of research to find out the operating regime for managing modified anthropogenic geosystems.

The object of our study is a number of sandpits in north-taiga and tundra climatic zones, as well as the efficiency of reclaiming activity due to compound methods of assessment and operating impact anti-genetic complex.

The research material was collected by the author from 2010 to 2012 during the complex study of sandpits in Tyumen Region, Khanti-Mansiyskiy and Yamalo-Nenetskiy autonomous okrugs.

To solve the study tasks we conducted route observations of 62 sandpits and made a component description of the environment and pollution indicators of the research territory. Geoecological research was carried out in accordance with the present regulatory documents.

To analyze the level of chemical pollution we tested soil in every meter up to 6 meters downwards. We also selected material to reveal high level of soil toxicity in laboratory and took groundwater to state chemical pollution level. Radiometric research were held in two stages: screening the territory to reveal radiation and defining the volume of dosimetric control at measuring the power of gamma radiation, which didn't exceed 0,6 mSv/h. Local radioactive abnormalities were not stated. The natural soil radionuclide activity was from 41 to 140 Bq/kg. According to the presence of natural nuclides the soil class is the first.

To estimate radon danger and state the number of radionuclides (according to согласно СИ 11-102-97) we sampled the ground at the 0,0-0,2; 3,0 and 6,0 meters.

The groundwater sampling was carried out according to the State Standard 51592-2000 «Water. General sampling demands». In bacteriological terms the waters are decent. However, groundwater at different depth has high pollution level, with the tendency to greater pollution the deeper groundwater.

Soil sampling for chemical pollutants testing was done in layers according to sanitary-epidemiological norms to soil quality 2.1.7.1287-03. The research revealed a number of typical chemical pollutants, as well as particles of formaldehyde, fluorine and cobalt. The analysis defined the category «clean».

We also studied the biological productivity of geosystems with the use of bioindicative methods in complex assessment of the environment and methods to describe successional stages at key areas. The basic study material, except authors' personal field and laboratory research, was obtained from the archives of industrial organisations, literary and cartographical resources.

On the basis of documentary study of the operational and reclaiming methods for sandpits, the author made a typology of geosystems using comparative-geographic, landscape-typological and cartographical methods. Together with the statistical methods we also employed the so-called method of purpose tree to reveal the main parameters of paradyamic complexes and methods of SWOT-analyses to state the risk and perspective of anthropological geosystem operation.

The literature study showed that most researchers and facts stated in the regulatory acts and methodic of reclaiming view it as a number of measures to recover the soil to its initial state after anthropological influence, so that it regains to its natural conditions and most suited to its primary nature management [3, 5, 7]. As most researchers agree, it is practically impossible because the geological environment, soil, hydrological regime and biocenosis are breached. A used-up sandpit is usually turned into a refuse dump for solid waste, a building site or a water body [6, 8, 9].

The new approach together with the traditional one should comprise the acknowledgement of precious experience of creating a different from zonal type anthropogenic system an effective management. The key factors should be the bioproductivity and complex component structure.

The results of recovering forest geosystem with the initial flowery components showed that brining in peat was ineffective for reclaiming soil covering because of the biological productivity of lower zones. But developing meadow vegetation leads to much greater biological formation comparing to zonal indexes [8, 9]. This fact confirms the refusal to employ traditional methods of reclaiming and the need to shift to the new ones – creating man managing complexes with exotic species and sinanthropus. We also resumed that peat could be substituted by compost and domestic waste with the following transformation into cereal and podded formations.

The reason for prairie and forest confrontation is the hydrological regime, blocking the movement of forest formations to the south. The results of deeper sandpits study showed that there were some changes to the unflattened scarps because of the water storage; move of the surface flow through the sandpit walls and increase its intensity due to the porosity of the underlying maternal rock. Water filtering leads to banks drainage and optimal conditions for roots nutrition during the flood period. The hydrological regime change leads to deformation of geochemical cycles and activation of geochemical exchange, what influences the soil formation process. Large amount of waters at a small territory results in thermal regime change, the warm period

in autumn and vegetation period last longer, phonological phases shift. Biocenosis structure becomes more complicated, as number of species rises and leads to intrazonal phytocenosis formation.

The reclaiming method without smoothing the slopes can be recommended for northern taiga and forest-tundra in Western Siberia, and can be used for working out technical recommendations and regulatory norms for reclaiming misbalanced territories. It may enhance the process of reclaiming, increase the profitability and decrease the cost of reclaiming at the final stage. As a result the sandpit environment will be optimized fastening geochemical cycles and rising bio-diversity.

On the basis of our research we come to the following conclusions:

1. The reclaiming of anthropogenic geomorphological areas are directed to the formation of manageable artificial intrazonal geosystems, different from the initial succession stage.

2. Setting the reclaiming methods should bear the zonal character, taking into account the optimality of anthropogenic transformations and the efficiency of natural regenerating processes in cryogenic zone conditions.

3. Refusal to smooth sandpit slopes increases the efficiency of drainage process of neighboring geosystems due to water and thermal regime activation and the acceleration of the successional process.

#### References

1. Babak N.A. Preventive assessment method, method of protection of natural and man-made systems and management during construction activities and utilities. Proceedings of the St. Petersburg State University of Railways, 2011. no. 3 (28). pp. 114-121.
2. Vasil'ev S.V. The impact of the oil and gas industry on the forest and wetland ecosystems [Middle Ob]. Novosibirsk, Nauka, 1998. 136 p.
3. Kondrat'ev K.Ya., Krapivin V.F., Phillips G.V. Pollution problems of the high-environment. St. Petersburg, Academy of St. Petersburg State University, 2002. 280 p.
4. Landscapes of the West Siberian permafrost gas provinces. E. Melnikov, L. Weisman, Moskalenko N. etc. Novosibirsk, Science, 1983. 166 p.
5. Melnikov E.S. Moskalenko N.G. Zoning of subsurface permafrost in Western Siberia for environmental purposes // hydrogeological and geotechnical studies of technogenic impacts on the geological environment. Moscow, VSEGINGEO, 1988. 15-27 p.
6. Melnikov E.S., Moskalenko N.G. Map of natural systems in the north of Western Siberia for geocryological forecasting and planning environmental measures during mass construction. Moscow, Head Department of Geodesy and Cartography, 1991. 6 p.
7. Guidelines for prediction of cryogenic physical and geological processes in the developed areas of the Far North. Moscow, VSEGINGEO (All-Russian Research Institute of Hydrogeology and Engineering Geology), 1981. 78 p.
8. Micro-focal processes as indicators of ecologically destabilized environment. Ed. Ed. Novikov N.M. Moscow, Academy of Agricultural Sciences, 2000. 193 p.
9. Moskalenko N.G. Anthropogenic vegetation dynamics of permafrost plains in Russia. Novosibirsk, Nauka, 1999. 280 p.

The work is submitted to the International Scientific Conference «Nature management and environment protection», France (Paris), 14-21, October 2012, came to the editorial office on 14.09.2012.