Ministry of Education and Science of the Russian Federation
Federal Independent Educational Institution
«NATIONAL RESEARCH TOMSK POLYTECHNIC UNIVERSITY»

Research School of Chemical and Biomedical Technologies
Direction of training 12.04.04 «Biotechnical systems and technologies»

MASTER'S THESIS

Topic of the work
Development of elements of a system for the prevention of cancer diseases of the population in areas of radiation-contaminated tailings

UDC 616-006-084

Student

Group	**Full name**	**Signature**	**Date**
9DM8I	Toktorbaeva Anari Ismailovna		

Scientific Supervisor and Technical Advisor

Position	**Full name**	**Academic degree, rank**	**Signature**	**Date**
Assistant professor	Romanenko Sergey Vladimirovich	Doctor of Chemical Sciences, Professor ISHHBMT		

ADVISORS:

Section «Financial Management, Resource Efficiency and Resource Saving»

Position	**Full name**	**Academic degree, rank**	**Signature**	**Date**
Student counseling	Menshikova Ekaterina Valentinovna	PhD in Philosophy		

Section «Social Responsibility»

Position	**Full name**	**Academic degree, rank**	**Signature**	**Date**
Student counseling	Gorbenko Mikhail Vladimirovich	Candidate of Technical Sciences		

ADMIT OT DEFENSE:

Head of the Program	**Full name**	**Academic degree, rank**	**Signature**	**Date**
Assistant professor	Gubarev Fedor Aleksandrovich	Candidate of Technical Sciences		

Tomsk – 2020

Planned program learning outcomes

Код резуль-тата	**Результат обучения (выпускник должен быть готов)**	**Требования ФГОС, критериев и/или заинтересованных сторон**
	Профессиональные компетенции	
P1	Применять глубокие специальные естественнонаучные, математические, социально-экономические и профессиональные знания в инновационной инженерной деятельности при разработке, производстве, исследовании, эксплуатации, обслуживании и ремонте современной биомедицинской и экологической техники	Требования ФГОС (ОК-2, ОПК-2), Критерий 5 АИОР (п. 5.2.1), согласованный с требованиями международных стандартов *EUR-ACE* и *FEANI*
P2	Ставить и решать инновационные задачи инженерного анализа и синтеза с использованием специальных знаний, современных аналитических методов и моделей	Требования ФГОС (ОПК-1, 3; ПК- 1 – 4), Критерий 5 АИОР (п. 5.2.2), согласованный с требованиями международных стандартов EUR-ACE и FEANI
P3	Выбирать и использовать необходимое оборудование, инструменты и технологии для ведения инновационной практической инженерной деятельности с учетом экономических, экологических, социальных и иных ограничений	Требования ФГОС (ОК-9, ПК-10, 14, 18). Критерий 5 АИОР (пп. 5.2.3, 5.2.5), согласованный с требованиями международных стандартов EUR-ACE и FEANI
P4	Выполнять комплексные инженерные проекты по разработке высокоэффективной биомедицинской и экологической техники конкурентоспособной на мировом рынке	Требования ФГОС (ОК-2, 3; ПК-5 – 11, 14), Критерий 5 АИОР (пп. 5.2.3, 5.2.5), согласованный с требованиями международных стандартов *EUR-ACE* и *FEANI*
P5	Проводить комплексные инженерные исследования, включая поиск необходимой информации, эксперимент, анализ и интерпретацию данных с применением глубоких специальных знаний и современных методов для достижения требуемых результатов в сложных и неопределенных условиях	Требования ФГОС (ОК-2, 3; ОПК-5, ПК-1 – 4). Критерий 5 АИОР (пп. 5.2.2, 5.2.4), согласованный с требованиями международных стандартов *EUR-ACE* и *FEANI*
P6	Внедрять, эксплуатировать и обслуживать современное высокотехнологичное оборудование в предметной сфере биотехнических систем и технологий, обеспечивать его высокую эффективность, соблюдать правила охраны здоровья и безопасности труда, выполнять требования по защите окружающей среды	Требования ФГОС (ОПК-1, 2), Критерий 5 АИОР (пп. 5.2.5, 5.2.6), согласованный с требованиями международных стандартов *EUR-ACE* и *FEANI*
	Универсальные компетенции	
P7	Использовать глубокие знания в области проектного менеджмента для ведения инновационной инженерной деятельности с учетом юридических аспектов защиты интеллектуальной собственности	Требования ФГОС (ОПК-2; ПК-14, 15). Критерий 5 АИОР (п. 5.3.1), согласованный с требованиями международных стандартов *EUR-ACE* и *FEANI*
P8	Владеть иностранным языком на уровне, позволяющем активно осуществлять коммуникации в профессиональной среде и в обществе, разрабатывать документацию, презентовать и защищать результаты инновационной инженерной деятельности	Требования ФГОС (ОК-1), Критерий 5 АИОР (п. 5.3.2), согласованный с требованиями международных стандартов *EUR-ACE* и *FEANI*
P9	Эффективно работать индивидуально и в качестве члена и руководителя команды, состоящей из специалистов различных направлений и квалификаций, с делением ответственности и полномочий при решении инновационных инженерных задач	Требования ФГОС (ОК-3, ОПК-3; ПК-3, 12, 13), Критерий 5 АИОР (п. 5.3.3), согласованный с требованиями международных стандартов *EUR-ACE* и *FEANI*
P10	Демонстрировать личную ответственность, приверженность и готовность следовать профессиональной этике и нормам ведения инновационной инженерной деятельности	Критерий 5 АИОР (п. 5.3.4), согласованный с требованиями международных стандартов *EUR-ACE* и *FEANI*
P11	Демонстрировать глубокие знание правовых социальных, экологических и культурных аспектов инновационной инженерной деятельности, компетентность в вопросах охраны здоровья и безопасности жизнедеятельности	Критерий 5 АИОР (п. 5.3.5), согласованный с требованиями международных стандартов *EUR-ACE* и *FEANI*
P12	Самостоятельно учиться и непрерывно повышать квалификацию в течение всего периода профессиональной деятельности	Требования ФГОС (ОК-2, 4; ОПК-4), Критерий 5 АИОР (п.5.3.6), согласованный с требованиями международных стандартов *EUR-ACE* и *FEANI*

Ministry of Education and Science of the Russian Federation
Federal Independent Educational Institution
«NATIONAL RESEARCH TOMSK POLYTECHNIC UNIVERSITY»

Research School of Chemical and Biomedical Technologies
Direction of training 12.04.04 «Biotechnical systems and technologies»

APPROVED BY
Head of the Program
__________ __________F.A. Gubarev
09.03.2020

ASSIGNMENT
for the Master's Thesis completion

In the form:

Master's Thesis

For a student:

Group	Full Name
9DM8I	Toktorbaeva Anari Ismailovna

Topic of the work:

Development of elements of a system for the prevention of cancer diseases of the population in areas of radiation-contaminated tailings	
Approve by the order of the Head (date, number)	

Deadline for completion of the Master's Thesis:	03.06.2020

TERMS OF REFERENCE:

Initial data for work: *(the name of the object of research or design; performance or load; mode of operation (continuous, periodic, cyclic, etc.); type of raw material or material of the product; requirements for the product, product or process; special requirements to the features of the operation of the object or product in terms of operational safety, environmental impact, energy costs; economic analysis, etc.).*	This work is devoted to the study of radioactive tailings and dumps in the Kyrgyz Republic, and their impact on the environment and the health of the population living in the vicinity. The subject of the study is the population living in areas of radiation-contaminated tailings and their incidence, including oncology.
List of the issues to be investigated, designed and developed *(analytical review of literary sources in order to elucidate the achievements of world science and technology in the field under consideration, the formulation of the problem of research, design, construction, the content of the procedure of the research, design, construction, discussion of the performed work results, the name of additional sections to be developed; work conclusion).*	1. Literature review; 2. Statistical calculations and data on pollutants and their components; 3. Main reasons he diseases living the of residents near the radioactive tailings and dumps; 4. Statistical calculation of oncological diseases by region, region and cities for 2016-2018; 5. Improvement of the system of prevention of oncological diseases by means of prevention, recultivation, strengthening of

	radiation-contaminated tailing stores and dump; 6. Financial management, resource efficiency and resource conservation; 7. Social responsibility; **8.** Conclusion.
List of graphic material *(with an exact indication of mandatory drawings)*	1. Map; 2. Detail scheme; 3. Table; 4. Picture.
Advisors on the sections of the Master's Thesis	
Chapter	**Advisor**
Section «Financial Management, Resource Efficiency and Resource Saving»	PhD in Philosophy Menshikova Ekaterina Valentinovna
Section «Social Responsibility»	Candidate of Technical Sciences Gorbenko Mikhail Vladimirovich

Date of issuance of the assignment for Master's Thesis completion according to a line schedule	09.03.2020

The task was issued by the Scientific Supervisor and Technical Advisor:

Position	Full Name	Academic degree, rank	Signature	Date
Assistant professor	Romanenko Sergey Vladimirovich	Doctor of Chemical Sciences, Professor ISHHBMT		09.03.2020

The assignment was accepted for execution by the student:

Group	Full Name	Подпись	Дата
9DM8I	Toktorbaeva Anari Ismailovna		09.03.2020

TASK FOR SECTION
«FINANCIAL MANAGEMENT, RESOURCE EFFICIENCY AND RESOURCE SAVING»

To the student:

Group	Full name
9DM8I	Toktorbaeva Anari Ismailovna

School	Research School of Chemical and Biomedical Technologies	**Division**	
Degree	Master	**Educational Program**	12.04.04 Biotechnical systems and technologies

Input data to the section «Financial management, resource efficiency and resource saving»:	
1. *Resource cost of scientific and technical research (STR): material and technical, energetic, financial and human*	- Salary of the head - 49141 rub. - Engineer's salary - 17 890 rubles. - The cost of materials and components is determined on the basis of price lists of companies
2. *Expenditure rates and expenditure standards for resources*	– Electricity costs – 5,8 rub per 1 kW
3. *Current tax system, tax rates, charges rates, discounting rates and interest rates*	– Labor tax – 27,1 %; – Overhead costs – 30%;
The list of subjects to study, design and develop:	
1. *Assessment of commercial and innovative potential of STR*	– comparative analysis with other researches in this field;
2. *Development of charter for scientific-research project*	– SWOT-analysis;
3. *Scheduling of STR management process: structure and timeline, budget, risk management*	– calculation of working hours for project; – creation of the time schedule of the project; – calculation of scientific and technical research budget;
4. *Resource efficiency*	– integral indicator of resource efficiency for the developed project.
A list of graphic material *(with list of mandatory blueprints):*	
1. *Competitiveness analysis* 2. *SWOT- analysis* 3. *Gantt chart and budget of scientific research* 4. *Assessment of resource, financial and economic efficiency of STR* 5. *Potential risks*	

Date of issue of the task for the section according to the schedule	

Task issued by adviser:

Position	Full name	Scientific degree, rank	Signature	Date
Associate professor	E.V. Menshikova	PhD		

The task was accepted by the student:

Group	Full name	Signature	Date
9DM8I	Toktorbaeva Anari Ismailovna		

SECTION TASK

"SOCIAL RESPONSIBILITY"

To the student:

Group	Full name
9DM8I	Toktorbaeva Anari Ismailovna

School	Research School of Chemical and Biomedical Technologies	**Division**	
Degree	Master	**Educational Program**	12.04.04 Biotechnical systems and technologies

Topic of the work:

Development of elements of a system for the prevention of cancer diseases of the population in areas of radiation-contaminated tailings	
Input data to the section «Social responsibility»:	
1. Characteristics of the object of study (substance, material, device, algorithm, method, working area) and its areas of application	Object of research: Radioactive tailings and dumps in the Kyrgyz Republic, and their impact on the environment and the health of the population living in the vicinity.
The list of subjects to study, design and develop:	
1. 1. Legal and organizational safety issues: 1.1. Special legal norms of labor legislation 1.2. Organizational arrangements for the layout of the working area	1. GOST 12.0.003–99. SSBT. Dangerous and harmful production factors. Classification 2. GOST 12.1.038-82 SSBT. Electrical safety. Maximum allowable levels of contact voltage and currents 3. GOST R 22.0.02-2016 Safety in emergency situations.
2. Industrial safety: 2.1. Analysis of harmful and dangerous factors that can be created by object of study 2.2. Justification of measures to protect the researcher from the effects of hazardous and harmful factors.	1. The harmful effects of uranium tailings leading to chronic diseases, including exacerbating existing diseases, due to prolonged relatively low-intensity exposure; 2. Polluted environment; 3. Use of polluted sources (water, soil and others). 4. Inadequate illumination of the working area 5. Electromagnetic field 6. Electric shock
3. Environmental safety:	Environmental pollution by toxic and radioactive substances
4. Safety in emergency situations:	Tailings accident

Date of issue of the task for the section according to the schedule	

Task issued by adviser:

Position	Full name	Scientific degree, rank	Signature	Date
Associate professor	Gorbenko Mikhail Vladimirovich	PhD		

The task was accepted by the student:

Group	Full name	Signature	Date
9DM8I	Toktorbaeva Anari Ismailovna		

Abstract

The master's work contains 87 pages, 11 figures, 30 tables, 31 links, 5 applications.

Key words: tailings, radioactive waste in the Kyrgyz Republic. The object of the study is the radioactive tailings and dumps in the Kyrgyz Republic, and their impact on the environment and the health of the population living in the vicinity.

Objective: During the study, a review of the literature on tailings and dumps, as well as their impact on the environment and the health status of the population of Kyrgyzstan was, conducted. Based on the review, an analysis was made of the geochemical features containing tailings and mountain dumps. As a result, of the study, the content of radionuclides in the tailings was, revealed, as well as, the assessment of the radioecological hazard and a statistical calculation of oncological diseases in the Kyrgyz Republic was, carried out.

Scope: it is an environment and environmental safety. Thanks to the proposed program of action and the project proposal, it is possible to improve the environmental situation as a whole and reduce the increase in incidence rates to which the incidence statistics, including oncology.

Economic efficiency / significance of the work: project efficiency calculations showed that the project has a high level to improve the overall environmental situation and protect the environment and territory from pollution. The project also helps to reduce disease statistics and protect the health of people living in the, vicinity of radioactive waste.

CONTENT

INTRODUCTION

Relevance. Environmental safety is the most important aspect of the state of protection of the natural environment, and the vital interests of a person, including his health, as well as material property, from the possible negative impact of economic and other activities, and in cases of emergencies of a natural and technogenic nature, and their effects.

To maintain environmental safety, it is necessary to touch upon such problems as environmental pollution, which damages both nature and the environment with harmful substances and waste.

In the recent past, Kyrgyzstan (hereinafter KR) was one of the most serious and important sources of uranium and rare earth metals in the USSR. In the mountainous region, starting in 1907, functional mines and plants engaged in the mining and processing of uranium ores, rare-earth elements with thorium mineralization. As a legacy from the many years of activity of these enterprises, a huge amount of radioactive waste left in the territory of the Kyrgyz Republic remained.

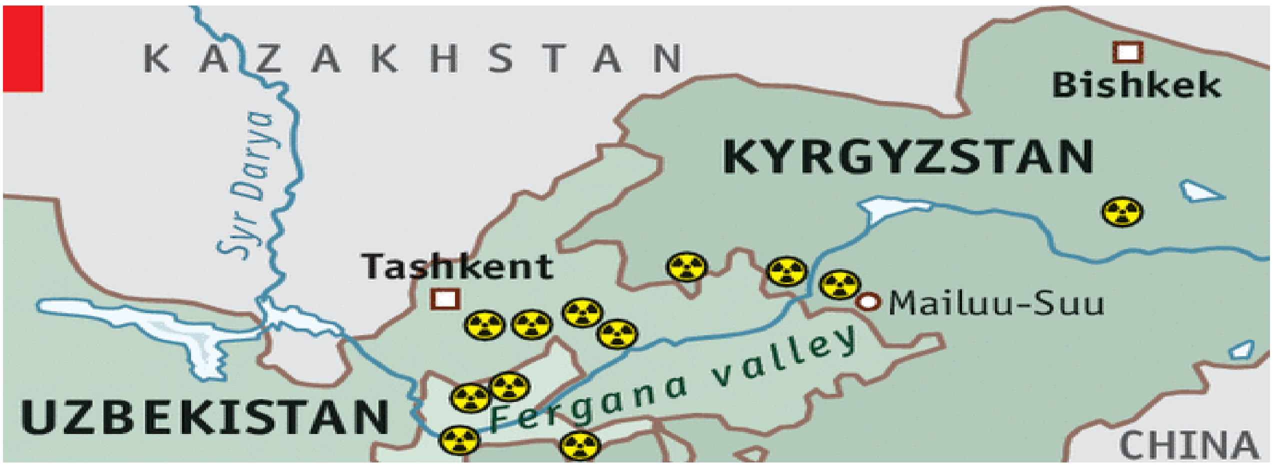


Figure 1. - Map of the location of radioactive tailings and dumps in Kyrgyzstan.

As a result inefficient production and irrational processing, 35 radioactive tailing dumps and 37 dumps remained with a total volume of more than 130 million m^3.

Of these, 25 are dumps and 35 tailings, 30 of which contain uranium production waste, 5 with non-ferrous metal production waste. Which the on the balance sheet of the Ministry of Ecology and Emergencies of the Kyrgyz Republic with a volume of 11.9 million m³, the rest is managed by existing enterprises. Their total radioactivity is more than 90 thousand curies.

By the Decree of the Government of the Kyrgyz Republic dated March 23, 1999 No. 161, the aforementioned tailings and dumps were transferred to the balance of the Ministry of Ecology and Emergencies of the Kyrgyz Republic.

The technical condition of the tailings, at the time of the adoption of the balance of the Ministry of Ecology and Emergencies, require thorough rehabilitation and restoration work. From 1993 to 1999, emergency recovery work and ongoing maintenance work carried out occasionally and not in full. Due to untimely work, most of the tailings exposed to dangerous natural processes. The situation is aggravated by the fact that most of the tailings and dumps in the region are located in areas of high seismic and landslide activity, mudflows and floods and in areas with close occurrence of groundwater.

In addition, almost all tailings and dumps are located within the boundaries of human settlements in the vicinity of the habitat of people. They are also located on catchment areas, often in channels and floodplains of transboundary river basins flowing into densely populated valleys of the entire Central Asian region.

The above dangerous natural processes and phenomena, combined with unauthorized access of the local population to the radioactive waste storage facilities, permanently worsen the environmental situation in the waste storage areas. Thus, having the greatest impact on the health of the population living vicinity of the radioactive waste and tailings dumps, which directly leads to numerous diseases, such as oncology or other types of diseases that can be detected over time.

The purpose of this work is to improve the system for the prevention of cancer of the population in areas of radiation-contaminated tailings with the help of prevention, strengthening and reclamation.

Tasks:

1. Conducting a literature review on the impact of radioactive tailings and dumps on the environment and the health status of the population of Kyrgyzstan.
2. The study of geochemical features containing tailings and dumps and their statistics.
3. Determination of the content of radionuclides in tailings, as well as an assessment of the radioecological hazard.
4. Protection of the environment and public health in areas of radiation-contaminated tailings using prevention, strengthening and reclamation.
5. Statistical calculation of oncological diseases in the Kyrgyz Republic, as well as ways to improve the cancer prevention system of the population in areas of radiation-contaminated tailings.

The object of the study is the radioactive tailings and dumps in the Kyrgyz Republic and their impact on the environment and the health of the population living in the vicinity.

The subject of the study is the population living in areas of radiation-contaminated tailings and their incidence, including oncology.

Materials and research methods. Statistical calculation of the incidence of the population, including oncology, living in areas of radiation-contaminated tailings and dumps was, carried out in the Kyrgyz Republic, from June to August 2019 together with the Tailings Management Agency under the Ministry of Emergencies of the Kyrgyz Republic and the State Agency for Environmental Protection and forestry of the Kyrgyz Republic.

The scientific novelty of the work. For the first time, an action program and a project proposal to improve the system for the prevention of cancer and other types of diseases of the population in areas of radiation-contaminated tailings using prevention, strengthening and restoration.

The practical significance of the work. The studies conducted allowed us to identify and calculate the increase in the incidence of the population of oncology and other types of disease in the Kyrgyz Republic. In the course of the work, a statistical monitoring calculation of the incidence rate by region and city was obtained as well as an action program and a project proposal to improve the system for the prevention of cancer and other types of diseases of the population in areas of radiation-contaminated tailings using prevention, strengthening and restoration. Statistical data can be used by government bodies to solve this problem, as well as to attract foreign sponsors. The results can, be used in the educational process when conducting classes for students of environmental specialties.

LITERATURE REVIEW

CHAPTER 1. RADIATION-CONTAMINATED TAILINGS IN THE TERRITORY OF THE KYRGYZ REPUBLIC

1.1 PHYSICO-GEOGRAPHICAL AND CLIMATIC CHARACTERISTICS OF KYRGYZSTAN

The Kyrgyz Republic is located in the northeast of the countries of Central Asia, occupying the western part of the Tien Shan mountain system and the northern mountainous regions of the Pamir-Alai. The area is 199.9 thousand km^2, of which 4.2% of the area is occupied by forests, 4.4% - is occupied by water, 53.5% - by agricultural land. The total area of the republic is approximately equal to the total area of Portugal, Holland, Belgium and Switzerland. The maximum distance from west to east is 925 km, from north to south - 453.9 km.

On three sides: from the north, west and south, the republic borders with the republics of the Commonwealth of Independent States - Kazakhstan, Uzbekistan, Tajikistan, and from the east and southeast with the People's Republic of China. The total length of the borders of Kyrgyzstan is 4508 km with the Republic of Kazakhstan - 1113 km of the border, the Republic of Uzbekistan - 1374 km and the Republic of Tajikistan - 972 km, with the People's Republic of China - 1049 km.

Figure 2. Detailed map of the Kyrgyz Republic.

Kyrgyzstan is a country of high mountain ranges, deep gorges and wide stretching basins. Kyrgyzstan is known for the Tien-Shan mountains, which stretch for hundreds of kilometers in Central Asia. Kyrgyzstan are located at an altitude of 1000 m above sea level, and 40.8% - at an altitude of 3000 m above sea level. Almost the entire population lives in areas located at an altitude of 1800 meters above sea level. The average height above sea level is 2750 m, the maximum - 7439 m, the minimum - 401 m (the territory of the Leilaika region). The large height difference difficult terrain long geological history of the region and other factors led to the formation of a wide range of natural conditions and rich mineral reserves. On the territory of the Kyrgyz Republic, you can find all the natural zones characteristic of the Northern Hemisphere, with the exception of the tropical one.

In the Kyrgyz Republic, there are 1923 lakes. The largest lakes of the republic are Lake Issyk-Kul whose water surface is 6236 km^2, Son-Kul whose area is 275 km^2, and Chatyr-Kul with a surface area of 175km^2. The longest rivers of the republic are the Naryn river with a length of 535 km, the Chatkal river with a length of 205 km and the Chu river whose length is 221 km.

Figure 3. Issyk-Kul Lake

By climatic conditions, Kyrgyzstan is characterized by a sharp continental zone, the duration of sunshine, high zonality and large spatial differences.

1.2 RADIATION-POLLUTED TAILINGS AND DUMPS IN THE TERRITORY OF THE KYRGYZ REPUBLIC OF THEIR DESCRIPTION AND LOCATION

The waste of uranium mining enterprises (the so-called “tails”) is directed, as a rule, to specially created “tailings”, which are essentially a hydraulic engineering structure with enclosing dams, with an open surface of stored waste (“tails”) [7].

Tailings uranium production facilities are a source of radiation hazard. Ensuring the safety of such facilities requires an understanding of the nature of the sources and routes of exposure from tailings, the environment and the population, both under existing conditions and in the context of possible potential manifestations of natural factors, living conditions and human activities. To make responsible, managing decisions, we need knowledge about radiation safety, variability of the characteristics of environmental pollution sources, radiation factors, and information about the state of former uranium production facilities [8].

Currently, most mines, tailings, dumps and storage facilities are in neglect and poorly guarded. Radioactive waste, heavy metals and other toxic substances pollute the environment: surface and groundwater, atmosphere, soil and plants. Literally all tailing dumps and dumps are located along the banks of mountain rivers, in a landslide of hazardous zones or areas of possible flooding by waters, as well as with the formation within settlements.

In due time, serious miscalculations were made when choosing the places for laying the storages of radioactive waste, methods for their design, operation and control. As a result natural disasters (earthquakes, landslides, mudflows, etc.), a number of uranium tailings are damaged and the threat of radioactive contamination of the territory of the republic [1]. This does not meet the radiation safety requirement. This situation is even, complicated by the fact that many burial sites are located in active seismic zones, in places where dangerous changes are occurring, as well as in the presence of coastal rivers, which form the basis of the vast water basin of the Central Asian region. The problem of uranium tailings and toxic industrial waste in Kyrgyzstan today remains extremely serious.

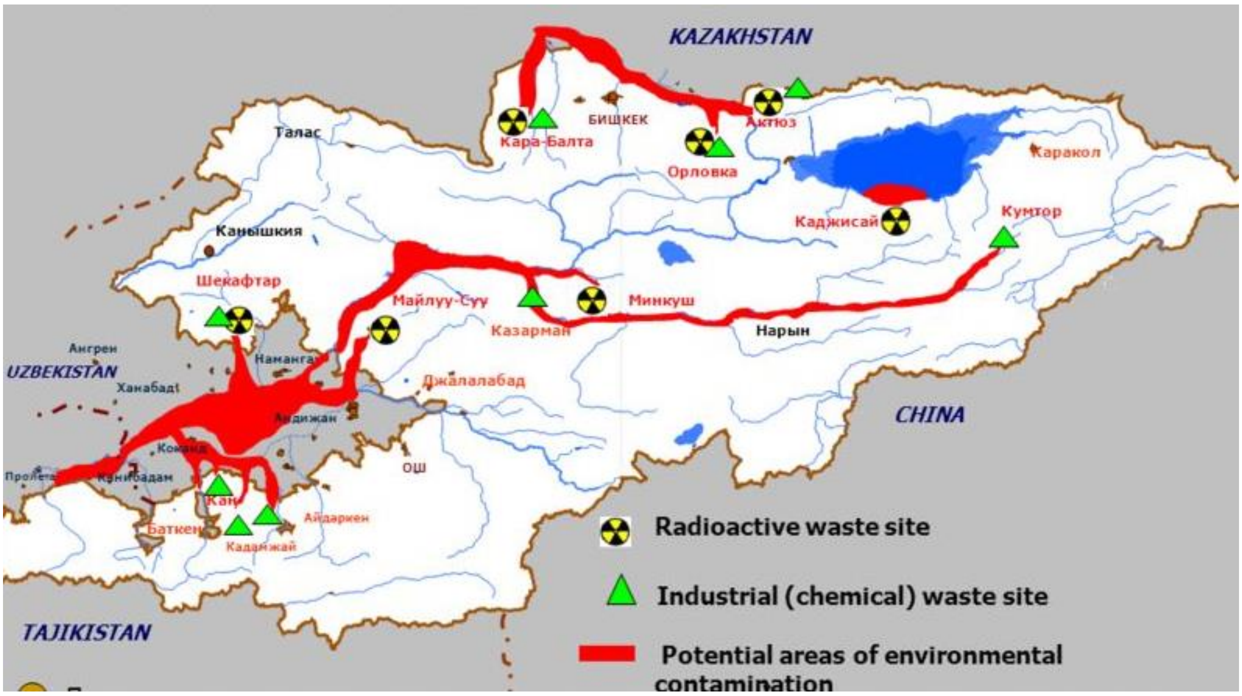


Figure 4. Map of the location of tailings and waste.

1.2.1 STATISTICAL CALCULATIONS AND DATA ON POLLUTANTS AND THEIR COMPONENTS

The technical condition of the tailings at the time of the adoption of the balance of the Ministry of Ecology and Emergencies required thorough rehabilitation and restoration work, since from 1993 to 1999 emergency recovery work and ongoing maintenance work were carried out sporadically and not in full [9]. Due to untimely work, most of the tailings was exposed to dangerous natural processes.

When designing and laying the tailings, long-term measures, potential landslides, floods and mudflows not taken into account.

In addition, almost all tailing dumps are located within the boundaries of settlements or directly near the habitat of people. The current state of the tailings is a matter of concern. In the case of the destruction of tailings, it will lead to an environmental disaster not only in Kyrgyzstan, but also in neighboring republics.

Since most of the tailings and dumps are located in the southern part of the country, descriptions of environmental problems and statistical calculations of the contained components will be presented in tabular form, starting from the southern part of the country to the northern.

JALAL-ABAD REGION

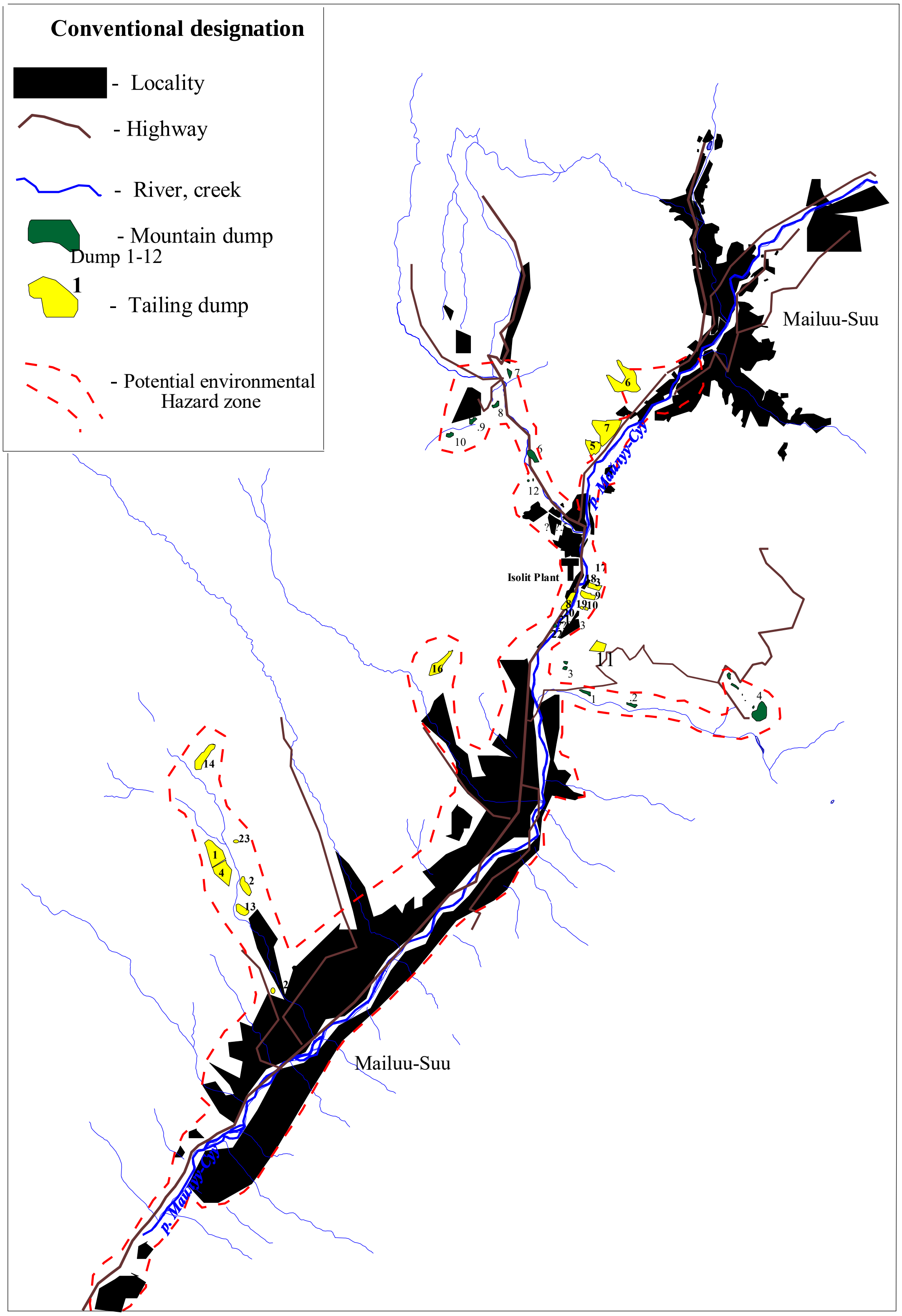
ENVIRONMENTAL PROBLEMS AND STATISTICAL CALCULATION OF THE CONTAINED COMPONENTS ON THE TAILINGS IN MAILUU-SUU

The uranium deposit in the area of Mailuu-Suu mined from 1946 to 1967. At present, there are 23 tailing dumps and 13 mountain dumps on the territory of this province with a total volume of about 1.99 million.m^3, anomalous sites up to 1000 μR / h [6]. In case of destruction and displacement of tailings in the region, may suffer: in Kyrgyzstan - 26 thousand people, in Uzbekistan about 2.4 million; Tajikistan - 0.7 million; Kazakhstan about 0.9 million people.

Currently, the disposal facilities in the city of Mailuu-Suu according to the degree of danger and exposure to natural processes divided into categories:

1. Unstable, in critical condition, for which urgent measures are necessary to ensure their safety. This category includes tailings No. 3,5,7,18,13.
2. Relatively stable tailings located in potential landslide zones and zones of possible destruction by mudflows. This category includes tailings No. 1, 2, 4, 6, 8, 9, 10, 11, 14, 15, 16, 19, 20, 21, 22. In the event of extreme natural processes – mudflows, landslides, their partial damage is possible. The most vulnerable of them are Nos. 8, 13, 20, 21, 22.
3. Dumps of substandard ores located in the channels of mudflow streams and directly in residential buildings of the city. This category includes dumps No. 1-7, 11, 12, 13. The dumps are non-reclaimed, under the influence of precipitation and erosion by their surface waters, natural leaching and washing of radionuclides and their removal to the Mailuu-Suu river occurs. Non-reclaimed dumps are a source of uranium-containing dust and pollution of the air, soil and surface water.

Figure 5. Map of tailings and dumps in Mailuu-Su



Calculation table in Mailuu-Suu:

Brief information on tailings and dump in Mailuu-Suu

Name of enterprise affiliation	Name of storage location	Operation period	Occupied area thousand m^2	Volume mln.m^3	Doses of gamma radiation, μR / hour	Main pollutants
Uranium deposit in Mailuu-Suu	23 tailings and 13 mountain dumps	1946 - 1968	Area by location, various	The total volume of 1.99 million.m^3 Waste nekonts, ore 940.5 thousand.m^3	On a turn, tail. 30-60 μR / hour On the anom.plots above 1000 μR / hour	Radioactive uranium, mine waste, heavy metals and cyanides

ENVIRONMENTAL PROBLEMS AND STATISTICAL CALCULATION OF THE CONTAINED TAIL COMPONENTS IN SUMSAR

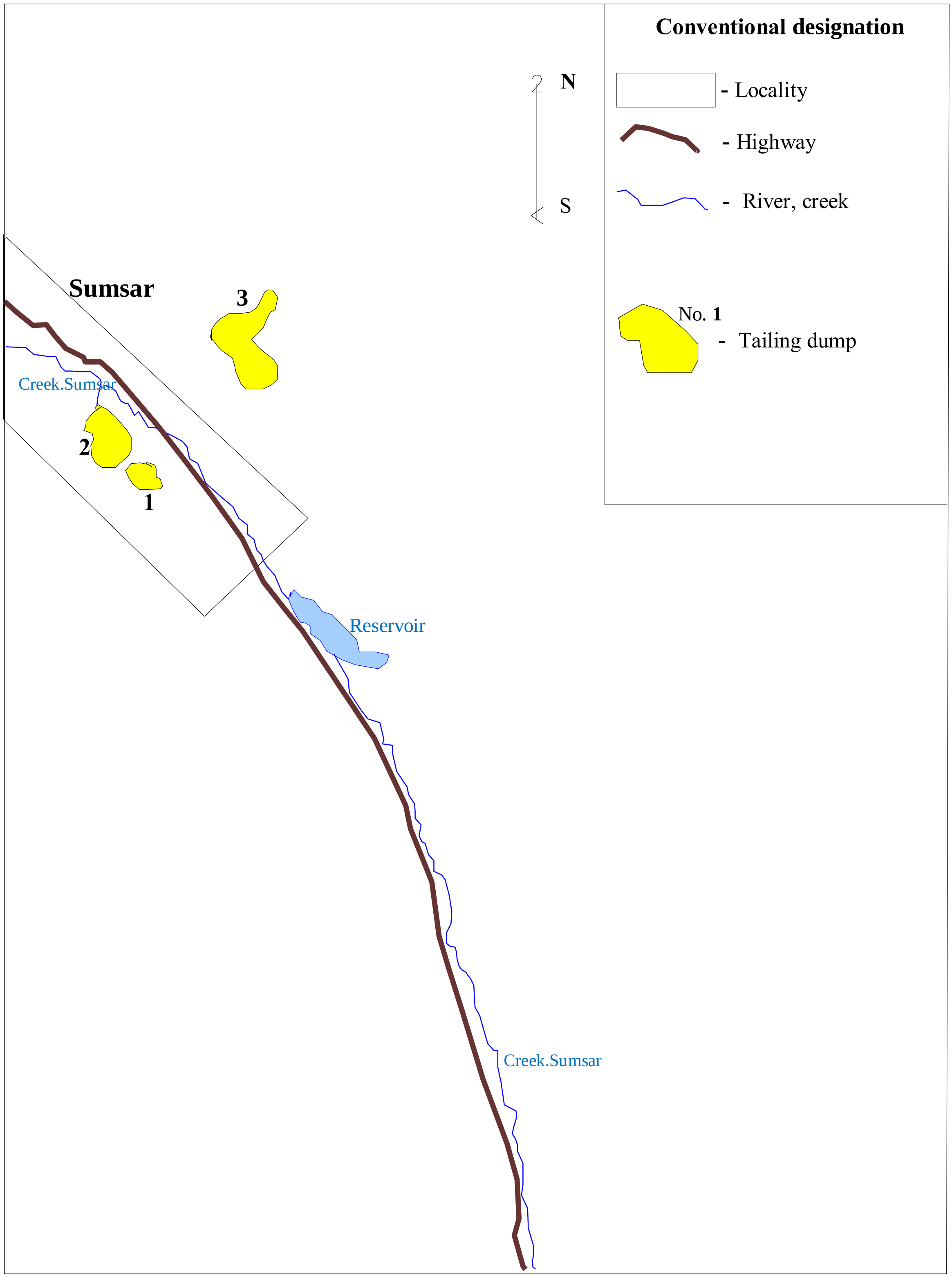
Sumsar village is located in a mountainous area on the territory of Chatkal district of Jalal-Abad region. The terrain is complex, rugged by streams. The Sumsar mine department functioned from 1950 to 1978, mined and processed polymetallic ores (lead, zinc, copper and silicon). As a result, enterprise's activity, 3 tailing dumps with a total volume of 2.65 million. m^3 (4.5 million tons) were reclaimed in the area of Sumsar village [2]. Tailings No. 1 and 2 were, mothballed and no tailing works at tailing No. 3 were, carried out.

At present, hydraulic structures and tailing dam No. 1 are destroyed, intense erosion of the alluvial dam of tailing dump No. 2, tailing material to the Sumsar river, then to the Ferghana Valley. The main pollutants are salts of heavy metals (lead, zinc, cadmium, antimony).

Below tailing, pond No. 1 there is a drinking water intake for the villages of Sumsar, Shekaftar and a number of other villages, which carries an increased risk of harm to public health.

A distinctive feature of tailing pond No. 3 is the presence of mine workings under its bottom. It should also be noted that tailing pond No. 3was not mothballed in the prescribed manner. On the surface of the tailing dump, there are lowered areas, the protective layer in some areas is destroyed. There are no fences and warning signs. According to the Sanitary and Epidemiological Station, the manganese content in the waters of the Sumsar River exceeds the maximum permissible concentration by 9 time and cadmium by 320 times.

Figure 6. Map layout of tailings in Sumsar



Calculation table in Sumsar:

Brief information on the tailings of the in Sumsar

Name of enterprise affiliation	Name of storage location	Operation period	Occupied area thousand m^2	Volume mln.m^3	Doses of gamma radiation, µR / hour	Main pollutants	Types of protective structures
Former Sumsar ore-administration of the USSR	Tailings pond number 1	1950 - 1976	10.8	0.18	-	Heavy metal salts	Alluvial dam
Former Sumsar ore-administration of the USSR	Tailings pond number 2	1950 - 1976	66	1.82	-	Heavy metal salts	Dam, upland ditch
Former Sumsar ore-administration of the USSR	Tailings pond number 3	1950 - 1976	100	0.65	-	Heavy metal salts	Conc. Not carried out

ENVIRONMENTAL PROBLEMS AND STATISTICAL CALCULATION OF THE CONTAINED COMPONENTS ON MINING DUMP SHEKAFTAR

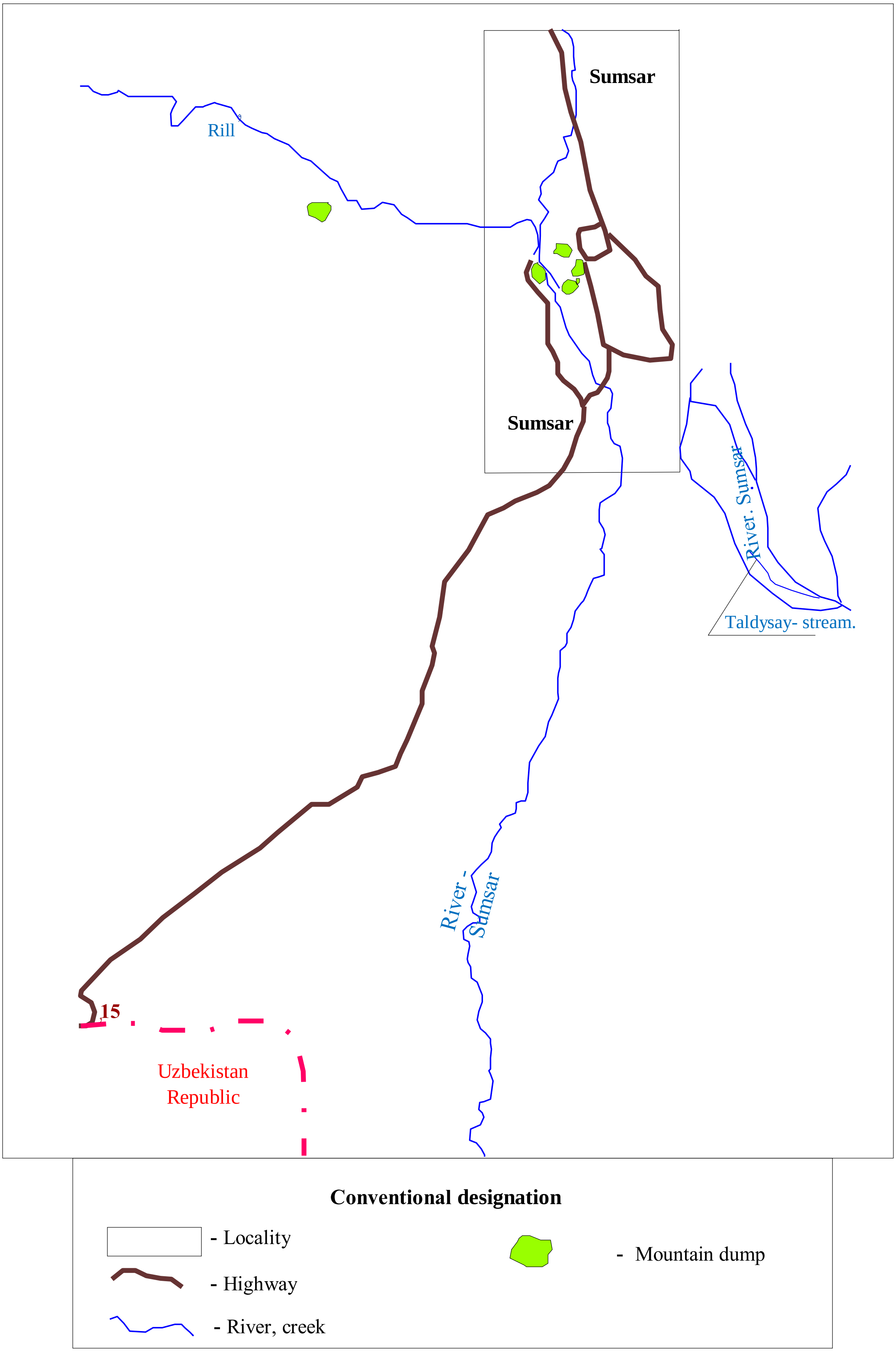
On the territory of Shekaftar, where earlier from 1946 to 1957 a mine was functioning, 8 dumps are located. About 700 thousand. m^3 of low-radioactive, rocks and substandard ores are stored in dumps [3].

In close proximity are residential buildings with household plots. The main pollutants are elements of the uranium series. The average gamma background is 60-100 μR / hour, in abnormal areas - up to 300 μR / hour [1]. All, dumps are not reclaimed.

The material, from them is used by local residents for household needs. Dump No. 5 located on the bank of the river Sumsar is intensively washed by its waters. The absence of vegetation on the surface contributes to the development of wind erosion and surface wash-off of the material of dumps and their spread not only to the territory of Shekaftar settlement, but also to the adjacent territory of the Ferghana Valley.

With more extensive destruction of dumps, the transboundary territories of Uzbekistan and Tajikistan will be infected.

Figure 7. Map of Shekaftar dumps



Calculation table Shekaftar:

Brief information on the mountain dumps Shekaftar

Name of enterprise affiliation	Name of storage location	Operation period	Occupied area thousand m^2	Volume $mln.m^3$	Doses of gamma radiation, μR / hour	Main pollutants Types of protective structures
Former Shekaftar ore management of the USSR	Dump № 1	1946 - 1967	7.5	0.06	60 - 150	Uranium row of elements Does not have
Former Shekaftar ore management of the USSR	Dump № 2	1946 - 1967	0.4	0.0016	60 - 80	Uranium row of elements Does not have
Former Shekaftar ore management of the USSR	Dump № 3	1946 - 1967	2.6	0.01	60 - 80	Uranium row of elements Does not have
Former Shekaftar ore management of the USSR	Dump № 4	1946 - 1967	7.5	0.06	60 - 150	Uranium row of elements Does not have
Former Shekaftar ore management of the USSR	Dump № 5	1946 - 1967	3	0.45	80 - 100	Uranium row of elements Does not have
Former Shekaftar ore management of the USSR	Dump № 6	1946 - 1967	3.2	0.026	60 - 80	Uranium row of elements Does not have

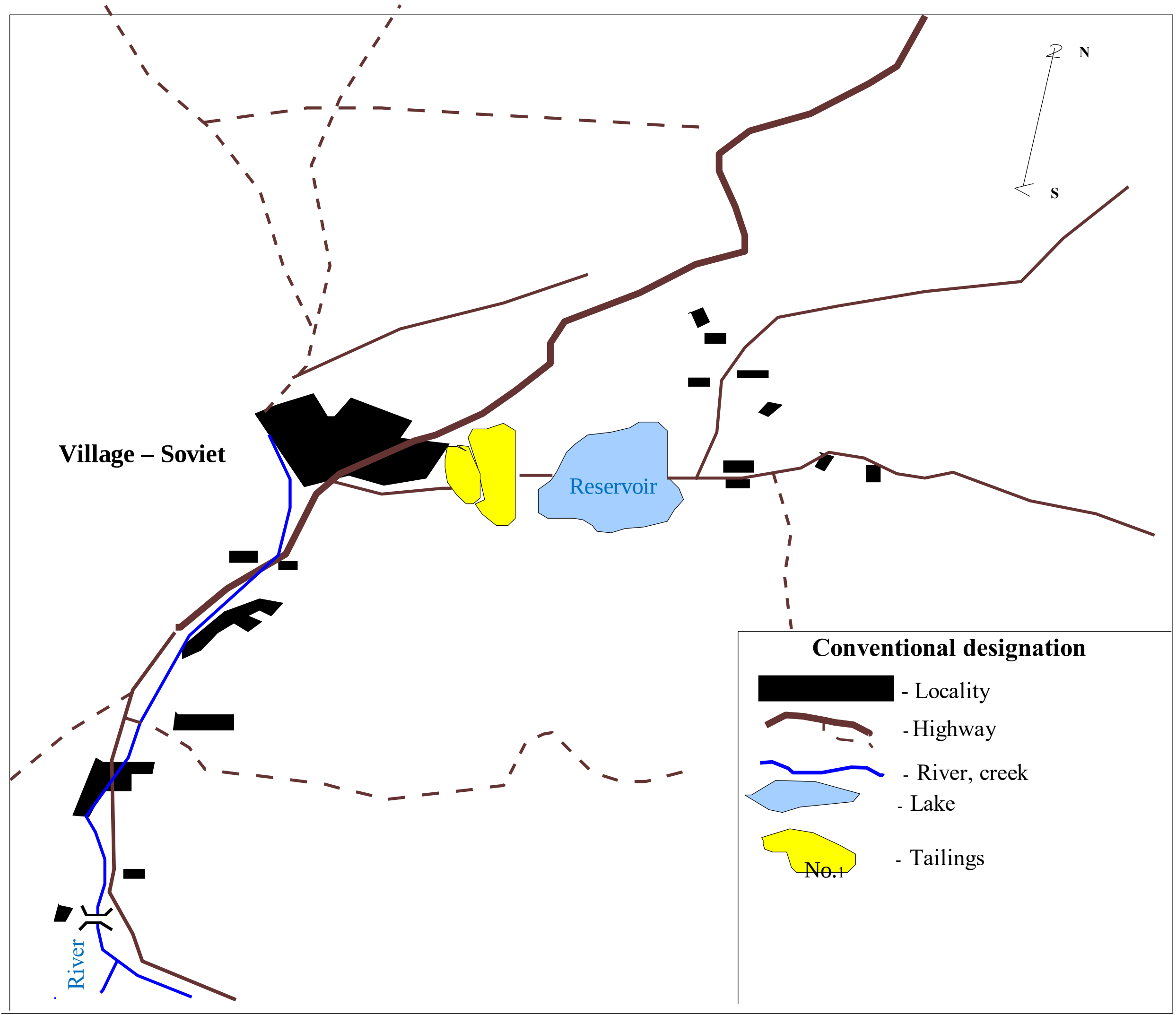
Former Shekaftar ore management of the USSR	Dump №7	1946 - 1967	5.625	0.045	60 - 80	Uranium row of elements Does not have
Former Shekaftar ore management of the USSR	Dump № 8	1946 - 1967	3.6	0.029	40 - 60	Uranium row of elements Does not have

BATKEN REGION

ENVIRONMENTAL PROBLEMS AND STATISTICAL CALCULATION OF THE CONTAINED TAIL COMPONENTS SOVIET (KAN)

The Kansk mine department, which developed lead-zinc ores since 1930 was liquidated in 1971. During operation, 2.5 million m^3 of sands containing heavy metal salts were, stocked up in tailings ponds located in the immediate vicinity of the Sovetsky settlement [10]. The tailings are not, mothballed. Wind erosion and flushing of tailings by surface waters occurs, polluting with salts of heavy metals not only the territory of the Kyrgyz Republic, but also the territory of the Republic of Uzbekistan. Locals spontaneously use tailings as building materials.

Figure 8. Map of the location of the tailings in the village of Soviet



Settlement table Soviet:

Brief information on the tailings of Soviet region

Name of enterprise affiliation	Name of storage location	Operation period	Occupied area thousand m^2	Volume $mln.m^3$	Doses of gamma radiation,	Main pollutants	Types of protective structures
Former Kanskoe-administration of the USSR	Tailing, dumps	1950 - 1978	110.7	2.65		Heavy metal salts	Dams

NARYN REGION

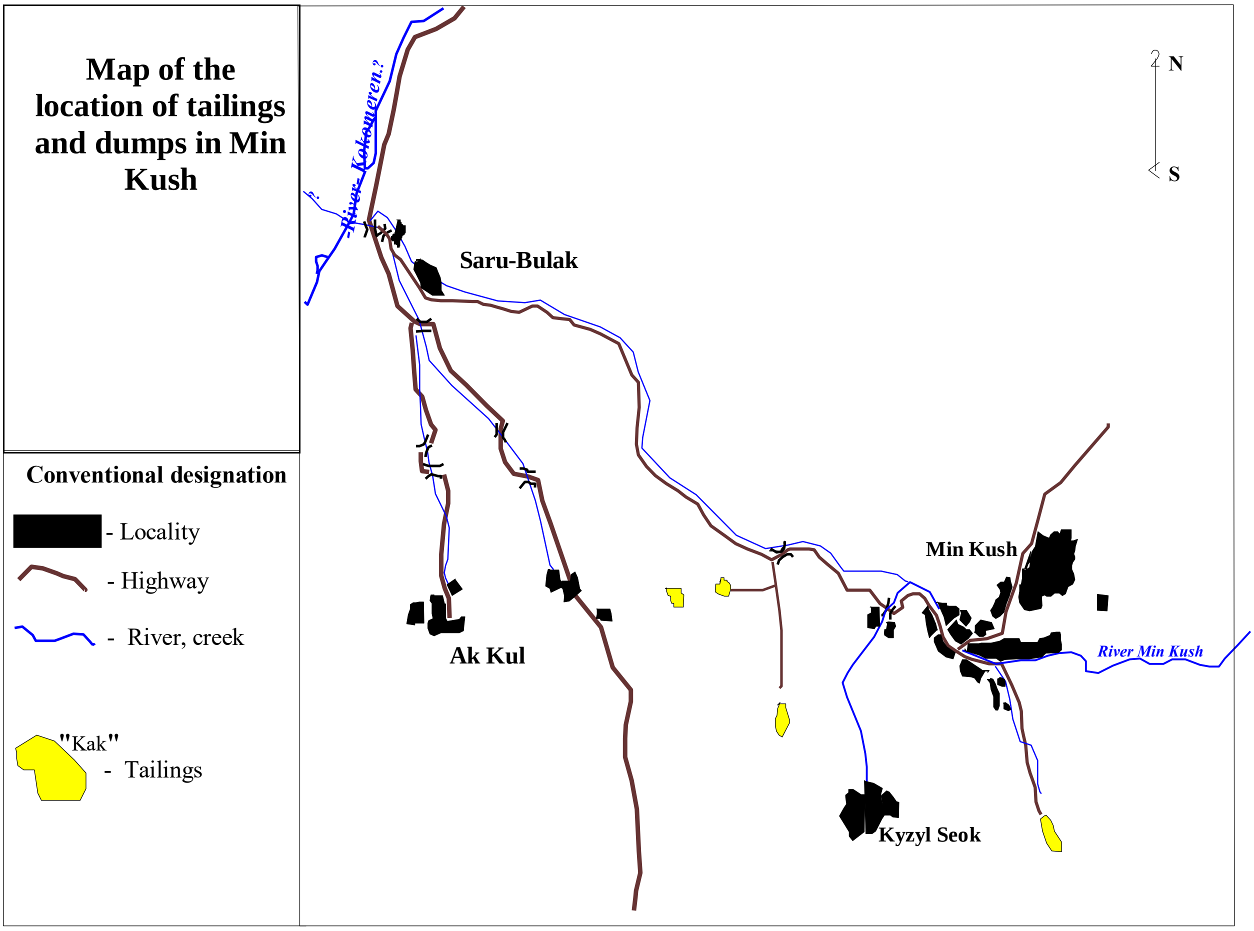
ENVIRONMENTAL PROBLEMS AND STATISTICAL CALCULATION OF THE CONTAINED COMPONENTS ON MIN-KUSH TAILINGS

The village of Min-Kush is located at an altitude of 1978.9 m, among the highlands in the basin of the river Min-Kush, the population of the village of Min-Kush is 4760 people. The only industrial production was an enterprise of the Ministry of Medium Engineering.

There are 4 tailing dumps and 4 dumps with radioactive materials in this region with a total volume of 1.15 million. m^3. The ore complex operated from 1958 to 1969. After the closure of uranium production, all tailings mothballed [11].

Currently, due to untimely repairs and maintenance, the destruction of protective structures and individual sections of the surface is occurring. The most dangerous are Tuyuk-Suu and Taldy-Bulak tailings.

Figure 9. Map of the location of tailings and dumps in Min Kush



Calculation table in Min-Kush:

Information on tailing dumps and mountain dumps of Min-Kush

Name of enterprise affiliation	Name of storage location	Operation period	Occupied area thousand m^2	Volume mln.m^3	Doses of gamma radiation, μR / hour	Main pollutants	Types of protective structures
Former Kyrgyz mining complex of the village. Min-Kush	Tailing dump "Tuyuk-Suu"	1956 - 1965	32	0.45	25-40	Uranium row of elements	Drainage channel, dam, spillway
Former Kyrgyz mining complex of the village. Min-Kush	Tailing dump "Taldy-Bulak"	1963 - 1969	35.5	0.39	25-30	Uranium row of elements	Embankment dam, drainage channel, drainage collector
Former Kyrgyz mining complex of the village. Min-Kush	Tailings (Kak)	1955 - 1969	131	0.306	25-30	Uranium row of elements	Dam, drainage channels, road
Former Kyrgyz mining complex of the village. Min-Kush	Tailing dump	1955 - 1969			25-30	Uranium row of elements	Dam, drainage channels
Former Kyrgyz mining complex of the village. Min-Kush	Ore storage No. 5 - 6	1955 - 1969	-	-	-	-	-

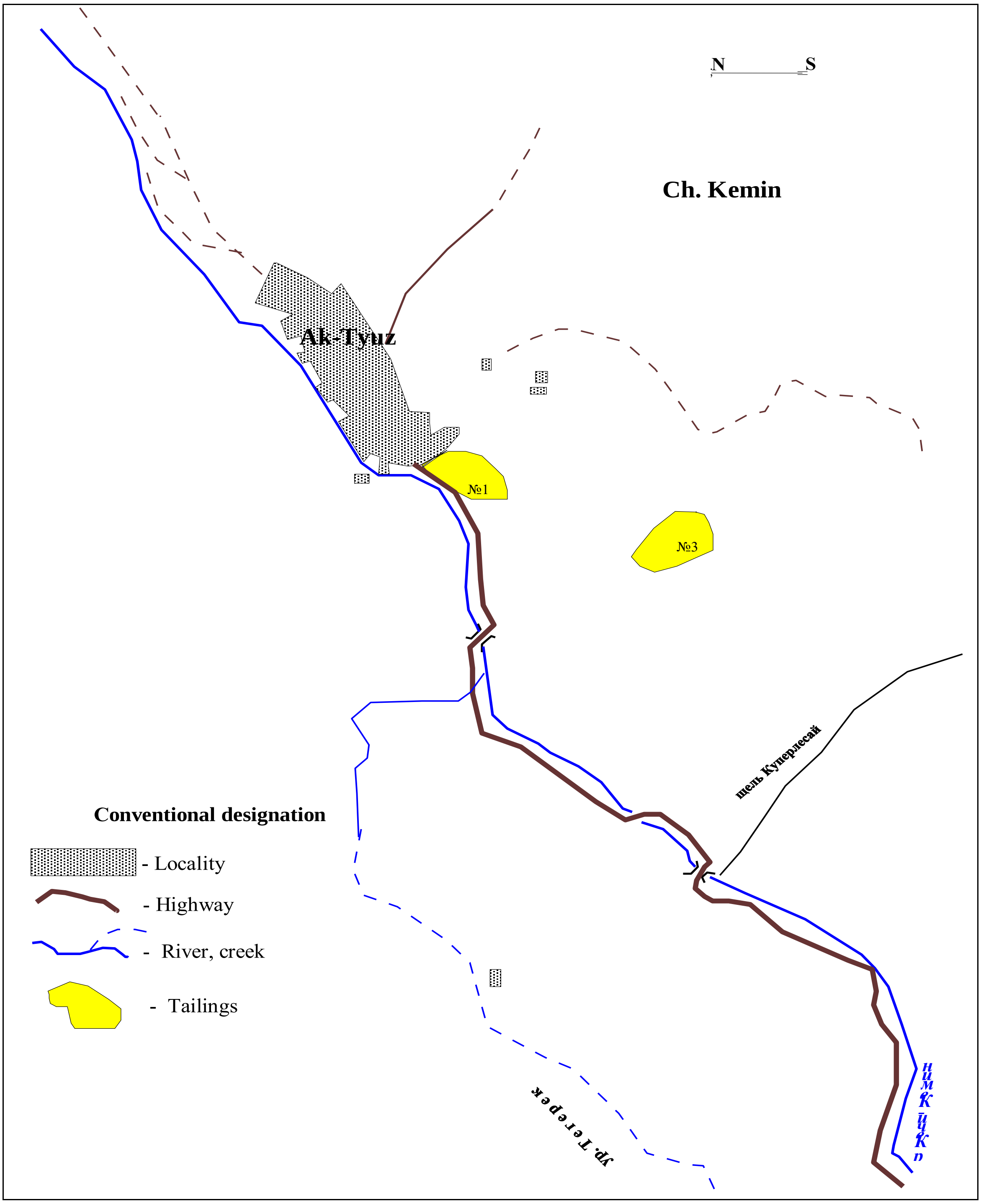
CHUI REGION

ENVIRONMENTAL PROBLEMS AND STATISTICAL CALCULATION OF THE CONTAINED COMPONENTS ON THE TAILINGS AK-TYUZ

The Aktuzskoye rare earth deposit is located in the Chuy region of the Kyrgyz Republic in the upper part of the Kichi-Kemin river valley of the Chu river basin. The terrain is complex, mountainous. Absolute heights exceed 2000 meters above sea level. The climate of the region is sharply continental with pronounced seasons. The vegetation cover of the region is sparse. Its area is covered with grassy vegetation and a rare, small shrub. In some areas, coniferous and deciduous trees are developed.

Since 1942, ore containing lead, zinc and rare earth elements has been mined and processed here. The processed ore in this area has radioactive elements from minerals containing thorium (turnerite, thorite, zirconium and others) [12]. According to experts, four tailing dumps with a total volume of about 2.3 million. m^3 and three dumps with empty rock are located near the village of Ak-Tyuz. Emergencies Ministry experts say that after every rain, radioactive substances get into the river flowing here.

Figure 10. Map of the locations of the tailings of Ak-Tyuz



Calculation table in Ak-Tyuz:

Brief information of Ak-Tyuz tailings

Name of enterprise affiliation	Name of storage location	Operation period	Occupied area thousand m^2	Volume mln.m^3	Doses of gamma radiation, µR / hour	Main pollutants
Ak-Tyuz Region	Tailing dump No. 1, 3	1950 - 1976	-	1.7 million. m^3	Wed of. 60-100 µR / h Anom. from 1000 µR / hour	Has a radioactive element ore, possible lead, zinc and rare earths.

CHAPTER 2. THE MAIN CAUSES OF DISEASES OF THE LOCAL POPULATION LIVING NEAR RADIOACTIVE WASTE AND DUMPS

2.1 MONITORING, CLASSIFICATION OF HAZARDS AND POSSIBLE RISKS

Impact monitoring and hazard assessment:

Monitoring includes radiological measurements, as well as their interpretation, and the use of available data to assess the level of danger and control over its impact [5].

The results of radiation monitoring, possible risks, dangers and their classification described below can be, used to solve problems of changing radiological conditions and other related tasks that need to be addressed.

The degree of radiation hazard is divided into three categories:

I- Safe;

II- Potentially dangerous;

III- Hazardous.

The main facilities in the Kyrgyz Republic for the extraction and processing of radioactive ores:

The main facilities for the extraction and processing of radioactive ores in Kyrgyzstan include enterprises of the former Leninabad Mining and Chemical Combine in Mailuu-Suu, Shekaftar, enterprises of the Kara-Balta Mining Plant (in Kara-Balta, and Min-Kush, Kadzhi-Sai, as well as enterprises of the Kyrgyz mining and metallurgical plant in Ak-Tyuz, Orlovka [15].

The table below will show the data on the degree of radiation hazard falling into the category: III - Hazardous. I - categories in the table will not be considered, since the degree of radiation hazard - does not exceed the limits of the norm. II - the category will be, reviewed and described in detail in the section classification of hazards and possible risks.

Enterprises of the former Leninabad Mining and Chemical Combine in Mailuu-Suu

At present, there are 23 tailing dumps and 13 mining dumps with a total volume of about 1.99 million m3 in the territory of this province [6].

Table of the radiation hazard of the Mailuu-Suu tailings

	Name (storage locations)	Period exploitation	Occupied area thousand / m^2	Volume million m^3	Doses of gamma radiation, μR / hour	Radiation hazard category	Main pollutants
1	Tailings dump No. 4	1966-1967	25	0.115	140-380, локально	III	Uranium row of elements
2	Tailings dump No. 5	1966-1967	10	0.111	50-85	III	Uranium row of elements
3	Tailings dump No. 10	1966-1967	11.5	0.05	60-70	III	Uranium row of elements
4	Tailings dump No. 11	1965	13.75	0.07	40-80	III	Uranium row of elements
5	Tailings dump No. 12	1966	10	0.002	60-80	III	Uranium row of elements
6	Tailings dump No. 13	1968-1969	13.95	0.04	60-80	III	Uranium row of elements
7	Tailings dump No. 18	1968	1.76	0.03	20-70 (90-360)	III	Uranium row of elements
8	Tailings dump No. 21	1967	1.75	1.75	30-80	III	Uranium row of elements
9	Tailings dump No. 22	1946-1967	2.24	2.24	60-80	III	Uranium row of elements
10	Tailings dump No. 23	1967	5	5	60-80	III	Uranium row of elements

Table of the radiation hazard of Mailuu-Suu dumps

1	Dump No. 1	1946-1967	9.9	0.148	13-110	III	Uranium row of elements
2	Dump No. 2	1946-1967	13.8	0.145	13-85	III	Uranium row of elements
3	Dump No. 3	1946-1967	5	0.011	15-120	III	Uranium row of elements
4	Dump No. 9	1946-1967	4.6	0.0184	15-105	III	Uranium row of elements
5	Dump No. 11	1946-1967	4.4	0.131	35-105	III	Uranium row of elements
6	Dump No. 12	1946-1967	2.8	0.084	30-180	III	Uranium row of elements
7	Dump No. 13	1946-1967	3.9	0.008	35-95	III	Uranium row of elements

Of the 23 existing tailings and 13 mining dumps in Mailuu-Suu, the hazardous category includes 10 tailing dumps and 7 mining dumps where the radiation background is increased.

Since all tailings ponds are located near settlements, there is a danger from radiation exposure on the body of the living population in this territory.

Shekaftarsky complex

Shekaftarsky complex consists of 8 mountain dumps, 7 of which are located in the village. Of the 8 dumps, 7 have an increased background radiation. The present danger of this territory lies in the lack of conservation and the lack of vegetation on the surface of the dumps, which contributes to the spread of small fractions in the adjacent territories [8].

Table of the radiation hazard of dumps in Shekaftar

	Name (storage locations)	Period exploitation	Occupied area thousand / m^2	Volume million m^3	Doses of gamma radiation, μR / hour	Radiation hazard category	Main pollutants
1	Dump No. 1	1946-1967	7.5	0.06	60-150	III	Uranium row of elements
2	Dump No. 2	1946-1967	0.4	0.0016	60-80	III	Uranium row of elements
3	Dump No. 3	1946-1967	2.6	0.01	60-80	III	Uranium row of elements
4	Dump No. 4	1946-1967	7.5	0.06	60-150	III	Uranium row of elements
5	Dump No. 5	1946-1967	3	0.45	80-100	III	Uranium row of elements
6	Dump No. 6	1946-1967	3.2	0.026	60-80	III	Uranium row of elements
7	Dump No. 7	1946-1967	5.625	0.045	60-80	III	Uranium row of elements

I, II category of radiation hazard, have enterprises of the Kara-Balta Mining Plant in the city of Kara-Balta, village Min-Kush, Kaji-Sai, as well as enterprises of the Kyrgyz mining and metallurgical plant in village Ak-Tyuz, Orlovka.

Hazard classification and possible risks:

The II - category includes tailings and dumps, the technical condition of which does not satisfy the relevant requirements. In the event of the destruction of radioactive tailings and dumps, which subsequently leads to an environmental disaster, which affects not only the population located in the, vicinity of objects, but also neighboring republics [19].

Most tailings, dumps and storage facilities are in disrepair, which require remediation work [20]. The situation is further, complicated by the fact that many burial sites are located in active seismic areas, mudflow areas, and areas prone to flooding, as well as near the banks of the rivers, which form the basis of the vast water basin of the Central Asian region.

As a result, of natural disasters (earthquakes, landslides, mudflows, etc.), radioactive waste, heavy metals and other toxic substances pollute the environment: surface and groundwater, atmosphere, soil and plants. This does not meet the radiation safety [19].

2.2 PROBABLE REASONS FOR POPULATION'S DISEASES BY VARIOUS DISEASES

PROPOSAL No. 1

Statistical calculation of probable morbidity of the population and their analysis:

Uranium burial sites in Mailuu-Suu have a serious environmental, demographic, socio-economic threat, and at the same time have a global character [6]. Researchers from the Institute of Medical Problems of the Academy of Sciences of the Kyrgyz Republic found that the radiation background in the city of Maili-Suu and the surrounding area exceeds acceptable standards.

The investigation of 5.5 thousand residents, including 2.5 thousand, it was found that more than two-thirds of the adult population (70.1%) were sick. An analysis of the incidence of adult residents of the city showed that diseases of the digestive system (32.1%) come first, followed by diseases of the endocrine system (25.6%), respiratory organs (5.4%). In women, gynecological diseases (27.4%) are in second place, followed by breast diseases (9.3%). Among adult patients, 1213 people (36%) were, identified with the so-called pre-tumor diseases. Among the examined children, patients were 849 (40.4%). Among sick children, 12 people with benign tumors, 78 with congenital anomalies, and 112 with diffuse and nodular goiter forms were, identified.

In diseases of children and adults in the city of Mailuu-Suu, an unfavorable environment plays a significant role. Geo-ecological studies have found that the main natural pollutants (water, soil, vegetation, bio-substrates of people) are selenium, uranium, thorium, chromium. In addition to them, increased concentrations of molybdenum, nickel, zinc, strontium and arsenic are, observed in natural environments, the combined effect of which with radionuclides has a negative effect on the health status of the local population [16].

As well as biologists and doctors, a health survey of 1,450 residents of the Min-Kush settlement was, carried out, including 650 children under the age of 14.

An analysis of the incidence of children showed that respiratory diseases are in the first place - 58% (of which 48% are acute respiratory diseases), which may be associated with increased concentrations of radon in the air of residential and public buildings, caused by emanation of radon from mines, mining dumps and tailings. Then there are diseases of the oral cavity, then blood, skin, endocrine system.

In the adult population (800 people) in the first place are diseases of the digestive system (52%), respiration (47%), and then the cardiovascular and genitourinary systems. A clinical examination of the inhabitants of the village showed a decrease in the general reactivity of the human body, frequent visits to the doctor about gastroenterological, neurological and cardiovascular diseases. Unlike residents of Bishkek, a survey of residents of Min-Kush indicates the presence of a variety of clinical syndromes that have been going on for many years.

When analyzing the causes of the morbidity of residents of uranium provinces and mines, doctors often point out that one of the main causes of various kinds of cancer and congenital malformations of children is the unfavorable environmental conditions in these areas, and in particular, increased radiation. With such statements, physicians practically do not provide data on radiation doses received by patients (recipients) as a result, of living near certain radioactive sources in areas of former uranium mines and / or waste storage facilities.

In this regard, further raising the awareness of the local population in matters of radiological protection should become one of the most important tasks in the process of rehabilitation of territories exposed to radioactive exposure. This will help to reduce radiation risk, although the risk of hazard perception dominates the actual risk of exposure to ionizing radiation [21].

2.3.1 STATISTICAL CALCULATION BY MALIGNANT FORMATIONS BY REGION, DISTRICT AND CITIES FOR 2016-2018.

The incidence of malignant neoplasms by region, district and city for 2016-2018.

Per 100,000 population			
	2016	**2017**	**2018**
Republic of Kyrgyzstan	**89.1**	**89.6**	**95.1**
Batken region	**43.9**	**45.0**	**57.8**
Kyzyl - Kya city	56.6	57.3	62.1
Sulukta city	32.9	27.6	86.1
Batken district	55.8	79.1	77.0
Kadamzhay district	30.7	22.9	33.3
Lyailaksky district	59.0	60.2	83.0
Jalal - Abad region	**67.0**	**57.9**	**65.8**
Jalal - Abad city	72.9	56.6	51.4
Kara-Kul city	192.3	117.6	91.2
Mailuu-Suu city	133.6	88.9	54.3
Tash - Kumyr city	54.3	82.4	70.3
Ala - Buki district	33.6	36.1	68.8
Aksy district	43.6	79.8	78.4
Bazar - Korgon District	103.9	64.3	55.9
Nookensky district	36.6	28.6	38.2
Suzak district	60.5	49.6	54.4
Toguz - Torous district	100.4	86.2	144
Toktogul district	65.9	61.5	69.0
Chatkal district	83.3	68.8	83.3
Regions	**Per 100,000 population**		
	2016	**2017**	**2018**
Issyk - Kul region	**118.3**	**124.8**	**123.8**
Karakol city	163.6	154.2	128.0
Balykchy city	117.9	102.9	127.7
Ak - Sui district	85.1	93.7	136.9
Jeti - Oguz district	80.7	145.7	105.6
Issyk - Kul District	152.8	142.3	151.2
Tonsky District	113.3	96.6	115.6
Tyup District	114.0	11.2	98.8
Naryn Region	**97.2**	**114.2**	**118.3**
Naryn city	127.1	146.7	82.8
Ak - Talinsky district	67.1	69.8	94.3
At - Bashinsky district	106.1	130.0	145.8
Zhumgal district	115.4	99.7	133.8

Osh region	**74.7**	**77.1**	**72.3**
Alai district	82.5	84.6	79.1
Aravan district	67.6	81.5	62.6
Kara - Suu district	69.5	81.6	78.0
Kara - Kulzhinsky district	75.8	88.7	89.4
Nookat district	73.7	64.7	54.1
Uzgen district	81.2	78.3	82.7
Chon - Alaska district	101.1	40.2	35.7
Regions	**Per 100,000 population**		
	2016	**2017**	**2018**
Talas region	**65.3**	**69.2**	**86.0**
Chu region	**116.2**	**114.9**	**136.5**
Tokmok city	107.3	166	171.8
Alamudun district	133.8	138.4	135.4
Ysyk - Ata district	104.6	75.4	187.2
Zhayyl district	126.6	131.0	100.3
Kemin district	135.1	118.8	155.9
Moscow region	118.5	129.9	118.6
Panfilovsky district	89.6	83.7	91.9
Sokuluk district	116.6	110.7	130.7
Chui district	82.8	69.5	103.5
Bishkek city	**125.4**	**121.1**	**120.8**
Osh city	**76.3**	**98.9**	**99.3**

CHAPTER 3. IMPROVING THE SYSTEM OF CANCER DISEASE PREVENTION WITH THE HELP OF PREVENTION, RESTORATION, STRENGTHENING IN THE AREAS OF RADIATION-CONTAMINATED TAILINGS AND DUMPS

3.1 PROGRAM OF ACTION AND PROJECT PROPOSALS FOR STRENGTHENING AND RESTORATION TAILINGS AND DUMPS

- ✓ Create an appropriate Regulatory Authority to address radiation safety issues with a clear mandate and relevant personnel in the Kyrgyz Republic.
- ✓ It is advisable to apply the experience of most countries of the European Union to create a Regulatory Authority for radiation safety, by the nature of its professional activities related to the study of radiation background, as well as radiation protection of the population as a whole.
- ✓ Improve interagency cooperation in the Kyrgyz Republic in order to achieve a coordinated approach and cooperation between competent institutions and organizations involved in ensuring adequate and safe maintenance of radioactive waste storage facilities.
- ✓ Continue to develop the existing supporting infrastructure, including radioecological laboratories, research institutions, and technical education of specialists, equipment and devices for radiation monitoring and monitoring, combine their efforts to systematically monitor the impact of radioactive waste on the environment and public health, create a unified database and ensure its availability.
- ✓ To develop and adopt appropriate programs and measures to monitor the environment and public health at all radioactive tailings and dumps, to assess the level of radiation dose and subsequent risk to the population and, if necessary, apply adequate protective measures.
- ✓ It is recommended that a central authority be established to collect and process data (create a database) in order to make best use of the available information. Such a body can be, created as part of an independent project with developed

programs and procedures for the exchange and dissemination of information among authorized state institutions and departments, such as the Regulatory Authority, for the purpose of further practical guidance and application in the field of radiation protection, justification and selection of priority rehabilitation and restoration.

- ✓ Raise public awareness of security issues regarding the threats posed by uranium production so that people are aware of the real situation and this will help to avoid radiation phobia.
- ✓ To improve further international cooperation through priority projects that should be, funded by interested institutions and organizations, including on the problems of the utilization of mining and processing industry wastes for commercial purposes, involving the private sector.

3.2 PROJECT PROPOSALS FOR STRENGTHENING AND RECLAIMING TAILINGS AND DUMPS.

PROJECT PROPOSALS NO. 1.

PROJECT PROPOSAL MAILUU-SUU

The name of the project: Development of technical projects for the rehabilitation of 23 tailings with waste from uranium production and 13 dumps of low radioactive rocks. Rehabilitation and reclamation of 23 tailings with uranium production waste and 13 dumps of low radioactive rocks based on developed technical projects.

Sector: Prevention of transboundary technological emergencies.

Location: Territory of Mailuu-Suu city of the Jalal-Abad region of the Kyrgyz Republic.

Purpose: Based on the available data, carry out rehabilitation and restoration work in compliance with all standards.

Project directions: The project aims to select measures and approaches to ensure the geotechnical integrity of tailings, reduce the risk of exposure to human health and reduce environmental pollution.

PROJECT PROPOSALS NO. 2.

PROJECT PROPOSALS SUMSAR

The name of the project:	Development of design and technical documentation for the rehabilitation of tailings in the village of Sumsar, Jalal-Abad Oblast, Kyrgyz Republic. Reclamation according to design documentation.
Purpose:	The project is, aimed at developing technical solutions for the rehabilitation of tailings in the village of Sumsar with the implementation of restoration work in order to eliminate pollution of heavy metals with salts of the Sumsar River basin and prevent their further impact on human health.
Project Content:	The project provides for work in two stages: **I - stage** ➢ Surveying of territories of tailings; ➢ Carrying out engineering research and engineering and survey works. **II – stage** ➢ Assessment and selection of available technologies to ensure the geotechnical integrity of tailings, their restoration and recommendations of the preferred method; ➢ Development of an engineering project for the rehabilitation of tailings with a description of physical work, their

volumes and technology, requirements for equipment and facilities (development of a detailed cost estimate). The project should also contain a program of health care, safety during the work, a program for quality control of work and monitoring after sealing tailings.

PROJECT PROPOSALS NO. 3.

PROJECT PROPOSALS SHEKAFTAR

The name of the project:	Development of the technical project “Reclamation of the Shekaftarsky complex of mountain dumps”. Reclamation of a dumping complex according to a technical design.
Location:	The territory of the village Shekaftar of the Kyrgyz Republic.
Purpose:	Elimination of the threat to human life and the environment by elements of the uranium series in Shekaftar and protection of the population living in areas of disposed dumps of uranium production.
Description:	Shekaftarsky complex consists of 8 dumps, seven of which are located in the village and unreserved mines for the extraction of uranium ore. The volume of dumps is 700 thousand cubic meters. All dumps are not reclaimed, not fenced, no warning signs. The mouths of the adits, pits, and racks of mines are not closed. The lack of vegetation on the surface of the dumps contributes to the spread of small fractions in the adjacent territories. The components of the dumps are used in household construction. Gardens and vegetable gardens are located in close proximity, while the gamma radiation power on the surface locally reaches 300 μR / hour.

PROJECT PROPOSALS NO. 4.

PROJECT PROPOSALS MIN-KUSH

The name of the project:	Development of a technical project for the rehabilitation and reclamation of the Minkush complex of tailings and dumps. Rehabilitation and reclamation of the Minkush complex of tailings and dumps. According to the technical design.
Sector:	Emergency warning.
Location:	Min-Kush urban settlement, Naryn region, Kyrgyz Republic
Purpose:	Drafting a project to eliminate the threat to human life and the environment by elements of the uranium series in the Min-Kush urban settlement and protect the population living in the area of the tailings and mining dumps of uranium production, as well as the population of the Ferghana Valley.
Description:	In the area of the Min-Kush urban settlement, there are 8 tailing dumps and mountain dumps with a total volume of 115 million cubic meters and a total area of 198.5 thousand square kilometers. Due to lack of funds, tailings and dumps were not rehabilitated. As a result, of disturbance of the surface layer at individual local points, the level of gamma radiation reaches 740 μR / hour. In order to ensure the safety of the Tuyuk-Suu, Taldy-

	Bulak, and other tailing dumps and dumps, the following must be, done: 1. Develop a technical project for the rehabilitation, reclamation and additional conservation of tailings and dumps. 2. Restoration of drainage canals and protective structures. 3. Strengthening the head dams, taking into account the accumulation of floodwaters. 4. The device of fences and warning signs. 5. Reclamation of dumps No. 17, 20, 21 and ore depots. 6. The creation of stationary installations for monitoring the status of tailings and dumps.
Expediency:	Ensuring the safety of human life and protecting the environment from radioactive and chemical pollution.

PROJECT PROPOSALS NO. 5.

PROJECT PROPOSALS AK-TYUZ

The name of the project:	Development of a technical project for the rehabilitation of tailings No. 1 and 3 with rare-earth waste. Rehabilitation of tailings No. 1 and 3 with rare-earth waste based on developed technical projects.
Sector:	The man-made emergency prevention.
Location:	The village of Ak-Tuz of the Kemin district of the Chui region of the Kyrgyz Republic.
Purpose:	Carrying out measures for the technical solution of problems of rehabilitation and reclamation work in order to minimize the risk of environmental disasters for settlements and pollution of the Kichi-Kemin and Chu river basins flowing through the territory of the Kyrgyz Republic and Kazakhstan.

Project Content:

- ✓ Analysis of the existing risk of the impact of uranium tailings on human health and environmental pollution. Assessment of the perceived risk after reclamation;
- ✓ Assessment of the geotechnical integrity of tailings and safety factors for sealing uranium tailings;
- ✓ Assessment of existing technologies to ensure geotechnical integrity of tailings closure and recommendations of the preferred method. Assessment of each method, taking into account their long-term reliability, cost for implementation and monitoring, as well as risk reduction;
- ✓ Development of an engineering project for sealing work with a description of the physical work, its scope and technology, requirements for equipment and facilities (development of a detailed cost estimate).
- ✓ The project should also include a health, safety and radiation protection program, quality assurance, control programs, environmental control programs to prevent pollution during work, and a monitoring program after sealing tailings.

CHAPTER 4. FINANCIAL MANAGEMENT

4.1 FINANCIAL MANAGEMENT, RESOURCE EFFICIENCY AND RESOURCE SAVING

The purpose of this section is the issues of resource efficiency and resource conservation, as well as financial costs associated with the object of study of the master's thesis. To do this, an analysis is carried out such as: SWOT analysis, which helps to identify strengths and weaknesses, opportunities and threats associated with the project, and gives an idea of working with them in each case. For the development of the project requires funds that go to pay for the project participants and the necessary equipment, a full list of which is given in the relevant section. The calculation of the resource, use efficiency indicator allows us to make a final assessment of the technical solution according to individual criteria and in general.

4.2 COMPETITIVENESS ANALYSIS OF TECHNICAL SOLUTIONS

To find sources of project financing, it is necessary, firstly, to determine the commercial cost of the work. Analysis of competitive technical and methodological solutions from the point of view of resource efficiency and resource saving allows us to evaluate the comparative effectiveness of project proposals proposed in scientific and dissertation works. This analysis should be carried out using a scorecard.

First, it is necessary to analyze possible technical solutions and choose the best, based on the considered technical and economic criteria.

The main competitors of the project proposals for the strengthening and remediation of radiation-contaminated tailings are other similar project proposals for tailings, the differences in the proposed methods of technology for implementing the project at the lowest or highest cost.

The proposed project proposals and competition are related to tailing dumps that require reclamation and restoration work, as in Mailuu-Suu, in this province there are 23 tailing dumps and 13 dumps whose technical condition does not meet the requirements and need emergency repair work [20].

Criteria for comparing and evaluating the effectiveness of project proposals using resources and their conservation are, presented in table 1.

Competition between participants in the proposed projects is, evaluated for each indicator on a five-point scale. Where one is the weakest position and five is the strongest. The weights of the indicators defined in the total should be

Analysis of competitive technical solutions is, determined by the formula:

$$C = \Sigma Wi \cdot Pi$$

- C - the competitiveness of research or a competitor;
- Wi– criterion weight;
- Pi – point of i-th criteria.

<u>Scorecard for comparing competitive technical solutions</u>

Evaluation criteria	**Criterion weight**	**Points**			**Competitiveness** Taking into account weight coefficients		
		P_f	P_{i1}	P_{i2}	C_f	C_{i1}	C_{i2}
1	2	3	4	5	6	7	8
Technical criteria for evaluating resource efficiency							
1. Consideration of engineering projects for the restoration and strengthening of tailings with a description of the physical work	0.15	4	3	4	0.6	0.45	0.6
2. Analysis of the proposed technology, the need for the necessary equipment	0.13	5	4	4	0.65	0.52	0.52
3. Assessment of long-term reliability, quality, and service life guarantees after hardening and sealing	0.12	5	4	4	0.6	0.48	0.48
4. A thorough study of the environmental control program to prevent pollution during and after completion of work	0.13	5	5	3	0.65	0.65	0.39
5. Safety for both workers and people living in the vicinity	0.14	5	5	3	0.7	0.7	0.42
Economic criteria for performance evaluation							

1. Cost for project implementation	0.15	4	3	4	0.6	0.45	0.6
2. Actual life of the facility	0.15	5	4	5	0.75	0.6	0.75
3. Turnaround time	0.11	4	4	4	0.44	0.33	0.55
Total	**1**	**37**	**32**	**31**	**4.99**	**4.18**	**4.31**

As we see after analyzing the competitiveness, between the participants of the proposed design work, the highest competitive points are observed for our project proposal in the, amount of 4.99, and other project proposals the amount is lower compared to ours. This is due to the choice of the most stable method of the proposed technologies for the territory and the peculiarities of their location, taking into account natural influences with minimal damage to an object in case of occurrence natural manifestations such as earthquakes, mudflows, landslides, etc.

4.3 SWOT ANALYSIS

Complex analysis solution with the greatest competitiveness is, carried out with the method of the SWOT analysis: Strengths, Weaknesses, Opportunities and Threats. The analysis has several stages. The first stage consists of describing the strengths and weaknesses of the project, identifying opportunities and threats to the project that have emerged or may appear in its external environment. The second stage consists of identifying the compatibility of the strengths and weaknesses of the project with the external environmental conditions. This compatibility or incompatibility should help to identify what strategic changes are, needed.

SWOT analysis

	Strengths: S1. The project aims to select measures and approaches to ensure the geotechnical integrity of tailings, reduce the risk of impact on human health and reduce environmental pollution S2.Project Summary: Rehabilitation, reclamation	**Weaknesses:** W1. High cost for the implementation of the project. W2. The state will not be able to allocate amounts for the implementation of the project and for a limited budget W3. A lot of time is required to attract foreign investors and conclude agreements for the implementation of the project.

	and additional conservation of tailings and dumps. S3. The project contains a health care program, safety during work, a program for quality control of work and monitoring after sealing tailings. S4. Quality assurance and long service life. S5. Installation of the necessary stationary installations for monitoring the status of tailings and dumps.	
Opportunities: O1. The possibilities of the project proposal during its implementation is to improve the environmental situation as a whole for the population living near the tailings O2. The ability to reduce the growth of various diseases, including oncology and for the direct and indirect effects of pollution O3. The ability to protect the public from high radiation background O4. The ability, when implementing the project, to identify other negative impacts in general	Proposed in the course of research, the project proposal is relevant, and for the increase in the incidence of the population living in the vicinity, including cancer, which increases every year and for the direct or indirect effects of contaminated tailings.	Attracting stakeholders to implement the project and resolving financial issues
Threats: T1. Since the project requires a large amount of time, it takes time to attract investors that can drag on for many years. T2. Other project proposals with the lowest cost may receive agreements for the implementation of their project	And for the financial issues of the project implementation it takes a lot of time, but the long-term service life, quality and protection of the population and territory is a promising investment	The chances of other projects associated with the least cost cannot give guarantees about the necessary security and long-term service in its implementation. They will not be able to justify the amount invested for its implementation even for a short service life.

4.4 PROJECT INITIATION

The initiation process group consists of processes that are, performed to define a new project or a new phase of an existing one. In the initiation processes, the initial purpose and content are determined and the initial financial resources are fixed. The internal and external stakeholders of the project who will interact and influence the overall result of the research project are determined.

<u>Stakeholders of the project</u>

Project stakeholders	Stakeholder expectations
➢ Tailings Management Agency under the Ministry of Emergencies of the Kyrgyz Republic. ➢ State Agency for Environmental Protection and Forestry of the Kyrgyz Republic.	The project proposal can be used by government bodies to solve this problem, as well as to attract foreign sponsors for its implementation.

<u>Purpose and results of the project</u>

Purpose of project:	Protecting the environment and public health in areas of radiation-contaminated tailings through prevention, strengthening and reclamation
Expected results of the project:	Improving the environmental situation as a whole, as well as reducing morbidity by reducing the direct and indirect effects of radiation-contaminated tailings
Criteria for acceptance of the project result:	If the project proposal justifies its investment in protecting the environment and public health
Requirements for the project result:	The safety of tailings lies in the sustainability of natural processes. To measure safety monitoring and calculation analyzes are performed.
	Protecting the population from pollution of the territories and improving the environmental situation in general
	Long term, planned service life 10 years

	Resistance to natural manifestations such as earthquakes and mudflows

4.4.1 THE ORGANIZATIONAL STRUCTURE OF THE PROJECT

When initiating a project, a working group of the project is needed, to determine the role of each participant in this project, and to assign the functions of participants and their number of working hours in the project.

<u>Structure of the project</u>

№	Participant	Role in the project	Functions	Labor time, hours (working days (from table 7) × 6)
1	Romanenko Sergey Vladimirovich Ph.D. Professor ISHHBMT	Project Manager	Leadership and coordination of the work of the working group. The approval of the main sections, the issuance of tasks for execution. Verification of reports and obtained results of inlet research.	174
2	Deputy Director Civil Protection Development: Sadabaeva Nargiza Dzhaylobaevna	Project expert	Verification of the results obtained during the research and their evaluation. Equipping with necessary and reliable information.	102
3	Toktorbaeva Anari Ismailovna	Project Executor	Execution of received tasks. Research and comparison of the results Planning, analysis and monitoring of	432

			data obtained during research. Writing reports on the results.	

4.4.2 PROJECT LIMITATIONS

Project limitations are all factors that can be as a restriction on the degree of freedom of the project team members.

<u>Project limitations</u>

Factors	Limitations / Assumptions
3.1. Project's budget	1035000 rubs
3.1.1. Source of financing	NR TPU
3.2. Project timeline:	
3.2.1. Date of approval of plan of project	**27.01.2020**
3.2.2. Completion date	**25.05.2020**

4.4.3 PROJECT SCHEDULE

As part of planning a science project, you need to build a project timeline and a Gantt chart.

<u>Project Schedule</u>

Job title	Duration, working days	Start date	Date of completion	Participants
Literature review	6	3.02.2020	8.02.2020	Toktorbaeva A. I.
Research planning	6	10.02.2020	15.02.2020	Romanenko S.V. Toktorbaeva A. I.
Consideration of the Lists to be investigated, designing issues	11	17.02.2020	29.02.2020	Romanenko S.V. Toktorbaeva A. I.

Study of tailings, calculation of statistical data on pollutants and their components	11	17.02.2020	29.02.2020	Toktorbaeva A. I.
The study of the causes of morbidity, the statistical calculation of cancer	6	2.03.2020	7.03.2020	Sadabaeva N. D. Toktorbaeva A. I.
The discussion of the results	6	2.03.2020	7.03.2020	Romanenko S.V. Toktorbaeva A. I.
Drawing up a project proposal, writing a scientific manuscript	11	9.03.2020	22.03.2020	Sadabaeva N. D. Toktorbaeva A. I.
Report writing	29	9.03.2020	11.04.2020	Toktorbaeva A. I.
Financial management	12	13.04.2020	25.04.2020	Toktorbaeva A. I.
Social responsibility	14	27.04.2020	16.05.2020	Toktorbaeva A. I.
Report checking and corrections	6	18.05.2020	23.05.2020	Romanenko S.V.

A Gantt chart, or harmonogram, is a type of bar chart that illustrates a project schedule. This chart lists the tasks to be, performed on the vertical axis, and time intervals on the horizontal axis. The width of the horizontal bars in the graph shows the duration of each activity.

A Gantt chart

№	Activities	Participants	T_c, days	Duration of the project											
				February			March			April			May		
				1	2	3	1	2	3	1	2	3	1	2	3
1	Literature review	Toktorbaeva A. I.	6												
2	Research planning	Romanenko S.V. Toktorbaeva A. I.	6												
3	Consideration of the Lists to be investigated, designing issues	Romanenko S.V. Toktorbaeva A. I.	11												
4	Study of tailings, calculation of statistical data on pollutants and their components	Toktorbaeva A. I.	11												
5	The study of the causes of morbidity, the statistical calculation of cancer	Sadabaeva N. D. Toktorbaeva A. I.	6												
6	The discussion of the results	Romanenko S.V. Toktorbaeva A. I.	6												
7	Drawing up a project proposal, writing a scientific manuscript	Sadabaeva N. D. Toktorbaeva A. I.	11												

8	Report writing	Toktorbaeva A. I.	29												
9	Financial management	Toktorbaeva A. I.	12												
10	Social responsibility	Toktorbaeva A.I.	14												
11	Report checking and corrections	Romanenko S.V.	6												

Toktorbaeva A.I- Romanenko S.V- Sadabaeva N. D-

4.5 CALCULATION OF MATERIAL COSTS

The amount of costs associated with the implementation of research work is the basis for the formation of the project budget. To form the final cost, all expenses are added up. In the process of budgeting, the following grouping of costs by items is used:

Name criterion	**Scientific and industrial trips \ country**	**Cost of goods and services**	**Amount of expenses spent**
Material costs for scientific and technical research. buying ticket a plane, bus ticket.	1 business trips, for collecting and studying tailings as well as analyzing and monitoring the available information	The ticket price from Novosibirsk to the Kyrgyz Republic and back amounted to 28 thousand rubles. The price of a bus ticket from Tomsk to Novosibirsk was 1000 rubles.	Total was spent 29 thousand rubles

Costs of special equipment for scientific work the purchase of dosimeter.	Country: Kyrgyzstan	Purchase of a device for tracking the background radiation in places of burial of radiation waste	The price of the dosimeter was 4499 rubles

4.5.1 BASIC SALARY

This point includes the basic salary of participants directly involved in the implementation of work on this research. The value of salary costs is determined based on the labor intensity of the work performed and the current salary system

The basic salary (S_b) is, calculated according to the formula:

$$s_b = s_d \cdot T_w$$

Where:

- S_b – basic salary per participant;
- T_w – the duration of the work performed by the scientific and technical worker, working days;
- S_d - the average daily salary of a participant, rub.

The average daily salary is, calculated by the formula:

$$S_d = \frac{S_m \cdot M}{F_v}$$

Where:

- S_m – monthly salary of an participant, rub;
- M – the number of months of work without leave during the year, at holiday in 48 days, M = 11.2 months, 6 day per week;
- F_v – valid annual fund of working time of scientific and technical personnel (244 days).

<u>The valid annual fund of working time</u>

Working time indicators	
Calendar number of days	365
The number of non-working days - weekend - holidays	 52 14
Loss of working time - vacation - isolation period - sick absence	 48 7
The valid annual fund of working time (f_d)	244

Monthly salary is, calculated by formula:

$$S_{month}=S_{base}\cdot(K_{premium}+K_{bonus})\cdot K_{reg}$$

Where:

- S_{base} – base salary, rubles;
- $k_{premium}$ – premium rate;
- k_{bonus} – bonus rate;
- k_{reg} – regional rate.

<u>Calculation of the base salaries</u>

Performers	S_{base}, rubles	$k_{premium}$ *30%*	k_{bonus} *15%*	k_{reg}	S_{month}, rub.	W_d, rub.	T_{p}, work days	W_{rasse}, rub.
Toktorbaeva A. I.	17 890	5367	2683.5	1.3	28355.7	1181.5	118	*139417*
Romanenko S.V	49141	14742.3	7371.2	1.3	77888.6	11126.9	29	322681.3

Sabaeva N. D.	22701	6819.3	3405.2	1.3	29511.3	1299.6	17	212692.1
Total								674790.4

4.5.2 ADDITIONAL SALARY

This point includes the amount of payments stipulated by the legislation on labor, for example, payment of regular and additional holidays; payment of time associated with state and public duties; payment for work experience, etc.

Additional salaries are, calculated on the, basis of 10-15% of the base salary of workers:

$$W_{add} = K_{extra} \cdot W_{base}$$

Where:

- Wadd – additional salary, rubles;
- Kextra – additional salary coefficient (10%);
- Wbase – base salary, rubles.
- Wadd (Toktorbaeva A. I.) = 13941.7 rubles;
- Wadd (Romanenko S.V.) = 32268.1 rubles;
- Wadd (Sadabaeva N. D.) = 21269.2 rub
- Total for the title "Additional salary" – 23803 rubles.

4.5.3 LABOR TAX

Tax to extra-budgetary funds are compulsory according to the norms established by the legislation of the Russian Federation to the state social insurance (SIF), pension fund (PF) and medical insurance (FCMIF) from the costs of workers.

Payment to extra-budgetary funds is determined of the formula:

$$P_{social} = K_b \cdot (W_{base} + W_{add})$$

Where:

- k_b – coefficient of deductions for labor tax.

In accordance with the Federal law of July 24, 2009 No. 212-FL, the amount of insurance contributions is, set at 30%. Institutions conducting educational and scientific activities have rate - 27.1%.

	Project leader (Romanenko S.V.)	**Project expert (Sadabaeva N. D.)**	**Engineer (Toktorbaeva A. I.)**
Coefficient of deductions	0.271		
Salary (basic and additional), rubles	354949.4	233961.3	153358.7
Labor tax, rubles	96191.3	63403.5	41560.2
Total for the title "Labor tax" – 201155 rub			

4.5.4 OVERHEAD COSTS

Overhead costs include other management and maintenance costs that can be, allocated directly to the project. In addition, this includes expenses for the maintenance, operation and repair of equipment, production tools and equipment, buildings, structures, etc.

Overhead costs account from 30% to 90% of the amount of base and additional salary of employees.

Overhead is, calculated according to the formula:

$$C_{ov} = K_{ov} \cdot (W_{base} + W_{add})$$

Where: k_{ov} – overhead rate.

Overhead is, calculated according to the formula:

$$C_{ov} = K_{ov} \cdot (W_{base} + W_{add})$$

Where: k_{ov} – overhead rate.

	Project leader (Romanenko S.V.)	**Project expert (Sadabaeva N.D.)**	**Engineer (Toktorbaeva A. I.)**
Overhead rate	0.3		
Salary, rubles	354949.4	233961.3	153358.7
Overhead, rubles	106484.8	70188.4	46007.6
Total for the title "Overhead costs" – 127541.3 rubles.			

4.5.5 OTHER DIRECT COSTS

Energy costs for equipment’s are calculated by the formula:

$$C = P_{el} \cdot P \cdot F_{eg}$$

Where:

- P_{el}– power rates (5.8 rubles per 1 kWh);
- P – power of equipment, kW;
- F_{eq}– equipment usage time, hours.

$$C=5,8\cdot 3,00 \cdot 240 = 4,176\ rub$$

1. Total for the title "Other direct costs" – 4,176 rubles

4.5.6 FORMATION OF BUDGET COSTS

The calculated cost of research is the basis for budgeting project costs.

Items expenses grouping

Name	**Cost, rubles**
1. Material costs	29000
2. Equipment costs	4499
3. Basic salary	674790.4
4. Additional salary	23803
5. Labor tax	201155
6. Overhead	127541.3
7. Other direct costs	4,176
Total planned costs	**1033792**

CHAPTER 5 SOCIAL RESPONSIBILITY

5.1 LEGAL AND ORGANIZATIONAL SECURITY ISSUES

Protecting the population from emergency situations, including radiation protection, is the most important task of state authorities and administration, as well as local governments of all levels, heads of enterprises, institutions and organizations of all forms of ownership. The main object of protection is a person with his right to protect life, health and property in case of emergency [25].

OCCUPATIONAL SAFETY STANDARDS SYSTEM

Standardization is an activity that is aimed at the development, publication and application of standards in order to ensure the safety of products, services and work for the environment, life and health of the population, as well as property. A system of standards is a set of standards that cover a specific field of activity [23].

Classification of standards for ensuring occupational safety:

1. GOST R 1.0-2012 Standardization in the Russian Federation. Key Points
2. GOST 12.0.003–99. SSBT. Dangerous and harmful production factors. Classification
3. GOST 12.1.038-82 SSBT. Electrical safety. Maximum allowable levels of contact voltage and currents
4. GOST R 22.0.02-2016 Safety in emergency situations.
5. SanPiN 2.2.1 / 2.1.1.1278-03 "Hygienic requirements for natural, artificial and combined lighting of residential and public buildings"
6. SNiP 23-05-95 "Natural and artificial lighting"
7. SanPiN 2.6.1.2368-08 Hygienic requirements for ensuring radiation safety

5.2 PRODUCTION SAFETY

Possible dangerous and harmful factors

Factors	Office work stages	Regulations
Insufficient illumination of the working area.	+	SanPiN 2.2.1 / 2.1.1.1278-03 SNiP 23-05-95
Electromagnetic field	+	SanPiN 2.2.4.1191-03 SanPiN 2.2.2 / 2.4.1340-03
Electric shock	+	GOST 12.1.038-82

INSUFFICIENT ILLUMINATION OF THE WORKING AREA

Insufficient illumination negatively affects the functioning of the visual apparatus, the human psyche, its emotional state, determines visual performance, and causes fatigue of the central nervous system resulting from the stresses used to identify dubious signals. When working in low light conditions, personnel may experience eye fatigue and overwork, resulting in poor performance. Depending on the light source, lighting can be of three types: natural, artificial and combined (mixed). Premises with a permanent stay of a person should have natural light. For general and local artificial lighting, light sources with a color-correlated temperature from 2400 ° K to 6800 ° K should be used.

The advantage is given to LED lamps that provide general illumination, the adjustment of illumination is carried out by local lighting. According to [27] SanPiN 2.2.1 / 2.1.1.1278-03 "Hygienic requirements for natural, artificial and combined lighting of residential and public buildings" and SNiP 23-05-95 "Natural and artificial lighting" lighting of scientific and technical laboratories should be at least 400 lux [28].

WORKPLACE ILLUMINATION

Workplace, in which the work was carried out has the following dimensions: length of the room A = 8 m, width B = 6 m, height H = 3.5 m. The height of the working surface above the floor h_p = 0.8 m.

Calculate the area of the room S:

$$S = A * B,$$

Where:

A – length, m;

B – width, m.

$$S = 6*8=48\ m^2$$

The reflection coefficient of freshly whitewashed walls with windows, no curtains, freshly whitewashed ceiling $\rho_п$ = 70% [31].

The safety factor, taking into account the pollution of the lamp, for rooms with low dust emissions is equal to $K_з$ = 1.5.

Uneven Coefficient for Fluorescent Lamps Z = 1.1.

Choose a fluorescent lamp LHB-40 luminous flux is equal to FLD = 2700 Lm.

Choosing lamps with fluorescent lamps such as Shod-2-80. This lamp has two lamps with a power of 80W each, the length of the lamp is 1227 mm, and its width is 265 mm.

The integral criterion for the optimal arrangement of luminaires is the value of λ, which for fluorescent luminaires with a protective grid lies in the range of 1.1-1.3. Accept λ = 1.1, the distance of the lamps from the ceiling (overhang) h_C= 0.3 m.

The height of the lamp above the working surface is determined by the formula:

$$h = h_n - h_p,$$

Where:

h_n– the height of the lamp above the floor, the height of the suspension;

h_p– the height of the working surface above the floor.

The smallest permissible height of the suspension above the floor for two-lamp SOD lamps: h_n= 2.5 m.

The height of the lamp above the working surface is determined by the formula: h = H - h_P - h_C= 3.5 - 0.8 - 0.3 = 2.4 m.

The distance between adjacent lamps or rows is determined by the formula:

$$L1 = \lambda * h = 1.1 * 2.4 = 2.7 \text{ m}$$

$$L2 = 2.128 \text{ m}$$

The number of rows of lamps in the room:

$$N_b = B / L = 6 / 2.7 = 2.22 \approx 2$$

Number of lamps in the row:

$$N_a = A / L = 8 / 2.64 = 3.03 \approx 3$$

Total number of fixtures:

$$N = N_a * N_b = 2 * 3 = 6$$

The distance from the extreme lamps or rows to the wall is determined by the formula:

$$l1 = L1 / 3 = 2.7 / 3 = 0.9 \text{ m}$$

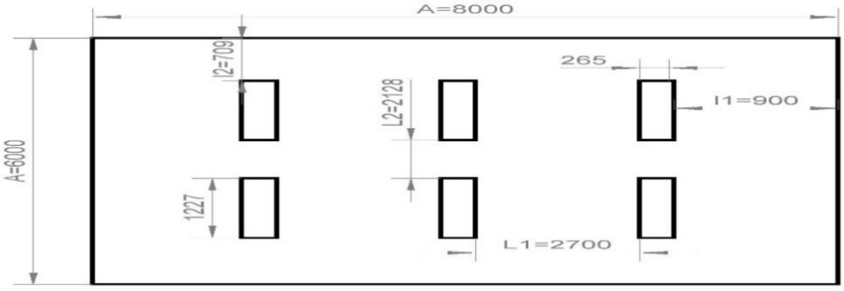
$$l2 = L2 / 3 = 2.128 / 3 = 0.709 \text{ m}$$

Substitute all values for verification:

$$A=2*L1+2/3*L1+3*265=2*2700+2/3*2700+3*265=8000$$

$$B=L2+2/3L2+2*1227=2128+2/3*2128+2*1227=6000$$

Images with the location of the lamp in the room



The room index is determined by the formula:

$$i = \frac{A \cdot B}{L1 \cdot (A+B)} = \frac{8 \cdot 6}{2.7 \cdot (8+6)} = 1.29 \approx 1.3$$

The coefficient of use of the luminous flux, which shows how much of the luminous flux of the lamps falls on the working surface, for SHOD luminaires with fluorescent lamps with $\rho_{П}$ = 70%, ρ_{C} = 50 % and room index i = 1.3 equals η = 0.5 [31].

The required luminous flux 1 of the fluorescent lamp of the lamp is determined by the formula: $\Phi_n = \frac{E \cdot A \cdot B \cdot K_з \cdot Z}{N \cdot \eta} = \frac{200 \cdot 8 \cdot 6 \cdot 1.5 \cdot 1.1}{2 \cdot 6 \cdot 0.5} = 2640$

Make a check on the condition: - 10%$\leq \frac{\Phi_{лд} - \Phi_{п}}{\Phi_{лд}} \cdot 100\ \% \leq 20\%$

$$\frac{Флд - Фп}{флд} \cdot 100\% = \frac{2700-2640}{2700} \cdot 100\% = 0.02\%$$

$$-10\% \leq 0.02\% \leq 20\%$$

Thus, we have obtained that the required luminous flux does not exceed the required range. Now we calculate the power of the lighting installation:

P_{oy}= N * P_{SHOD}

P_{oy}= 6 · 2 · 80 = 960W

ELECTROMAGNETIC FIELD

The main sources of EMF of anthropogenic origin include television and radar stations, powerful radio engineering facilities, industrial technological equipment, high-voltage power transmission lines of industrial frequency, thermal shops, plasma, laser and X-ray installations, atomic and nuclear reactors, etc.

The most vulnerable human organs from the electromagnetic field are the nervous, immune, endocrine and reproductive systems.

The first alarming signs are fatigue, irritability, sleep disturbances, memory and attention. With prolonged exposure to the electromagnetic field, the body's protective resources begin to deplete faster.

The maximum permissible values of electric and magnetic fields of industrial frequency depending on the time of their exposure are established by SanPiN 2.2.4.1191-03 “Electromagnetic fields in production conditions”. According to this normative document, staying in an industrial frequency electricity with a voltage of up to 5 kV / m is allowed throughout the entire working day [29].

When working on a personal computer, the permissible EMF levels are regulated by SanPiN 2.2.2 / 2.4.1340-03 “Hygiene requirements for personal electronic computers and organization of work”. According to this standard, the temporary permissible levels of EMF generated by a personal computer in the frequency range of 5 Hz-2 kHz is 25 V / m, in the frequency range of 2 kHz-400 kHz is 2.5 V / m [30]. To protect personnel from the EMF created by the PC, it is necessary to limit the time of use of the PC.

ELECTRIC SHOCK

A source of electric current during analyzes on equipment, as well as when working on a PC, can be voltage drops, high voltage and the probability of a person shorting an electric circuit. Passing through the human body, an electric current exerts:

- Thermal effect (burns, heating to high temperatures of internal organs);
- Electrolytic effect (decomposition of organic body fluids and violation of their composition);
- Biological effect (irritation and excitation of living body tissues, which is accompanied by involuntary convulsive muscle contractions).

Rationing: the voltage value in the electric circuit must satisfy GOST 12.1.038-82 SSBT. Touch voltages and currents flowing through the human body during normal (non-emergency) electrical installation should not exceed the values specified in table 2 [25].

Rationing of contact voltage and current GOST 12.1.038-82

Current type	U. B	I. мА
50 Hz variable	2.0	0.3
400 Hz variable	3.0	0.4
Constant	8.0	1.0

According to the danger of electric shock, premises with a personal computer and the laboratory belong to rooms without increased danger, because the following conditions prevail in these rooms:

- Relative humidity is 50-60%;
- Indoor air temperature does not exceed 35 °C;
- No conductive floors (wooden floors).

THE IMPACT OF DANGEROUS AND HARMFUL FACTORS ON THE POPULATION LIVING NEAR RADIOACTIVE TAILINGS

The main elements that form dangerous and harmful factors

Name of research	Work stages (Settlement and research)	Factors (GOST 12.0.003-2015)		Regulations
		Dangerous	Harmful	
Radioactive tailings and dumps in the Kyrgyz Republic, and their impact on the environment and the health of the population living in the vicinity.	The impact of dangerous and harmful factors on the population living near radioactive tailings.	Factors leading to non-fatal injuries.	Factors leading to chronic disease Factors leading to acute disease	The Law of the Kyrgyz Republic "On Tailings and Mountain Dumps" was adopted by the ZhK KR on 06.06.01. №57. The Law of the Kyrgyz Republic "On Radiation Safety of the Population of the Kyrgyz Republic" was adopted by the LCD of the Kyrgyz Republic on 1.08.03, № 168. The Law of the Kyrgyz Republic OTR "On Radiation Safety" was adopted by the LCD of the Kyrgyz Republic on 02/18/10 SanPiN 2.6.1.001-03 SanPiN 2.6.1.007-03 SanPiN 2.6.1.008-03

5.3 ANALYSIS OF DANGEROUS AND HARMFUL FACTORS

Harmful factors will be, considered according to two criteria described below:

- ✓ Factors leading to chronic diseases, including aggravating existing diseases, due to prolonged relatively low-intensity exposure;
- ✓ Factors leading to acute diseases (poisoning, damage) or injuries due to short-term (single and / or almost instantaneous) relatively high-intensity exposure.

The harmful effects of uranium tailings and waste on the population are manifested:

- ✓ Due to dust demolition
- ✓ Due to direct gamma irradiation;
- ✓ Increased concentrations of radon gas;
- ✓ Due to drinking contaminated water that flows into rivers and streams with drainage water from irrigated mines and tailings, as well as the consumption of food products that are, grown in contaminated areas, including the use of contaminated water for irrigation (water pollution will not be, considered below since there is already a description and reasons).

DUST DEMOLITION

No less significant damage to the environment is caused by the removal of dust from the surfaces of dumps and tailings. This factor also applies to permanent ones, since dust, settling on adjacent territories pollutes the Earth's surface, and upon subsequent dissolution, toxic compounds migrate to soils, plants, and groundwater. This can lead to irreversible environmental degradation at the local and interregional scales, the withdrawal from circulation and degradation of vast agricultural land, and have a negative effect on plants, animals and humans.

Tailings ponds are concentrated technogenic arrays of processing and concentration waste, which, depending on the type of processed ores and concentrates, contain, in addition to uranium, in high concentrations such radioactive elements as radium-226, thorium-230, radon-222, as well as salts harmful to the population heavy metals, and toxic substances used as reagents in the extraction of valuable components of mineral raw materials, which include cyanides, acids, sulfates, nitrates, etc. Therefore, glad is important radiation safety of the population and territories of the Republic [1].

GAMMA RADIATION

Gamma radiation is photons, i.e. electromagnetic wave carrying energy. In air, it can travel long distances, gradually losing energy as a result, of collisions with atoms of the medium. Intense gamma radiation, if not protected, can damage not only the skin, but also internal tissues [11]. Gamma radiation affects the body equally strongly, which is from the outside, that from the inside, so you can protect yourself from such radiation only by leaving a considerable distance from the radiation source. But since most of the populations living near the location cannot leave and leave their place of residence, that is, the question remains of the home relevant.

If we briefly recall that alpha, radiation by its characteristics is practically not dangerous, if you do not inhale its particles or eat with food. Beta radiation can cause skin burns as a result, of exposure. And the most dangerous is gamma radiation. It penetrates deep into the body it is very difficult to get it out of there, and the effect is very destructive. In any case, it is impossible to know what kind of radiation is present in this particular case without special devices, especially since it is always possible to accidentally inhale particles of radiation with air. Given that the population does not have special devices for monitoring, the likelihood of diseases of various diseases, including cancer, is not, excluded.

INCREASED RADON GAS CONCENTRATIONS

Radon is a radioactive gas of natural origin. It has no smell, color or taste. Radon is, formed in the process of natural radioactive decay of uranium, which is, found in all types of rocks and soil. Radon may also be present in water. Radon is, easily released from the soil into the air, where it decays to form other radioactive substances [13]. In the process of breathing, these substances are, deposited on the tissues lining the airways, which can cause damage to the DNA of the cells and lead to the development of lung cancer. The argument is the fact that in the population living near radioactive tailings, children are born with congenital anomalies in most cases.

DANGEROUS FACTORS

Non-fatal injury factors:

Unauthorized access of the local population to radioactive waste storage facilities permanently worsen not only the environmental situation in the waste storage areas, but also entails various injuries and damage that arise as a result, of the penetration of fenced protective structures, access to which is, prohibited.

5.4 ENVIRONMENTAL SAFETY AND MEASURES TO REDUCE EXPOSURE TO HAZARDOUS AND HARMFUL FACTORS

Uranium tailings production facilities are a source of radiation hazard [8]. Ensuring the safety of such facilities requires an understanding of the nature of the sources and routes of exposure from tailings of the environment and the population, both in existing conditions and in the context of possible potential manifestations of natural factors, living conditions and human activities. To make responsible, managing decisions, we need knowledge about radiation safety, variability of the characteristics of environmental pollution sources, radiation factors, and information about the state of former uranium production facilities.

Currently, most mines, tailings, dumps and storage facilities are in neglect and poorly guarded. Radioactive waste, heavy metals and other toxic substances pollute the environment: surface and groundwater, atmosphere, soil and plants [3]. To solve the existing problems, a program of action and a project proposal were, proposed to improve the system for the prevention of cancer and other types of diseases of the population in areas of radiation-contaminated tailings using prevention, strengthening and remediation, as well as equipping and installing the necessary instruments and equipment.

5.5 EMERGENCY SAFETY

Accidents at tailings [26]. The physical and geographical features of the high-mountain ecosystems, to which the territory of the Kyrgyz Republic belongs, determines their special natural instability, increased vulnerability to anthropogenic impacts. An emergency may also arise due to the manifestations of natural processes of mudflows, earthquakes, landslides, as a result, of which the likelihood of pollution of other and significantly large territories increasing. At the same time, the risks and threats to life and health of people not only living in the vicinity but also in other territories of the population's location are increasing. To eliminate catastrophes of a large scale, premature strengthening, reclamation, tailings which already have damage to structures and structures are necessary [2]. Thanks to premature measures, global disasters can be, avoided in the future.

To ensure the safety of tailings, it is necessary:

- ✓ Development of engineering design work for the restoration of tailings and dumps.
- ✓ Assessment of the geotechnical integrity of tailings and safety factors for sealing uranium tailings;
- ✓ Assessment of existing technologies to ensure geotechnical integrity of tailings closure and recommendations of the preferred method. Assessment of each method, taking into account their long-term reliability, cost for implementation and monitoring, as well as risk reduction;
- ✓ Development of an engineering project for sealing work with a description of physical work, their volumes and technology, requirements for equipment and facilities (development of a detailed cost estimate).

The project should also include a health, safety and radiation protection program, quality assurance control programs, environmental control programs to prevent pollution during work, and a monitoring program after sealing tailings.

CONCLUSION

The problem of uranium tailings and industrial waste in Kyrgyzstan remains extremely serious, and the potential consequences associated with an ineffective solution to this problem can affect millions of people in Central Asia and delay the resolution of the problem for many decades. Since most of the radioactive waste and tailings are located in the, vicinity of settlements, which greatly complicates the environmental situation. Which entails various types of diseases, including oncological ones, which manifest with the passage of time.

In order to reduce at times the increase in the incidence of the population in areas where radiation-contaminated tailings and dumps are located, it is necessary to consider the above project proposals 1, 2, 3, 4, 5 and take measures with foreign investors to solve this problem, as well as consider various project proposals for improving the environmental situation in the Kyrgyz Republic.

REFERENCES

1. Aydaraliev B.R., Toychubekov E.A., Ordobaev B.S., Sadabaeva N.J. Radiation safety of the population and territories of the Kyrgyz Republic. - Bishkek: KRSU, 2016.-192 p.
2. Torgoev I.A., Aleshin Yu.G. Geoecology and wastes of the mining complex of Kyrgyzstan Bishkek: Ilim, 2009.
3. Bykovchenko Yu.G., Bykova EI, Belekov T. et al. Technogenic pollution by uranium of the biosphere of Kyrgyzstan. Bishkek, 2005.
4. UNDP / GEF Project - Capacity Building to Improve National Financing for General Environmental Management in Kyrgyzstan. Application of the best international experience in the management of environmental funds in the Kyrgyz Republic.
5. The state program for the support of environmental monitoring and technical supervision facilities for former uranium production facilities of the Kyrgyz Republic.
6. Aleshin Yu.G., Torgoev I.A., Losev V.A. Radiation Ecology Mailuu-Suu. / SIC "Geopribor". Bishkek: Ilim, 2000.
7. The Law of the Kyrgyz Republic “On Tailings and Mountain Dumps” was adopted by the LCD of the Kyrgyz Republic on June 26, 2001 No. 57.
8. Law of the Kyrgyz Republic General technical regulation “On radiation safety” was adopted by the Jogorku Kenesh, of the Kyrgyz Republic on February 18, 2010.
9. Saltanat Berdikeeva, “The Threat of Radiation in Central Asia,” Network of International Relations and Security, 2009, www.isn.ethz.ch.
10. “The race of Kyrgyzstan for the stabilization of buried ponds with uranium waste,” Science magazine, January 14, 2005; Issue 307, 5707.
11. Friedrich Steinhausler and Ludmila Zaitseva, “Uranium mining and enrichment: material security and risk assessment”, Int. J. Nuclear Management, Economics and Ecology, no. 1, No. 3, 2007.

12. Government of the Kyrgyz Republic: framework document, preliminary project “Uranium tailings: local problems, regional consequences, global solution”, www.uranium.kg.
13. Jonathan Tyrone and Subramaniam Sharma, “Radioactive beer barrels threaten the public, increase costs for processors”, Bloomberg, November 11, 2008, www.beyondnuclear.org; and Jeffrey Donovan, “Kyrgyzstan: IAEA Seeking Answers for Radioactive Hijacking,” Free Europe Radio, January 18, 2008, www.rferl.org.
14. “Decommissioning Projects - Asia,” WISE Uranium Project, August 18, 2009, www.wise-uranium.org.
15. Government of the Kyrgyz Republic, Framework Document, Preliminary Draft, “Uranium Tailings: Local Problems, Regional Implications, Global Solution”, www.uranium.kg.
16. “Uranium Tailings in Central Asia: A Regional Problem Requires a Global Solution,” Times of Central Asia, Issue 572, July 9, 2009
17. “Uranium tailings in Central Asia: local problems, regional implications, global solution: joint declaration”, Geneva, Palais des Nations, June 29, 2009
18. “Kyrgyzstan is developing a Soviet-era uranium waste management plan,” Environmental News Service, May 7, 2009, www.ens-newswire.com: Government of the Kyrgyz Republic: framework document, preliminary project “Uranium tailings: local problems, regional consequences, global solution”.
19. Zaituna Abdullo, “Kyrgyz environmentalists are sounding the alarm about landfills of Soviet times,” “Central Asia Online,” February 6, 2009, centralasiaonline.com.
20. “ISTC, the most important mechanism for solving the problem of uranium tailings in Central Asia”, July 30, 2009, www.istc.ru.
21. “Kyrgyzstan: Nuclear Wastes Threaten the Environment,” Irin News, September 10, 2008, www.irinnews.org. “Uranium tailings pose an environmental risk in Kyrgyzstan” https://thediplomat.com/2016/12/soviet-uranium-mines-still-have-deadly-impact-in-kyrgyzstan.

22. Internet search engine, images https://www.google.ru.
23. GOST R 1.0-2012 Standardization in the Russian Federation. Key Points
24. GOST 12.0.003–99. SSBT. Dangerous and harmful production factors. Classification
25. GOST 12.1.038-82 SSBT. Electrical safety. Maximum permissible levels of contact voltage and currents
26. GOST R 22.0.02-2016 Safety in emergency situations.
27. SanPiN 2.2.1 / 2.1.1.1278-03 "Hygienic requirements for natural, artificial and combined lighting of residential and public buildings"
28. SNiP 23-05-95 "Natural and artificial lighting"
29. SanPiN 2.2.4.1191-03 "Electromagnetic fields in a production environment."
30. SanPiN 2.2.2 / 2.4.1340-03 “Hygienic requirements for personal electronic computers and organization of work”.
31. The approximate value of reflection coefficients file: ///C:/Users/User/Desktop/МУ%20Calculation for %20 artificial% 20 lighting.pdf