

Comparison of the definitions proposed by Special Task Force with the definitions of Ukraine Classification and instruction on their application for separate kinds of mineral resources

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Appendix I NEA/IAEA CLASSIFICATION SCHEME FOR URANIUM RESOURCES

Decreasing Economic Attractiveness ↑	Recoverable Costs	\$130- \$260/kg U	REASONABLY ASSURED RESOURCES	ESTIMATED ADDITIONAL RESOURCES I	ESTIMATED ADDITIONAL RESOURCES II	SPECULATIVE RESOURCES
		\$80- \$130/kg U	REASONABLY ASSURED RESOURCES	ESTIMATED ADDITIONAL RESOURCES I	ESTIMATED ADDITIONAL RESOURCES II	SPECULATIVE RESOURCES
		\$40-\$80/kg U	REASONABLY ASSURED RESOURCES	ESTIMATED ADDITIONAL RESOURCES I	ESTIMATED ADDITIONAL RESOURCES II	SPECULATIVE RESOURCES
		\$40/kg U or less	REASONABLY ASSURED RESOURCES	ESTIMATED ADDITIONAL RESOURCES I	ESTIMATED ADDITIONAL RESOURCES II	SPECULATIVE RESOURCES
			Decreasing Confidence in Estimates →			

1. This presentation continues the one we presented on the workshop 27-28 February Comparison of the definitions proposed by Special Task Force on UNFC revision with the Classification of the mineral reserves and resources of the State bowels of the earth Fund of Ukraine. We have taken with us several copies of this presentation, so you may study them.

In the previous table we compared:

- Proposals of Special task Force (demonstrate);
- Proposals of DKZ of Ukraine;
- Instruction on application of Classification for oil and gas fields.

Analysis which was carried out in February, allowed us to conclude that proposed revised definitions of major UNFC categories can be compared with those from current Classification of Ukraine, while UNFC's "umbrella effect" remains unchanged .

Moreover, proposed by Special Task Force the expression of the degree of geological studies through the characteristics of reserves (but not the stages of geological exploration works), approaches Classification of Ukraine to UNFC due to one and the same principle of reserves division on G axis.

2. For your attention is a table, where are outlined category definitions, applied in the Instruction on application of Classification for uranium and coal fields. The definitions taken from the Instruction on application of Classification for oil and gas fields are put in this table once again in order to facilitate process of comparing.

In order to avoid detailed characterizing of each category of reserves and uranium resources, you should concentrate your particular attention to the main important points.

2.1 The wording of definitions on economic efficiency axis for major E_1 , E_2 , E_3 categories as well as for $E_{1.1}$, $E_{1.2}$, $E_{2.1}$ subcategories can be linked with the classes of prime cost of U concentrate recovery, applied in IAEA Classification. Thus, to economically effective refer the reserves with the prime cost up to \$80/kg. To potentially economic and outbalance- with the prime cost of U up to \$130/kg.

The wording of definitions on geological studies axis considers the requirements of IAEA classification. Thus, G1 category by the degree of geological studies correspond to RAR (reasonably assured resources), G2, correspondingly, to EAR-1 (estimated additional resources), G3- EAR-2 (additionally estimated resources of category 2), G4-SP category (speculative resources).

Thereby, we have an opportunity to outline the ways to compare UNFC with the classification of IAEA.

In the future prime cost characteristics can be used for the classifying of other mineral (primarily, energy) resources as well.

In conclusion, I would like to repeat that “umbrella” effect of 3-d UN classification, based on digital codification of the classes of mineral resources, which are singled out, allows it to make up the base for Global Reporting Code about the use of mineral resources and reserves.

Table of Comparison of mineral reserves and resources category definitions, introduced into the instructions on application of different types of mineral resources.

Category	Uranium	Coal	Oil & Gas
E ₁	Quantities, which on the moment of estimation in accordance with technical-economic calculations can be economically and effectively recovered and used.	Quantities, which on the moment of estimation in accordance with technical-economic calculations can be economically and effectively recovered and used under conditions of modern production and enrichment technique and technology application, which ensure maintenance of the requirements of rational and complex use of all accompanying coal deposit mineral resources and components and environment protection.	Balance reserves (normally economic), which on the calculations moment one can, in accordance with technical-economic calculations, economically effective recover and use under conditions of current technique and technology of hydrocarbon raw materials production and refining application, that ensure observing demands of rational mineral resources use and protection of natural environment

Category	Uranium	Coal	Oil & Gas
E1.1	<p>Quantities, which on the moment of estimation in accordance with technical-economic calculations can be economically and effectively recovered and used under conditions of current uranium raw material production and processing technique and technology application, which ensure the maintenance of the requirements of rational and complex use of mineral raw materials resources and environment protection.</p> <p>The profitability of mining enterprise production, which is under project, has been determined by DKZ and exceeds the rate of National bank refinancing.</p> <p>The prime cost of production of U concentrate is less than \$80/kg.</p>	<p>The profitability of mining enterprise production, which is under project, has been determined by DKZ and exceeds the rate of National bank refinancing.</p>	

Category	Uranium	Coal	Oil & Gas
E1.2	<p>Reserves, the effectiveness of which production and use has been determined by DKZ and is possible only on the condition of providing the user of the entrails with subsidiaries, tax remissions, donations or other means of support at the expense of state or local budget.</p> <p>The prime cost of production of U concentrate is \$40-80/kg.</p>	<p>Reserves, the effectiveness of which production and use has been determined by DKZ and is possible only on the condition of providing the user of the entrails with subsidiaries, tax remissions, donations or other means of support at the expense of state or local budget.</p>	

Category	Uranium	Coal	Oil & Gas
E ₂	<p>Quantities, which on the moment of estimation are not economically viable to extract and use, but in the future they may become of commercial importance.</p> <p>The prime cost of U concentrate production is \$80-130/kg.</p>	<p>Quantities, which on the moment of estimation are not economically viable to extract and use, but in the future they may become an object of commercial importance.</p>	<p>Outbalance reserves (potentially economic), which production and use on the moment of estimation is economic inexpedient, but in the future they can be the object of commercial meaning</p>

Category	Uranium	Coal	Oil&Gas
E_{2.1}	<p>Quantities, effectiveness of which production and use on the moment of primary geologic-economic estimation can't be synonymously determined, as well as reserves which meet the requirements of balance reserves, but for different reasons can't be used on the time of estimation.</p> <p>Prime cost of U concentrate production slightly exceeds \$80/kg</p>	<p>Quantities, effectiveness of which production on the moment of estimation can't be synonymously determined, as well as reserves which meet the requirements of balance reserves, but for different reasons can't be used on the time of estimation.</p>	<p>Conditionally balance reserves (economic limited), which production effectiveness and use on the estimation moment can not be synonymously determined, and also the reserves that meet the requirements of balance reserves, but from different reasons can not be used on the estimation moment. In particular, the use of this group of reserves is possible in the case of favorable terms assignment of production or other investors supporting for the State side</p>
E_{2.2}	<p>Prime cost of recovery of U concentrate is more than \$130/kg.</p>		

Category	Uranium	Coal	Oil & Gas
E₃	Reserves and resources, for which has been accomplished only the detailed economic evaluation with the use of assumed technological and economic initial data, the industrial significance of which has not been defined.	Coal resources as well as resources, for which has been accomplished only detailed economic evaluation with use of assumed technological and economic initial data refer to those, industrial significance of which has not been defined.	With indeterminate commercial meaning (possible economic), reserves for which is accomplished only initial geologic-economic estimation with use of possible technological and economic initial data
E_{3.1}			
E_{3.2}			
E_{3.3}			

Category	Uranium	Coal	Oil & Gas
F₁	Reserves, on the basis of which has been carried out primary geological evaluation of their industrial exploitation effectiveness, the materials of which, including technical-economic substantiation of constant quality requirements on uranium mineral materials, have been approved by DKZ; profitability of mining enterprise production activity, which is under project, and the effectiveness of capital investments into the development of a deposit (plot) has been agreed upon with the user of the entrails; the amount of explored reserves keeps mining enterprise's production or its first stage for the period, sufficient for the acquiring of return on investments.	Coal reserves, on the basis of which has been accomplished primary geological evaluation of their industrial exploitation effectiveness, the materials of which, including technical-economic substantiation of constant quality requirements on raw materials, have been approved by State Commission on mineral resources.	The reserves, on the base of which detailed geologic-economic estimation (GEE-1) of their industrial exploitation effectiveness is carried out. Materials of GEE-1, which are positively evaluated by the State commission on mineral products reserves, are for the investor the principle document, which substantiate economic expediency of works financing for projects of oil and gas production enterprise construction development.
F_{1.1}			
F_{1.2}			
F_{1.3}			

Category	Uranium	Coal	Oil & Gas
F₂	<p>Reserves, on the basis of which has been accomplished the preliminary geological-economic evaluation of their industrial significance, and the materials of technical-economic report about the expediency of further deposit exploration works, including substantiation of temporary quality requirements on uranium raw material, have been approved by DKZ or by customer (investor) of geological-exploration works.</p> <p>The degree of technical-economic studying of uranium ore production and processing conditions and selling of commodities is sufficient for the correct estimation of their industrial significance.</p> <p>The object can proceed to the exploration and test-commercial development.</p>	<p>Coal reserves, for which has been accomplished preliminary geological-economic evaluation of their industrial exploitation, while the materials of technical-economic report about the expediency of further deposit (plot) exploration works, including substantiation of temporary quality requirements, have been approved by DKZ or the funder of geologic-exploration works.</p> <p>The degree of technical-economic studying of coal reserves allow to identify all useful components and harmful additions in coal, technological properties of coal and its processing as well as mine-geological bedding conditions, mine-technical, ecological and other coal production techniques and selling of commodities in detail, which is sufficient for the correct estimation of industrial significance.</p>	<p>The reserves, on the base of which the preliminary geologic-economic estimation (GEE-2) of theirs commercial meaning is accomplished.</p> <p>Materials of GEE-the form of technical-economic report (TER) must pass the approbation in the State commission on mineral products reserves or in client (investor) of the works study and use of these reserves</p>
F_{2.1}			
F_{2.2}			13
F_{2.3}			

Category	Uranium	Coal	Oil & Gas
F ₃	Reserves and resources, on the basis of which has been accomplished only detailed geological-economic evaluation of possible industrial significance of entrails perspective areas, and materials of technical-economic opinions about the expediency of further prospecting and exploration works, and parameters of preliminary quality requirements on uranium raw mineral materials, have been approved by the customer (investor) of geological-exploration works.	Reserves and resources of coal, on the basis of which has been accomplished detailed geological-economic evaluation of their possible commercial exploitation, and materials of technical-economic opinions about the expediency of further prospecting and exploration works, and parameters of preliminary quality requirements on mineral raw materials, have been approved by the funder of geological-exploration works.	The reserves and resources on the base of which is executed initial geologic-economic estimation (GEE-3) of possible commercial meaning of subsurface perspective area. The materials of GEE-in the form of technical-economic opinions (TEO) must be approved by client (investor) of exploration works.
F _{3.1}			
F _{3.2}			

Cat.	Uranium	Coal	Oil & Gas
<p>G₁ Part1</p>	<p>Explored reserves of uranium ore are the volumes of uranium ore, quantity, quality, technical properties, mine-geological, hydrogeological and other bedding conditions of which have been studied with completeness, sufficient for mining-production construction and ore processing objects projects working out. Basic parameters of the explored reserves, which stipulate project decisions about uranium ore production and processing as well as nature protection are determined by the data of immediate measurements or investigations, executed in pools limits all over the dense grid, in combination with limited extrapolation, which is grounded on geological, geophysical and other investigations.</p>	<p>Explored coal reserves are the volumes of coal, quantity and quality, hydrogeological, mine-geological and other bedding conditions of which have been studied with completeness, sufficient for elaboration of mining and ore enrichment enterprise construction projects. Basic parameters of explored reserves, which influence project decisions of coal production and processing and ensure environment protection, have been determined by data of immediate measurements and investigations, executed in the strata intersections all over sufficiently thin grid. Explored reserves by the degree of their geological studying are divided into A, B and C categories.</p>	<p>The explored reserves are calculated on the explored fields (pools) and on the fields (pools) which are in development under condition of study of type, form, sizes of pool, effective oil-and-gas saturated thickness, type of reservoir, type of reservoir and oil-and-gas recovery properties, oil-and-gas saturation of productive beds, composition and properties of oil, gas and condensate in the formation and standard conditions, and also basic peculiarities of pool, that determine conditions of its development, ecological and other parameters, sufficient for compiling the projects of a construction and commercial development of the fields.</p>

Cat.	Uranium	Coal	Oil&Gas
G₁ Part 2	<p>By the degree of morphological characteristics, internal structure and bedding conditions of ore pools explored reserves are divided into A, B, C₁ extent of exploration categories.</p> <p>Reserves of category A include part of explored reserves within the limits of which have been established forms, sizes and bedding conditions of ore pools, have been determined correlation and spatial distribution of plots with different natural types and industrial (technological) sorts of ore, non-ore and plots, which do not meet quality requirements have been singled out and delineated within ore pools, the locations and displacement amplitudes of disruptive violations have been established.</p>	<p>The reserves of category A are calculated in the blocks for which:</p> <p>the endurance and regularities of changing (variable) thickness, internal stratum structure and basic coal quality indices have been established;</p> <p>basic calculating parameters (the structure of stratum, provided for by the quality requirements and coal quality indices) have been determined by the sufficient amount of reliable data; possible variability in the thickness of stratum and coal quality in intersections of strata is proved to have had remained within the limits of the corresponding quality requirements;</p> <p>tectonics studies has been performed with sufficient completeness. This excludes the possibility of other constructions building, the details of strata bedding and disruptive violations with amplitude of more than 10m have been determined without damage, general regularities of small amplitude violation showing have been established with completeness, which allows to estimate its impact on the production of reserves.</p>	

Cat.	Uranium	Coal	Oil & Gas
<p>G₁ Part 3</p>	<p>Category B reserves include part of explored reserves, within the limits of which have been established the dimensions, basic form peculiarities, internal structure, and ore body bedding conditions, spatial distribution of non-ore and unconditioned pools in ore pools, the position and displacement amplitude of large disruptive violations and development zone of small-scale amplitude disruptive violations have been determined.</p>	<p>The reserves of category B are calculated in the blocks for which: the endurance of thickness, coal stratum structure, basic regularities of spatial distribution of the plots located inside the contours with extreme value of stratum thickness and coal quality indices have been established; determination of average values of calculating parameters (stratum thickness and established by quality requirements coal grade indices) is grounded on sufficient amount of reliable data; basic peculiarities of strata bedding conditions have been studied, the possible degree of the additional folding and small amplitude disruptive violations has been determined, tectonics details are subject to supplementary investigation;</p>	

Cat.	Uranium	Coal	Oil & Gas
<p>G₁ Part 4</p>	<p>Category C₁ reserves include part of explored reserves within the limits of which have been mainly established the dimensions and characteristic forms of ore pools, the basic peculiarities of their bedding conditions and inner structure, possible ore bodies breakage, the location of the main tectonic violations as well as areas and zones of their most intensive development have been characterized. Spatial distribution and correlation of different natural types and industrial sorts of ore, location of non-ore plots, made from ore, which doesn't meet quality requirements have been established in general terms.</p> <p>By the degree of geological studying explored reserves meet the requirements of reasonably assumed resources of IAEA classification scheme.</p>	<p>To the category C₁ belong the reserves of coal strata, which satisfy such requirements: dimensions and characteristic forms of coal stratum, basic peculiarities of bedding conditions and internal structure have been determined, the endurance and possible stratum violation as well as zones of small amplitude of tectonic violations have been determined; rank of coal, basic quality indices, which are regulated by standards or quality requirements, general regularities of their spatial distribution and qualitative correlations have been determined.</p>	

Cat.	Uranium	Coal	Oil & Gas
<p>G₂ Part 1</p>	<p>Preliminary explored reserves of uranium ore that are the volumes of uranium ore, quantity, quality, technological properties, mine-geological, hydrogeological and other bedding conditions of which have been studied with completeness, sufficient for the definition of the industrial significance of deposit. Basic parameters of preliminary explored reserves, which influence the method choice of production and ore processing, have been estimated mainly on the basis of data extrapolation of the</p>	<p>Preliminary explored reserves that are the volumes of coal, quantity, quality, technological properties, mine-geological, hydrogeological and other bedding conditions of which have been studied with completeness, sufficient for the definition of the industrial significance of deposit (plot). Basic parameters of preliminary explored reserves, which influence the method choice of production and ore processing, are estimated mainly on the basis of extrapolation of the immediate measurements and investigations, located within deposit limits all over thin or uneven grid. Extrapolation is grounded on the analogy with the explored deposit as well as data of geological, geophysical, geochemical and other investigation of the entrails.</p>	<p>Preliminary explored reserves are calculated on partially explored fields (pools)-under condition of obtaining on one or several wells oil or gas inflows, including with the formation tester, and positive results of geophysical studies in the non-tested wells. The floor-space of reserves calculation for each pool on a structural base is limited by the level of lower mark of its bottom at presence of waterless inflow, or on a mark of contacts.</p>

Cat.	Uranium	Coal	Oil & Gas
<p>G₂ Part 2</p>	<p>immediate measurements and investigations, located within deposit limits all over thin or uneven grid. Extrapolation is grounded on the analogy with the explored deposit (pool) as well as data of geological, geophysical, geochemical and other investigation of the entrails. Preliminary explored reserves by the degree of morphologic characteristics studying, internal structure and uranium ore bedding conditions meet the requirements of the reserves from category C₂. The contour of category C₂ reserves is delineated on the basis of</p>	<p>Preliminary explored reserves by the degree of morphological characteristics studying, internal structure, bedding conditions of coal strata and quality indices, hydrogeological, mine-geological and other nature conditions meet the requirements of category C₂ reserves.</p> <p>To category C₂ belong the reserves of coal strata which meet such requirements: dimensions, morphology, internal structure of coal strata and their bedding conditions have been estimated by geological and geophysical data and confirmed by the intersections of coal strata by limited quantity of wells or mining constructions all over thin or uneven grid; quality and technological peculiarities of coal have been determined by the results of laboratory tests or estimated by the analogy with more studied plots of the same or similar deposit;</p>	

Cat.	Uranium	Coal	Oil & Gas
<p>G₂ Part 3</p>	<p>substantiated data extrapolation of exploration constructions. On newly discovered deposits, where the reserves of higher deposits not available, to the category C₂ belong the plots of the pools, where the quantity and quality of uranium ore are measured in several points not on one and the same line towards the spreading of ore bodies.</p> <p>By the degree of morphological characteristics preliminary explored reserves meet the requirements of the evaluated additional resources (EAR-I) of IAEA classification scheme.</p>	<p>hydrogeological, engineering-geological, mine-geological and other natural conditions have been estimated by data characteristic of other deposit areas, observations in mining constructions and by the analogy with known deposits within the region limits;</p> <p>the contour of coal reserves has been determined in accordance with the quality requirements on the ground of the limited quantity of wells testing, mining constructions, natural layer separation or their combinations, taking into consideration geophysical data and data of geological constructions as well as by the way of grounded extrapolation of parameters, which are determined at the calculation of reserves of higher categories.</p>	

Cat.	Uranium	Coal	Oil & Gas
<p>G₃ Part 1</p>	<p>Perspective resources reflect the possibility of new deposits (pools) discovery of the same geological-industrial type, the existence of which is grounded on the positive estimation of the uranium ore showings , showings of uranium mineralization, geophysical, geochemical and other anomalies, nature and perceptivity of which has been proven.</p>	<p>Coal perspective resources are estimated in quantitative terms by the results of geological, geophysical, geochemical and other investigation of plots within the limits of productive areas with known coal deposits (plots). Perspective resources reflect the possibility of discovery of new deposits of known geological-industrial types, the existence of which has been confirmed by positive estimation of coal pools development areas on the ground of geophysical, geochemical and other indices. Their connection with coal deposits has been proven.</p>	<p>The perspective resources of oil and gas-that are resources of prepared for deep drilling floor spaces, which are in the limits of oil-and-gas bearing region and also not opened with drilling beds of fields if their productivity is established on this or other fields of the region.</p>

Cat.	Uranium	Coal	Oil & Gas
<p>G₃ Part 2</p>	<p>By the degree of trustworthiness perspective resources are divided into the categories P₁ and P₂.</p> <p>To category P₁ belong perspective resources on the areas of uranium ore spreading, which adjoin to the contours of explored and preliminary explored reserves of the discovered uranium ore deposits and in the perspective plots of entrails, where the existence of uranium ore, its form, dimensions, internal structure and bedding conditions have been estimated by geological, geophysical, geochemical data and are confirmed by solitary intersections of geological constructions.</p>	<p>By the degree of trustworthiness perspective resources are divided into P₁ and P₂ categories.</p> <p>To category P₁ belong the prospective resources within the plots of spreading coal-bearing areas, which adjoin to the contours of explored and preliminary explored reserves of the indicated coal deposits and in the prospective plots of entrails, where the existence of pools, their form, dimensions, inner structure and bedding conditions have been estimated by geological, geophysical data and confirmed by solitary strata intersections. Perspective resources of category P₂ include the possibility of new coal deposits (plots) discovery in certain coal-bearing area, the existence of which is stipulated on the basis of positive estimation of coal-bearing rocks, geophysical and geochemical and other anomalies, the nature and perceptivity of which has been proven on the indicated analogical objects.</p>	

Cat.	Uranium	Coal	Oil & Gas
G₃ Part 3	<p>Perspective resources of category P₂ include the possibility of new uranium ore deposits discovery in the known ore-bearing region, ore field, the existence of which is envisaged on the basis of positive estimation of uranium ore showings, rocks, which contain ore, geophysical, geochemical and other anomalies, nature and perceptivity of which has been proven by similar uranium and ore objects. Bedding conditions and morphological characteristics of mineralization are estimated by analogy.</p> <p>By the degree of trustworthiness perspective resources meet the requirements of evaluated additional resources of the second group (EAR-II) of IAEA classification scheme.</p>		

Cat.	Uranium	Coal	Oil & Gas
G ₄	<p>Forecast uranium resources reflect the potential possibility of certain geological-industrial type of deposit forming, which is grounded on positive stratigraphic, lithological, mineragenic, paleogeographic and other preconditions, established within the limits of perspective areas with undiscovered industrial deposits.</p> <p>Forecast resources by trustworthiness meet the requirements of speculative resources (SR) of IAEA classification scheme.</p>	<p>Forecast coal resources are determined taking into consideration potential possibility of certain geological-industrial type deposit forming and are based on positive stratigraphic, lithological, tectonic, paleogeographic and other preconditions, established within the limits of perspective areas with undiscovered coal deposits.</p>	<p>Forecast resources of oil and gas are the resources which take into account a potential productivity of definite lithologic-stratigraphic complexes within the limits of large regional structures with proved and unproved oil-and-gas bearing capacity. The quantitative estimation of forecast resources is carried out on possible parameters on the basis of general geologic ideas and by statistical analogy with other regional structures, where are explored oil and gas fields.</p>