RULE FOR MAKING DECISIONS ON CONFORMITY OF PRODUCTS WHEN MEASURING PHYSICAL AND CHEMICAL QUANTITIE

[1]Masharipov Sh.M., [2]Qudratov J.X., [3]Sh.Turaev
[1,2,3]Tashkent State Technical University named after Islam Karimov
https://doi.org/10.5281/zenodo.8386794

Abstract. *The article discusses the rules for printing a decision on the compliance of parameters with the established requirements of technical documents in the field of environmental engineering. A compliance assessment is any activity undertaken to determine, directly or indirectly, whether a product, process, system, person or body meets the relevant standards and meets certain requirements. During product control, the assessment of compliance with the specified requirements is made based on the measurement results (the measurement is considered as the main source of information on the characteristics/parameters of the product). Since the measurement result is presented in the form of a set of values (the measured value of the value and the extended uncertainty form the coverage interval), and the requirements are set in the form of tolerances or maximum permissible values, there are risks of making incorrect decisions on compliance*

Keywords: *environmental engineering, measurement, decision-making rules, compliance, regulatory document, measurement uncertainties, magnitude, environmental standards, measurement results*

Currently, the following projects are being implemented in the Republic of Uzbekistan: regulatory documents, legal acts and agreed improvements, in order to maintain confidence in demand, safety and quality. Today it is an effective influence on the peaceful economy, messengers and the detection of objects that affect analysis, business decisions and revenues, reputation and financial transactions.

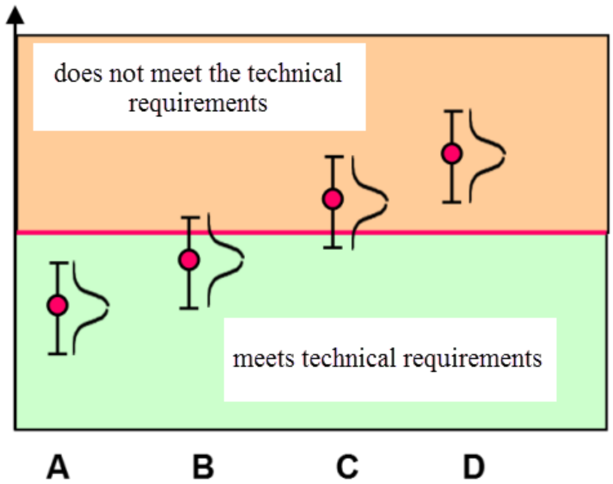


Figure 1 - Spanish results and their lack of representation in relation to supremacy

With authentic coordination, not only quantitative results, but also a variety of scenarios, such as powerful searchers or approximate extreme specific servants (options: At do Dona figure

1). In this case, variants A and D lead to a common resolution, neither rise nor influence of non-representation. Homogeneous variant V and S, with a portable interval of uncertainty. Such an analysis should have an objective criterion (pattern) to accept the results, which has an increased frequency of the uncertainty interval, followed by admission items.

District Court for Evaluation. The most decisive in determining the Law of acceptance of the question, it should be proven and when assessing compliance: correspondence or untimely specification (techno-vegetation) or limit. Supplier risk (α) or risk- (β).

You can set the procedure for performing a compliance assessment based on the following steps:

Detailed description of the measured value (Y) and the measurement of the subject object.

Experimental/analytical results (estimates of y measured value Y).

Standard measurement uncertainty, u (y), and for a certain level of trust, extended measurement uncertainty.

The only tolerance limit (upper or lower) or tolerance limits set in the schedule.

Establish a compliance zone, non-compliance zone, and security band for the assumed probability of a type I error (α supplier risk) or type II error (β consumer risk).

Decision rule.

Figure 2 shows the main international standards for decision-making rules.

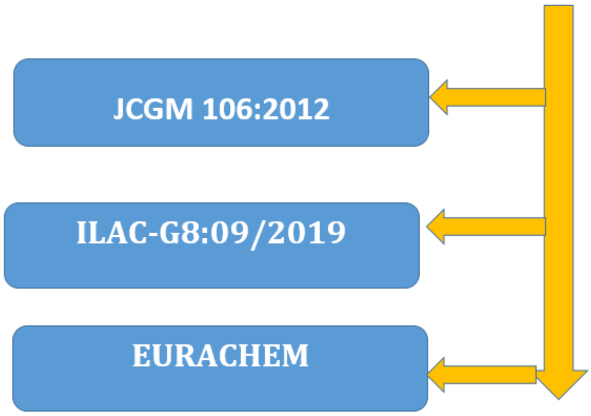


Figure 2. International Standards for Risk-Based Decision Rules

When evaluating compliance (corresponds/nonconformity), the decision is made based on the observed data (measured quantities). The obtained product test data are registered in the work logs of the employee of the accredited test laboratory with identification data (date, test method, surname, name, patronymic of the employee of the accredited test laboratory, etc.).

Ncorrect decisions are divided into two categories: one or another position recognized as meeting the requirements may actually be inappropriate (this case constitutes improper acceptance, or a risk to the consumer), and a position rejected as non-conforming to the requirements may actually be appropriate (this case constitutes unlawful deviation, or a risk to the manufacturer).

To assess the conformity of the test object with the requirements specified in the regulatory document, based on the test results obtained using quantitative test methods, it is necessary to calculate and take into account the uncertainty of measuring the test results.

In general, a confidence level of approximately 95% (coverage ratio k = 2) is considered acceptable. A higher level of trust is selected in agreement with the customer.

The accredited test laboratory applies the following decision-making rules when assessing compliance, taking into account the specific 3 cases.

General rule

An object meets a specified requirement if the true value of its Y property lies within the tolerance field. Knowledge of Y is represented by the probability density function (PDF) f (x_i) in such a way that the compliance statement is always a conclusion having some probability that it is true.

Case № 1 for single lower limit of tolerance field (e.g. not less than 50 mg/l).

The probability of compliance is determined by the following formulas (1). If the probability of compliance P_s>95% decides on compliance. If P_s<95%, a nonconformity decision is made.

The formula for calculating rs is as follows:

$$p_c = \Phi\left(\frac{y - T_L}{u}\right). \quad (1)$$

Case № 2 for single upper limit of tolerance field (e.g. not more than 50 mg/l).

The probability of compliance is determined by the following formulas: If the probability of compliance Ps>95% decides on compliance. If Ps<95% decides on non-compliance.

The formula for calculating rs is as follows:

$$p_c = \Phi\left(\frac{T_U - y}{u}\right). \quad (2)$$

Case № 3 for two-sided tolerance field (e.g. 50 mg/l to 80 mg/l).

The probability of compliance is determined by the following formulas: If the probability of compliance Ps>95% decides on compliance. If Ps<95% decides on non-compliance.

The formula for calculating rs is as follows: (3)

$$p_c = \Phi\left(\frac{T_U - y}{u}\right) - \Phi\left(\frac{T_L - y}{u}\right).$$

When measuring unspecified physical quantities, the decision on the conformity of the product sample is assigned to the customer.

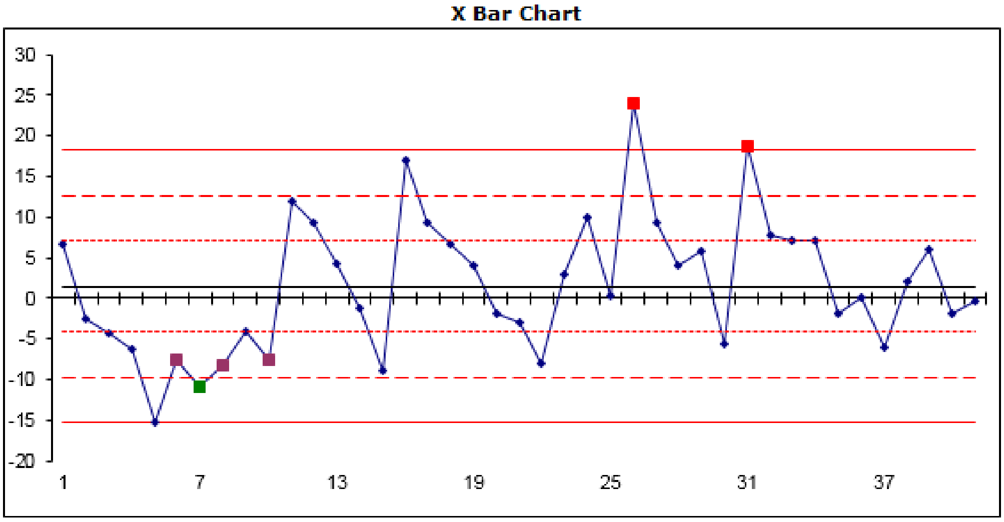
Figure 3 shows the results of experimental work with data processing and extended uncertainty of measurements.

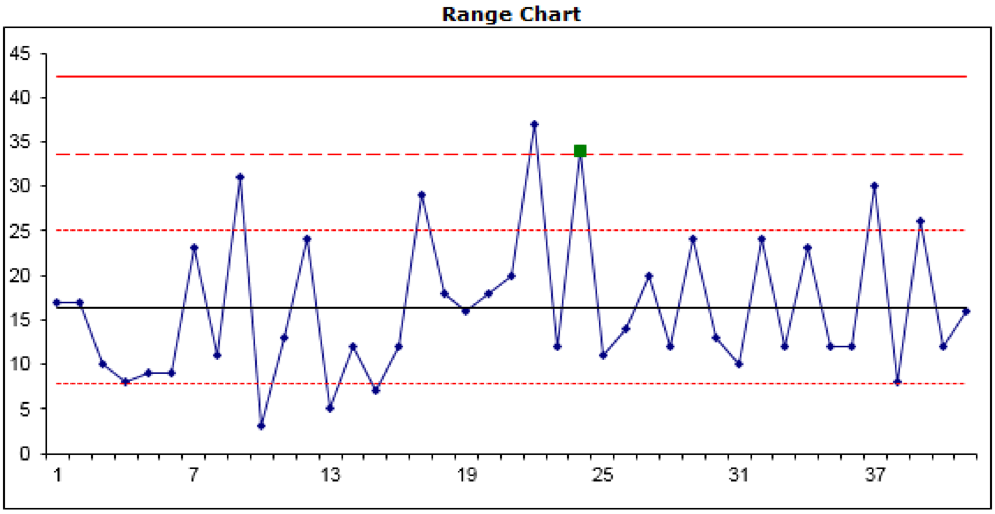
Name of defined characteristics (parameters)	Designation of regulatory documents on test methods with indication of items	Measurement result with indication of extended uncertainty of measurements		
No. 1 measurement object				
pH	O‘z O‘U 0556:2012	9,9400	±	0,0415
Ammonium nitrogen, mg/dm^3	O‘z O‘U 07.0682:2015	1484,3800	±	0,1658
nitrite nitrogen mg/dm^3	O‘z O‘U 07.0265:2005	0,1520	±	0,0144
nitrate nitrogen mg/dm^3	O‘z O‘U 07.0705:2016	90,9000	±	0,0095

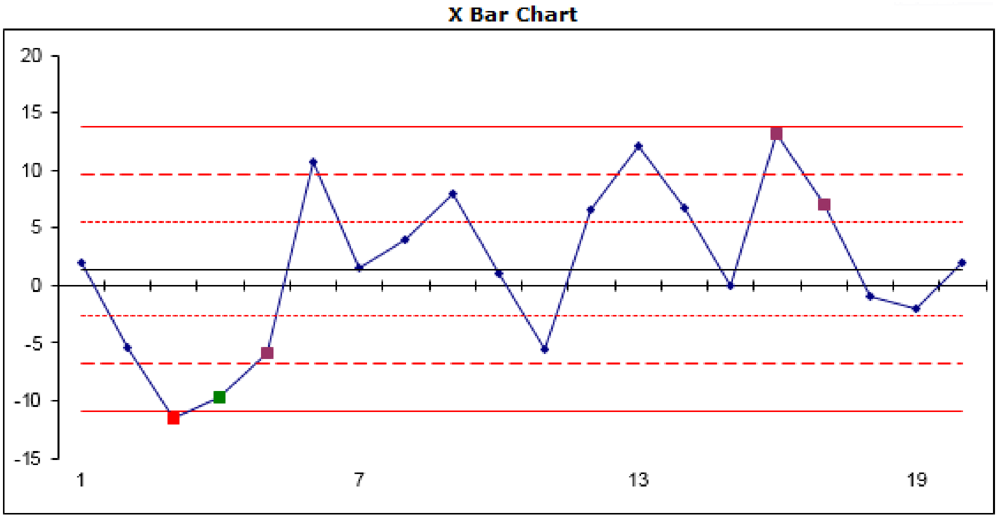
Petroleum products, mg/dm^3	O‘z O‘U 0608:2013	0,0103	±	0,0008
mineralization mg/dm^3	O‘z O‘U 07.0495:2010	10184,0000	±	0,5902
Chlorides mg/dm^3	O‘z O‘U 0418:2009	5033,9000	±	0,5045
sulfates mg/dm^3	O‘z O‘U 07.0676:2015	2965,0000	±	0,5017
Phosphates mg/dm^3	O‘z O‘U 07.0171:2001	1,0000	±	0,0086
Iron, mg/dm^3	O‘z O‘U 07.0171:2001	not detected	±	-
No. 2 measurement object				
pH	O‘z O‘U 0556:2012	9,4000	±	0,0412
Ammonium nitrogen, mg/dm^3	O‘z O‘U 07.0682:2015	74,2100	±	0,1572
nitrite nitrogen mg/dm^3	O‘z O‘U 07.0265:2005	0,1520	±	0,0144
nitrate nitrogen mg/dm^3	O‘z O‘U 07.0705:2016	7,9500	±	0,0072
Petroleum products, mg/dm^3	O‘z O‘U 0608:2013	0,0725	±	0,0018
mineralization mg/dm^3	O‘z O‘U.0495:2010	1012,0000	±	0,5805
Chlorides mg/dm^3	O‘z O‘U 0418:2009	141,8000	±	0,4912
sulfates mg/dm^3	O‘z O‘U 07.0676:2015	253,0000	±	0,5001
Phosphates mg/dm^3	O‘z O‘U 07.0171:2001	0,4000	±	0,0081
Iron, mg/dm^3	O‘z O‘U 07.0171:2001	0,1300	±	0,0021
No. 3 measurement object				
pH	O‘z O‘U 0556:2012	3,0700	±	0,0395
Ammonium nitrogen, mg/dm^3	O‘z O‘U 07.0682:2015	19,5300	±	0,1561
nitrite nitrogen mg/dm^3	O‘z O‘U 07.0265:2005	1,2190	±	0,0168
nitrate nitrogen mg/dm^3	O‘z O‘U 07.0705:2016	9,0900	±	0,0081
Petroleum products, mg/dm^3	O‘z O‘U 0608:2013	0,0681	±	0,0017
mineralization mg/dm^3	O‘z O‘U 07.0495:2010	840,0000	±	0,5801
Chlorides mg/dm^3	O‘z O‘U 0418:2009	301,3300	±	0,4922
sulfates mg/dm^3	O‘z O‘U 07.0676:2015	210,0000	±	0,4985
Phosphates mg/dm^3	O‘z O‘U 07.0171:2001	0,1000	±	0,0079
Iron, mg/dm^3	O‘z O‘U 07.0171:2001	1,4500	±	0,0026

Figure 3. Results of experimental work with data processing and extended uncertainty of measurements

Select the correct subgroup size. When in doubt, select a subgroup size of one. Partial subgroups are not displayed (figure 4).


X Bar Chart
30
25
20
15
10
5
0
-5
-10
-15
-20
1
7
13
19
25
31
37


Range Chart
45
40
35
30
25
20
15
10
5
0
1
7
13
19
25
31
37


X Bar Chart
20
15
10
5
0
-5
-10
-15
1
7
13
19

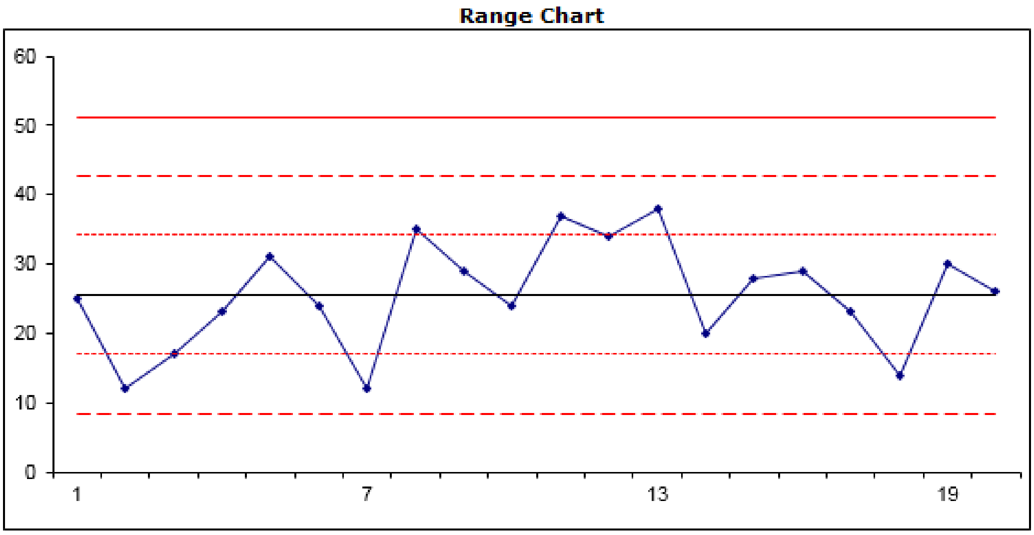


Figure 4. Evaluation of measurement results using a control map

Conclusion. A compliance assessment is any activity undertaken to determine, directly or indirectly, whether a product, process, system, person or body meets the relevant standards and meets certain requirements. During product control, the assessment of compliance with the specified requirements is made based on the measurement results (the measurement is considered as the main source of information on the characteristics/parameters of the product). Since the measurement result is presented in the form of a set of values (the measured value of the value and the extended uncertainty form the coverage interval), and the requirements are set in the form of tolerances or maximum permissible values, there are risks of making incorrect decisions on compliance. In the field of eco-engineering, accounting for measurement uncertainty minimizes the risk of decision-making.

REFERENCES

1. Blinov, L.N. Ecology: a textbook for secondary vocational education/L.N. Blinov, V.V. Polyakova, A.V. Semencha; under the general editorship of L. N. Blinov. - Moscow: Yurite Publishing House, 2018. - 209 p.
2. Gurova, T.F. Ecology and Rational Environmental Management: a textbook and workshop for academic undergraduate studies/T.F. Gurova, L.V. Nazarenko. - 3rd ed., Edited and additional. - Moscow: Publishing House Yurit, 20KhKh. - 188 p.
3. Miraliyeva, A.K., Rashidov, A.S., Ernazarova, Z.X., Masharipov, Sh.M., Mirpayziyeva, G.M.Experimental quantification of measurement uncertainty and other verification criteria for analytical test methods.Journal of Physics: Conference Seriesthis link is disabled, 2021, 2094(5), 052031https://iopscience.iop.org/article/10.1088/1742-6596/2094/5/052031/pdf
4. Masharipov, Sh.M., Ruzmatov, K.R., Rahmatullayev, S.A., ...Mahmudjonov, M.M., Isaqov, A.G.Assessment and investigation of measurement uncertainty of standard samples of substances and materials in physicochemical measurements based on standard test methods. Journal of Physics: Conference Seriesthis link is disabled, 2021, 2094(5), 052011 https://iopscience.iop.org/article/10.1088/1742-6596/2094/5/052011/pdf
5. Masharipov, S.M., Azimov, R.K.Multifunctional Information and Measuring Complex for Controlling the Parameters of Fibrous Materials and Dispersed MediaMeasurement Techniquesthis link is disabled, 2017, 60(6), стр. 643–646

https://www.springerprofessional.de/en/multifunctional-information-and-measuring-complex-for-controllin/15100128

6. Matyakubova P.M, MasharipovSH.M., Ruzmatov K.R, Sultanov M.K.. Published under licence by IOP Publishing Ltd. Methods for monitoring metrological characteristics of scientific and physical parameters of intelligent sensors in real operating conditions. Journal of Physics: Conference Series, Volume 1889, Cybernetics, economics and information measuring systemsCitation Parahat M Matyakubova et al 2021 J. Phys.: Conf. Ser. 1889 032037.
7. Gurova, T.F. Ecology and Rational Environmental Management: a textbook and workshop for secondary vocational education/T.F. Gurova, L.V. Nazarenko. - 3rd ed., Edited and additional. - Moscow: Publishing House Yurit, 2021. - 188 p.
8. Kondratyeva O. E. Ecology: textbook and workshop for secondary vocational education/O. E. Kondratyeva [and others]; edited by O. E. Kondratyeva. - Moscow: Yurite Publishing House, 2017. - 283 p.
9. Masharipov, Sh.M.,Ruzmatov, K.R., Rahmatullayev, S.A., ...Mahmudjonov, M.M., Isaqov, A.G. Assessment and investigation of measurement uncertainty of standard samples of substances and materials in physicochemical measurements based on standard test methods. Journal of Physics: Conference Seriesthis link is disabled, 2021, 2094(5), 052011
10. Sh. M. Masharipov, K. R. Ruzmatov, B. X. Ametova, N. A. Djumaniyazova, and Z. S. Kenjayeva . Verification of food testing methods in the operations of accredited testing laboratories according to ISO/IEC 17025:2017 // AIP Conference Proceedings 2647, 070006 (2022)
11. SH.M.Masharipov. Software for measurement uncertainty assessment and actual metrological characteristics of viscometers // Published under licence by IOP Publishing LtdJournal of Physics: Conference Series, Volume 2373, Cybernetics, Computational Science and Information Measuring, *Ser.* 2373 052001, **DOI** 10.1088/1742-6596/2373/5/052001
12. Kuznetsov, L. M. Ecology: textbook and workshop for applied undergraduate studies/L. M. Kuznetsov, A. S. Nikolaev. - 2nd ed., Rev. and additional - Moscow: Yurit Publishing House, 2022. - 280 p.
13. Pavlova, E.I. Transport Ecology: a textbook for applied undergraduate studies/E.I. Pavlova, V.K. Novikov. - 5th ed., Rev. and additional - Moscow: Yurit Publishing House, 2022. - 479 s.
14. Totai A.V. Ecology: textbook and workshop for applied undergraduate studies/A.V. Totai [et al.]; under the general editorship of A.V. Totay, A.V. Korsakov. - 5th ed., Rev. and additional - Moscow: Yurit Publishing House, 2016. - 353 p.
15. Andreeva, N. D. Theory and methodology of environmental education: a textbook for SPO/N. D. Andreeva, V. P. Solomin, T. V. Vasilyeva; ed. N. D. Andreeva. - 2nd ed., Rev. and additional. - M.: Publishing House Yuryt, 2017. - 190 p.
16. Astafieva, O. E. Environmental basics of nature management: a textbook for SPO/O. E. Astafieva, A. A. Avramenko, A. V. Pitryuk. - M.: Yurite Publishing House, 2017. - 354 p.
17. Bogolyubov, S. A. Legal foundations of nature management and environmental protection: a textbook and a workshop for academic undergraduate studies/S. A. Bogolyubov, E. A. Pozdnyakova. - 3rd ed., Rev. and additional - M.: Yurite Publishing House, 2018. - 429 p.

18. Vartapetov, L. G. Ecological ornithology: tutorials. Manual for undergraduate and graduate studies/L. G. Vartapetov. - M.: Yurite Publishing House, 2019. - 170 p.
19. Gurova, T.F. Ecology and Rational Environmental Management: a textbook and workshop for academic undergraduate studies/T.F. Gurova, L.V. Nazarenko. - 3rd ed., Rev. and additional. - M.: Publishing House Yuryt, 2019. - 188 p.
20. Danilov-Danilyan, V.I. Ecology: textbook and workshop for academic undergraduate studies/N. N. Mitin, B. M. Malashenkov; ed. V.I. Danilov-Danilyan. - M.: Yurite Publishing House, 2019. - 363 p.
21. Kolesnikov, E. Yu. Environmental Impact Assessment. Security examination: textbook and workshop for bachelor's and master's degree/E. Yu. Kolesnikov, T. M. Kolesnikova. - 2nd ed., Rev. and additional - M.: Yurite Publishing House, 2017. - 469 p.
22. Korytny, L. M. Environmental basics of nature management: tutorials. Manual for SPO/L. M. Korytny, E. V. Potapova. - 2nd ed., Rev. and additional. - M.: Publishing House Yuryt, 2019. - 374 p.
23. Arslanov, Sh.; Turabdjanov S.; Azimova, Sh.; Azimov D.; Sultankhojaeva N.; Egamberdiev E.: Physico-chemical properties and research of acids contained in oils of Uzbekistan. E3S Web E3S Web of Conferences, 2023, 371, 01021, DOI 10.1051/e3sconf/202337101021
24. Larionov, N. M. Industrial Ecology: textbook and workshop for SPO/N. M. Larionov, A. S. Ryabyshenkov. - 2nd ed., Rev. and additional - M.: Yurite Publishing House, 2018. - 382 p.