



CURRICULUM ECOLOGICAL RISK ASSESSMENT

SPECIALIZATION: ECOLOGY AND NARURAL RESOURCE USE

PROFILE: GEOECOLOGY

DEGREE: Master

YEAR OF ENROLLMENT: 2014

YEAR 2; TERM 4

CREDITS: 2

PREREQUISITES: «Humankind sustainable development», «Human ecology», «General ecology», «Technogenic systems and ecological risk»

COREQUISITES: «Health and ecotoxicology», «Theory and methodology of modern ecology»

FORMS OF EDUCATIONAL ACTIVITY AND TIME BUDGET:

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LECTURES	10 hours
PRACTICAL CLASSES	40
CLASS HOURS	50 hours
SELF-STUDY	30 hours
TOTAL	80 hours

FORM OF STUDY Full-time

FORM OF INTERMEDIATE ATTESTATION:: EXAM AND CREDIT-TEST in the 4-th TERM

DEPARTMENT: Geoecology and Geochemistry Department

THE HEAD OF THE DEPARTMENT: Doctor of geol.-min. science, Prof. Ye.G. Yazikov

THE HEAD OF THE BASIC EDUCATIONAL PROGRAM: Doctor of geol.-min. science, Prof. L.P. Rikhvanov

LECTURER: Candid. of Chem. Sc., associate professor N.A.Osipova

1. Objectives of the course

- to give students the idea about techniques of environmental risk management, its minimization

The course tasks:

- assessment of acceptable environmental impact levels, effect assessment in case of increasing technogenic loads on the environment;

- learning the methods of quantitative and qualitative assessment of technogenic and natural risk;

- learning the methods of predicting the effect development and assessment of accidents and emergencies;

- analysis in the methods of environmental risk management and its minimization.

2. The place of course in the Basic Educational Program

The course curriculum «**Environmental risk analysis and management**» is intended for engineering master students of specialization: **Ecology of natural resource use**.

Numerous examples of international and native practice show that development of such programs is not only desirable but also necessary. Development of similar programs coincides with the recommendation of international standard introduction ISO 9000 and ISO 14000 (environment protection and management quality standards) prepared by Russian Research Institute of certification for approving by the Russian State Standard.

At the moment risk management is a synthesized scientific discipline dealing with influence of casual events posing physical and economic damage on different spheres of human activity. The given course has its objective to transfer the accumulated professional data into practical use.

The theoretical part of the course includes general ideas about modern techniques of environmental risk assessment from different factors. There are system concepts of ecological, geologic and geoecological risk factors. The methods of quantitative hazard assessment of different genesis are underlined. The course reviews the environmental risk management methods, environmental effect minimization methods in details.

The practical part presents the risk assessment and management methods. The curriculum gives the list of practical classes, sources and forms of estimation.

3. Outcomes

In the course of study master-students are to learn to calculate and assess risks, compare with the criteria of risk acceptability, make conclusions on risk acceptability or choose method of its minimization. This is the essence of the Risk management course.

As a result of the course study master-students are to acquire knowledge, skills and experience corresponding to the outcomes of the Basic Educational Program: **M.1, M.2, M.3***. Correspondence of the course outcomes «Ecological

Risk Management» to the competences developed by the Basic Educational Program is presented in the Table.

P1	To apply basic and professional, scientific and qualified knowledge in professional activity for solution of problems related to rational nature use and environmental protection	Requirements of FSES (ПК-1, 2, 8, 9; ОК-1), Criterion 5 of AEER (p. 5.1, 5.2.1-5.2.3., 5.2.5, 5.2.9)
P2	To develop nature protection measures, practical recommendations for environmental protection and sustainable development, assess the impact of planned construction on the environment, diagnose the environmental problems.	Requirements of FSES (ПК-5, 6, 7, 12) Criterion 5 of AEER (p. 5.2.4, 5.2.7-5.2.8)
P4	To work independently as a part or a leader of a team consisting of professionals of different qualifications, show responsibility for the results and readiness to follow company corporate culture	Requirements of FSES (ПК 11, ОК-3, 5, 6) Criterion 5 of AEER (p. 5.1, 5.2.16)
P5	To present and defend the results of innovative activity in the sphere of environment protection	Requirements of FSES (ПК 11, ОК-3,) Criterion 5 of AEER (p. 5.2.12-5.2.16)
P6	To study independently and permanently master the skills during period of professional activity long	Requirements of FSES (ПК-1, 8, 11, ОК-2-4) Criterion 5 of AEER (p. 5.1, 5.2.13-5.2.16)

* The outcome codes are deciphered in GOS VPO of specialization 130100 «Geology and Mineral Exploration» by April, 14 2000, № 340 Educational standard of TPU (2010).

4. Structure and content of the course

4.1. Course structure in units, activity and estimation forms

№	Name of the Unit	Class hours			Self-study (hours)	Total	Forms of control and attestation
		Lectures	Pract./ seminars	Lab works			
1	Concept and structure of environmental risk	1	2		6	9	Intermediate estimation
2	Methods of	1	4		4	9	Oral report

	environmental risk assessment						
3	Sanitary-hygienic human health risk assessment from environmental chemical pollution		6		4	10	
4	Methods of risk management	1	8		6	15	Intermediate estimation. Practical work report
5	Environmental risk management in petroleum engineering	2	8		4	14	Oral report. Practical work report
6	Environmental risk management in coal mining	2	6		4	12	Intermediate estimation
7	Environmental risk management hazardous natural and technogenic processes	2	6		2	10	Final estimation
8	Final estimation	1				1	Exam
	Total	10	40		30	80	

When submitting written reports students have to defend them.

4.2 Course unit titles and content

Unit 1. Concept and structure of environmental risk. Concept and structure of environmental risk. Types of environmental risks

Unit 2. Methods of environmental risk assessment.

Unit 3. Sanitary-hygienic human health risk assessment from environmental chemical pollution. International experience in risk assessment. Sanitary-hygienic risk assessment in Russia. Concept of carcinogenic potential factor, hazard coefficient. Criteria of acceptable risk. Multi-media health risk assessment for soil, air, water, food pollution.

Unit 4. Environmental risk management

Risk management as a type of activity: objectives, tasks, functions. Risk management. Risk forecast.

Unit 5. Environmental risk management of petroleum engineering

Unit 6. Environmental risk management in coal mining industry

Unit 7. Environmental risk management of hazardous natural and technogenic processes

4.2. Competence distribution in the units of the course

Distribution of the planned outcomes in the course units in terms of the Basic Educational Program developed within the given course and stated in paragraph 3 are presented in the Table.

№	Competencies	Course units						
		1	2	3	4	5	6	7
1.	OK-1			x				
2.	OK-2							
2.	OK-3			x	x		x	x
3.	OK-4							
4.	OK-5	x	x	x	x	x	x	x
5.	OK-6	x	x	x	x			
6.	ПК-1,6,8,11	x	x	x	x	x	x	x
7.	ПК-4,2,8,12			x	x			

5. Educational activities

In the process of the course study the following forms of students' activity in combination of the methods and forms of students' learning activity activation are used for achieving the planned educational results and competence development.

Methods and forms of study

Forms of study	Lectures	Lab works	Pr. classes./ Seminars	Self-study
<i>IT-methods</i>			x	x
Team work				
<i>Case-study</i>			x	
Game	x		x	x
Problem study	x		x	x
Experience-based study			x	x
Advance self-study			x	x
Project method			x	x

To achieve the course objectives the following means, techniques and procedures are realized:

- study of theoretical material of the curriculum at lectures using computer and information resources;
- self-study of theoretical material of the curriculum using *Internet*-resources, information resources, methodical aids, course books and other sources;
- drill of theoretical material at individual classes carrying out problem-solving, searching, and research projects.

6. Arrangement and methodical assistance of students' self-study (SSS)

6.1.1. Current and advance SSS, aimed at development of awareness as well practical skills includes:

- masters' work at lectures, search for and analysis of literature and internet

sources of information on the chosen theme of master dissertation,

- performance of home assignments,
- using materials from information resources,
- study of the topics for self-study,
- study of theoretical material for individual classes,
- preparation for the credit-test.

6.1.1. Topics for self-study:

- Environmental risk management at mineral exploration and mining
- Planning of natural protection measures for minimization of adverse technogenic impact on the environment
- Geologic factors of environmental risk
- Regional approach to risk management
- Risks of environmental component pollution

6.2 Creative problem-oriented autonomous work (CPAW) is aimed at development of intellectual skills, a complex of universal and professional competences, formation of creative approach includes:

- search for, analysis, structuring, and presentation of research, analysis of scientific publications on the given topic of research,
- analysis of statistical and factual materials on the chosen topic,
- research work and participation in students' conferences, seminars, and olympiads.

6.2.1. Approximate list of research tasks and problems:

1. Environmental risk analysis and management for population from environmental pollution.
2. Database of toxicological information
3. Computer software for risk calculation
4. Methods of health risk assessment from heavy metal environmental pollution
5. Geochemical peculiarities in distribution of mercury in soil and its relation with population disease rate

7. Current and final estimation of the course study

Estimation of a master's work is performed in terms of the results:

- self-study practical work,
- masters' mutual review of their works,
- analysis of the masters' practical work reports,
- oral questions at the individual classes, exam (to estimate the awareness of the theoretical material).

7.1. Requirements for the content of credit-test

The exam paper includes two types of tasks:

1. Theoretical question.
2. Problem solution.

7.2. Approximate exam questions

1. Problems of risk management for industrial plant operation
2. Peculiarities in natural resource use and environmental pollution by coal production plants
3. Source classification of environmental risks for coal mining plants polluting the environment
4. Methods of environmental risk assessment for coal mining industry
5. Environmental risk assessment of coal industry operation as a determinant of environmental insurance
6. Development of structure-element system of environmental risk management for industrial enterprises
7. Peculiarities in natural resource use and environmental pollution by petroleum industry enterprises
8. Methods of environmental risk assessment for petroleum industry
9. Risk management at territory level
10. Risk management at enterprise level
11. Environmental risk management induced by environmental pollution
12. Cost efficiency in risk minimization

8. Methodical and information sources

Basic sources:

1. GLASSON, John. Introduction to Environmental Impact Assessment / J. Glasson, R. Therivel, A. Chadwick. — 2nd ed. — Oxford : UCL Press, 1999. — 496 p. — (The Natural and Built Environment Series) . — ISBN 1-85728-945-5: 150 p.
2. Keller, Edward. Essential Environmental Science / E. Keller, D. B. Botkin. — Danvers : John Wiley & Sons, Inc., 2007. — 454 p. : ил. — Index: p. 433-454. — Notes: p. 417-432. — Glossary: p. 410-416. — ISBN 978-0-471-70411-9.
3. Ecological Risk Assessment for Contaminated Sites / G. W. Suter II [et al]. — New York: Taylor & Francis, 2000. — 438 p. : ил. — Glossary: p. 369-376. — References: p. 377-422. — Index: p. 423-438. — ISBN 1-56670-525-8.
4. Alymov V.T., Tarasova N.P. Technogenic risk: Analysis and assessment: Manual for university students. — Moscow: «Akademkniga», 2004. — 118 p.
5. Alymov V.T., Krapchatov V.P., Tarasova N.P. Analysis og technogenic risk: Manual for university students. — Moscow: Kruglyi god, 2000. — 160 p.
6. Nikanorova A.M., Khoruzhaya T.A. Ecology: Manual for university ecologist-students. — Moscow: Vysshaya shkola, 1999. — 304 p.
7. Osipova N.A. Technogenic systems and ecological risk: Manual. Part 1. — Tomsk: Tomsk Polytechnic University Publishing House, 2005. -112 p.

Additional sources

1. Hopkins, Andy. *Animals in Danger* / A. Hopkins, J. Potter. — New York : Oxford University Press, 1997. — 22 p. — (Oxford Bookworms Factfiles. 1) . — ISBN 0194228053.
2. *Hydrology and Lakes* [[Electronic Library Index](#)]. — 261 Items. — Berlin : Springer Berlin Heidelberg, 1998. — (Encyclopedia of Earth Science) . — Заглавие с титульного экрана. — Электронная версия печатной публикации. — online date Wednesday, March 15, 2006. — Доступ из корпоративной сети ТПУ. — Adobe Acrobat Reader. — ISBN 978-0-412-74060-2 (Print). — ISBN 978-1-4020-4513-4
3. *Encyclopedia of Environmental Science and Engineering* / Ed. by J. R. Pfafflina, E. N. Zieglera. — 5th ed. — New York : Taylor & Francis, 2006. Vol. 2: M-Z. — 2006. — 1383 p. — ISBN 0-8493-9843-6.
4. *Encyclopedia of Environmental Science and Engineering* / Ed. by J. R. Pfafflina, E. N. Zieglera. — 5th ed. — New York : Taylor & Francis, 2006.
5. Lisanov M.V. On technical regulation and criteria of acceptable risk // *Bezopasnost truda v promyshlennosti*. - 2004. - № 5. - P. 11-14.
6. Lesnykh V.V. Risk standardization: foreign and domestic experience. hazard.fromru.com/Seminar/6/Lsnh_txt.htm.
7. *Natural and technogenic emergencies: hazards, dangers, risks* / Akimov V.A., Novikov V.D., Radaev N.N. — Moscow: ZAO FID «Delovoy express», 2001. — 344 p.
8. Khoruzhaya T.A. *Assessment of ecological hazards*. — Moscow: Kniga-service, 2002. — 208 p.

Internet-resources:

1. <http://www.wiz.uni-kassel.de/dain/> A set of references for various electronic resources in the sphere of ecology, chemical safety, and risk assessment.
2. <http://www.riskworld.com/> The site reflecting different aspects of risk assessment contains information about new editions and publications, database and computer systems etc.
3. <http://www.epa.gov/> The site of Environment Protection Agency (EPA).
4. <http://www.epa.gov/iris/> The Integrated Risk Information System, (IRIS).
5. <http://www.epa.gov/iris/gloss8.html> Glossary of IRIS Terms. Revised: October 1999.
6. <http://www.epa.gov/iris/subst/> Description of carcinogenic and toxic properties of the substances.
7. <http://www.scorecard.org/> Database on toxic danger.
8. Official site of the Natural Resource Department of Tomsk Oblast: <http://www.green.tsu.ru/>
9. Universal encyclopedia: http://en.wikipedia.org/wiki/Main_Page
10. <http://demoscope.ru/erh/index.html>

9. Course rating

Course rating of master-students' study estimation during a term is presented in the Appendix. In terms of the rating system the current estimation is performed every month during the term by means of points for students' awareness of the course (answers for the questions, maximum points are 36), results of practical activity (practical work performance, maximum points are 36), answer at the exam (maximum points are 28).

Maximum rating of the curriculum is defined by 100 points that corresponds to 100 % quality of knowledge.

10. Methodical aids of the course

To teach the course the following manuals and aids are used:

- Power Point lecture presentation;
- Library electronic resource;
- Electronic library Elsevier;
- A set of graph applications;
- Computers;
- Computer program «Risk Assistant»

The curriculum is based on the Standard of the TPU BEP in accordance with the requirements of FSES in specialization 022000 «Ecology and Natural Resource Use» of major «Geoecology». The curriculum is designed in the course of Agreement on development and performance of the Joint Master (Double Degree) Program of Tomsk Polytechnic University (Tomsk, Russia) and Paris-11 University (Paris, France).

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The curriculum was approved at the meeting of Geoecology and Geochemistry Department

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