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«Central Asian Academic Research Center» LLP is pleased to announce that “News of NAS RK. Series of Geology and Technical sciences” scientific journal has been accepted for indexing in the Emerging Sources Citation Index, a new edition of Web of Science. Content in this index is under consideration by Clarivate Analytics to be accepted in the Science Citation Index Expanded, the Social Sciences Citation Index, and the Arts & Humanities Citation Index. The quality and depth of content Web of Science offers to researchers, authors, publishers, and institutions sets it apart from other research databases. The inclusion of News of NAS RK. Series of Geology and Technical Sciences in the Emerging Sources Citation Index demonstrates our dedication to providing the most relevant and influential content of geology and engineering sciences to our community.

«Орталық Азия академиялық ғылыми орталығы» ЖШС «ҚР ҰҒА Хабарлары. Геология және техникалық ғылымдар сериясы» ғылыми журналының Web of Science-тің жаңаланған нұсқасы Emerging Sources Citation Index-те индекстелуге қабылданғанын хабарлайды. Бұл индекстелу барысында Clarivate Analytics компаниясы журналды одан әрі the Science Citation Index Expanded, the Social Sciences Citation Index және the Arts & Humanities Citation Index-ке қабылдау мәселесін қарастыруда. Web of Science зерттеушілер, авторлар, баспашылар мен мекемелерге контент тереңдігі мен сапасын ұсынады. ҚР ҰҒА Хабарлары. Геология және техникалық ғылымдар сериясы Emerging Sources Citation Index-ке енуі біздің қоғамдастық үшін ең өзекті және беделді геология және техникалық ғылымдар бойынша контентке адалдығымызды білдіреді.

ТОО «Центрально-азиатский академический научный центр» сообщает, что научный журнал “Известия НАН РК. Серия геологии и технических наук» был принят для индексирования в Emerging Sources Citation Index, обновленной версии Web of Science. Содержание в этом индексировании находится в стадии рассмотрения компанией Clarivate Analytics для дальнейшего принятия журнала в the Science Citation Index Expanded, the Social Sciences Citation Index и the Arts & Humanities Citation Index. Web of Science предлагает качество и глубину контента для исследователей, авторов, издателей и учреждений. Включение Известия НАН РК. Серия геологии и технических наук в Emerging Sources Citation Index демонстрирует нашу приверженность к наиболее актуальному и влиятельному контенту по геологии и техническим наукам для нашего сообщества.

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RADIATION, CHEMICAL SITUATIONS AND COMMUNAL DAMAGE CAUSED DURING POSSIBLE EARTHQUAKE IN TURKESTAN REGION

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Abstract. The soils in the Turkestan region, as in other regions of the Republic of Kazakhstan, are susceptible to seismic influences and are considered earthquake-prone, with earthquakes up to 8-9 points. In the event of seismic impacts, several dozen chemical industries are located in the region, which can lead to serious consequences. The article examines the damage caused by earthquake engineering networks, communications of cities, settlements, as well as industrial accidents in the chemical industry of the Turkestan region. At 6-7 points, various degrees of life support systems are damaged, and in an earthquake with a magnitude of more than 7-8 points, such systems remain paralyzed for a long time. The life support systems of energy-saturated cities are particularly affected by earthquakes, as due to the destruction of thermal power grids and hydroelectric power plants, generators, transformers fail, insulators, tires, switchgear, etc. break, short circuits occur and power equipment fails. In addition, population losses in the foci of chemical damage depend on the toxicity, the concentration of a highly toxic substance and the time of arrival of people in the lesion, the degree of their protection and the timely use of personal protective equipment (gas masks). The nature of the damage

to the population located in the zone of chemical contamination may be different. This is mainly determined by the toxicity of a highly toxic substance and acquired toxodosis.

Keywords: soils, seismicity, utility networks, communications, industrial accidents, energy facilities

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ТҮРКІСТАН ОБЛЫСЫНДА БОЛЖАМДЫ ЖЕР СІЛКІНІСІ КЕЗІНДЕГІ РАДИАЦИЯЛЫҚ-ХИМИЯЛЫҚ ЖАҒДАЙ ЖӘНЕ КОММУНАЛДЫҚ ЗАҚЫМДАНУЫ

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Аннотация. Түркістан облысындағы топырақтар Қазақстан Республикасының басқа өңірлеріндегідей сейсмикалық әсерлерге ұшырайды және 8-9 баллға дейін ықтимал жер сілкіністерімен сейсмикалық қауіпті болып саналады. Облыс аумағында ондаған химиялық өнеркәсіп орындары орналасқан, сейсмикалық әсер пайда болған жағдайда бұл ауыр зардаптарға әкелуі мүмкін. Мақалада жер сілкініс әсерінен туындайтын қалалардың және елді мекендердің инженерлік желілері мен коммуникацияларының зақымдануы, сондай-ақ Түркістан облысының химия өнеркәсібінің өндірістік апаттарының салдары қарастырылған. Мүмкін болған 6-7 балл жер сілкінісі кезінде тіршілікті қамтамасыз ету жүйелерінің әртүрлі дәрежелері зақымдалады, ал күші 7-8 баллдан жоғары жер сілкінісі кезінде мұндай жүйелер ұзақ уақыт бойы істен шығып, коммуналдық жүйесіз қалады. Қазіргі таңда энергиямен қаныққан қалалардың тіршілікті қамтамасыз ету жүйелері, әсіресе жер сілкіністерінен көптеп зардап шегеді, өйткені қажетті жұмыс атқарып отырған жылу электр желілері мен гидроэлектростанциялардың бұзылуына байланысты генераторлар, трансформаторлар істен шығады, окшаулағыштар, тарату құрылғылары және тағы да басқалар бұзылады, энергетикалық жабдықтардың қысқа тұйықталуы және істен шығуы орын

алады. Сонымен қатар, химиялық зақымдану ошақтарындағы халықтың уыттылыққа улануы, күшті улы зат концентрациясының мөлшеріне және адамдардың зақымдану ошағында болу уақытына, олардың қорғалу дәрежесіне және жеке қорғаныс құралдарын (газқағарларды) дер кезінде пайдалануға байланысты. Жер сілкінісінен орын алған химиялық ластану аймағында орналасқан халықтың зақымдану түрі мен сипаты әртүрлі болуы мүмкін. Зақымдану түрі мен сипаты негізінен күшті улы заттың уыттылық түрі және қабылданған токсодозбен анықталады.

Түйін сөздер: топырақ, сейсмика, инженерлік желілер, коммуникациялар, өндірістік апаттар, энергетика объектілері

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РАДИАЦИОННО-ХИМИЧЕСКИЕ СИТУАЦИИ И КОММУНАЛЬНЫЕ ПОВРЕЖДЕНИЯ ПРИ ВОЗМОЖНОМ ЗЕМЛЕТРЯСЕНИИ В ТУРКЕСТАНСКОЙ ОБЛАСТИ

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Аннотация. Грунты Туркестанской области, как и в других регионах Республики Казахстан, подвержены сейсмическим воздействиям. Регион относится к сейсмоопасным зонам, где возможны землетрясения интенсивностью до 8–9 баллов. На территории области расположено множество предприятий химической промышленности, аварии на которых при сейсмических воздействиях могут привести к тяжёлым радиационно-химическим последствиям. В статье рассмотрены возможные повреждения инженерных сетей и коммунальных коммуникаций городов и населённых пунктов, а также риски техногенных аварий на объектах химической промышленности вследствие землетрясений в Туркестанской области. Установлено, что при землетрясениях силой 6–7 баллов системы жизнеобеспечения подвергаются различным степеням повреждения, а при колебаниях интенсивностью свыше 7–8 баллов — длительной дезорганизации

и выводу из строя. Особенно уязвимыми оказываются энергосистемы, где сейсмические разрушения приводят к повреждению генераторов, трансформаторов, распределительных устройств и другим нарушениям, вызывающим короткие замыкания и полное отключение электроэнергии. Потери населения в очагах химического поражения зависят от типа и токсичности вещества, его концентрации, времени пребывания людей в зоне заражения, степени их защищённости и своевременного применения средств индивидуальной защиты. Характер и степень поражения населения вследствие землетрясения определяются видом токсичных веществ и уровнем полученной токсодозы. Проведённый анализ подчёркивает необходимость разработки эффективных систем мониторинга и планов ликвидации последствий возможных радиационно-химических аварий в сейсмоопасных регионах Казахстана.

Ключевые слова: грунты, сейсмичность, инженерные сети, коммуникации, производственные аварии, объекты энергетики

Introduction. The soils of the Turkestan region are subject to the same seismic impact as in other regions of Kazakhstan. The seismicity of the territory is determined by General seismic zoning maps and seismic micro-zoning maps, which take into account the probability of exceeding seismic intensity for 50 years. The Turkestan region, like other southern regions, is considered seismically dangerous, where earthquakes can occur up to 8-9 points.

During a possible earthquake of 6-7 points, various levels of life support systems are damaged. However, during an earthquake of more than 7-8 points, such systems are paralyzed for a long time. The life support systems of energy-intensive cities are especially affected by earthquakes, since generators and transformers fail due to the failure of TPP (Thermal Power Plant), HPP (Hydroelectric Power Plant). Electrical equipment fails due to short circuits in insulators, switchgear, etc. (Xu et al, 2022; Raimbekov et al, 2013; Mavroulis et al, 2023; Bata et al, 2022; Blinov, 2007).

Materials and methods.

Electricity supply:

In the area of 7-8 points, accidents at energy facilities may occur, which will lead to a loss of electricity supply for 2 to 5 days.

In the area with a seismic potential of 6 points, there will be no changes in the number of individual accidents.

In the area of increased seismic activity with a seismic potential of 7 points, individual accidents may occur.

In the Turkestan region, in the area of increased seismic activity with a seismic potential of 8 points, numerous accidents may occur. Based on the analysis conducted, we have considered the volumes of engineering systems of the Turkestan region below.

Gas supply:

In the 6-point zone, underground gas pipelines are deformed, but, as a rule, remain in working condition.

In the zone of high seismic activity with an earthquake probability of 7-8 points, joints are broken:

- 544 773.8 km of 10 895.476 km of gas distribution pipelines available in the region, including 278 064 km underground, 266 709.9 km above ground.

- 64672 km of high-pressure gas distribution pipelines, including 8993 km underground steel, 48382 km polyethylene, 7297 km above ground.

Medium pressure gas pipelines are only 301.9236 km, including underground steel 10.3767 km, polyethylene 190.6896 km, aboveground 100.8573 km.

Only 178.1781 km of low pressure gas pipelines, including 3.3644 km underground steel, 16.2584 km polyethylene, 158.5553 km aboveground.

- Total 0.0123 km of main gas pipelines.

- Gas pipeline inlets are 4.9346 km.

Water supply:

In addition, water supply networks and structures are also subject to disruption and damage. Out of the total length of the existing drinking water pipelines in the region, there may be individual cases of damage and destruction of the joints of 745.15 km of pipelines.

Also, there may be individual cases of damage and rupture of the joints of 20.97 km of sewer pipes with a total length of 419.4 km.

Heat supply:

Also, accidents may occur in heat supply systems with a total length of 17.605 km (main 6.815 km, inter-district 10.835 km). Among them:

- “Kentauservis” SUE - 8.45 km (main 1.91 km, inter-district 6.54 km).

- “Turkestan Zhylu” SUE - 2.25 km (main 0.73 km, inter-district 1.52 km).

- “Arys-Zhylu” SUE - 0.415 km (main 0.27 km, inter-district 0.14 km).

- “Saryagash-Turmys” SUE - 1.8 km (main 1.45 km, inter-district 0.35 km).

- “Lenger Su” SUE - 2.05 km (main 1.0 km, inter-district 1.1 km).

- “Otyrar Zhylu” SUE - 0.78 km (main 0.76 km, inter-district 0.02 km).

- “Sholakkorgan Su” SUE - 1.86 km (main 0.695 km, inter-district 1.165 km).

Results and discussion

In the event of an accident at a chemically hazardous facility in the region, the main hazardous substances are: chlorine, ammonia, fluorine, hydrochloric and nitric acids (Kirillov, 2013; Polyakov, 2009; León et al, 2022; Markhotsky, 2007).

The greatest danger is posed by accidents associated with the complete destruction of containers with hazardous chemicals, since a significant amount of liquefied substances can be released into the atmosphere and onto open surfaces (On the Use of Atomic Energy RK).

The forecast calculation is carried out taking into account the possible consequences, in consideration of:

- type, properties and amount of the substance;

- features of local meteorological conditions, wind direction;
- state of vertical stability of the atmosphere - inversion, isotherm, convection;
- terrain;
- trajectory of cloud movement of a hazardous chemical substance;
- scale of contamination of the surface layer of the atmosphere, distribution of concentrations of hazardous chemicals in certain meteorological conditions (in calm weather conditions);
- number of people and their time in the disaster area, and other factors.

The degree of toxicity of the population in the areas of chemical contamination depends on the concentration of the HTS and the time of arrival of people at the site of contamination, the degree of their protection and the timely use of personal protective equipment (gas masks). The nature of the damage to the population located in the area of chemical contamination may be different. It is mainly determined by the toxicity of the HTS and the toxic dose received (Safety Requirements for Toxic and Highly Toxic Substances, RK; On civil protection, RK; Guerrero-Miranda et al, 2021).

In the event of an accident due to the release of hazardous substances, the area of potential chemical contamination is predicted in stages (Yunus et al, 2023; GOST 12.1.007-76):

- prediction of the probability of an accident;
- determination of the level and dynamics of environmental pollution (first of all);
- calculation of potential sanitary expenses.

“Kantau Service” SUE is located at the address: Ryskulbekov street, No. 111, Khantagy village, Kantau. Its activities are heating residential buildings in the city of Kantau. This is a chemically hazardous facility, its production includes hydrazine hydrate - 60 liters, aqueous ammonia - 60 liters. The storage method is in a specialized container. The facility borders on a residential area on all sides.

In the event of an accident due to the release of hazardous substances, the area of potential chemical contamination is approximately 1.2 km². At the same time, the number of workers is 80 people and the population is 6364 people, including irrecoverable losses - 1114 people, sanitary losses - 2068 people;

“Barsat” LLP is located in the Saryagash district, Kokterek settlement, Duysebev street, No 35. This is a chemically hazardous facility, in its production of which a total of 200 kg of ammonia is used. The method of storing ammonia is liquefied gas, in receivers. The facility borders on one side with a residential area.

The area of the potential chemical pollution zone in the event of an accident associated with the release of hazardous substances is approximately 0.5 km². The number of workers is 30 people and the population is 816 people, including irreversible losses -143 people, sanitary losses - 265 people;

“ALEKS” LLP is located in the Saryagash district, Nurlyzhol settlement, Akimbekov street, No. 7. It produces mineral drinks. It is a chemically hazardous

facility, in its production of which a total of 2.2 tons of ammonia is used. The method of storing ammonia is liquefied gas, in receivers. The facility borders on all sides with a residential area.

In the event of an accident associated with the release of hazardous substances, the area of the potential chemical contamination zone is approximately 0.5 km². The number of workers is 365 people and the population is 21 people, including irrecoverable losses - 67 people, sanitary losses - 126 people:

Zones of infection by HTS may appear in the event of accidents on the railways, as well as in the event of defects in containers for transporting HTS.

At the large railway junction of the city of Arys, HTS may accumulate from vehicles.

11 radiation hazardous facilities operate in the territory of two districts of the region, including:

- there are 2 facilities in the Otrar district:

The enterprise of JSC "Zarechnoye" JV is located in the western part of the Otrar district of the Turkistan region, on the territory of the Tabakbulak settlement.

The mine is designed to extract uranium-containing ores by the method of well-hole underground leaching. The processing of the resulting solutions of underground leaching is carried out by the sorption concentration method.

The technology of underground uranium leaching from the subsoil is associated with changes in the surface. The minimum amount of mining mass during the preparation of exploitation blocks is practically waste-free production.

The total area of the production area is 3800 hectares, the area of the production base is 12.25 hectares, the area of the site is 7.74 hectares, the construction area is 3.5 hectares, the area of greening is 1.97 hectares, the contour of the sanitary protection zone (SPZ) of the complex.

The SPZ of the production site is set at a distance of -250 m.

An asphalt highway runs along the left bank of the Syrdarya river, 50 km from the deposit, from which a dirt road with an improved coating is laid in the Bozhban well area to the Tabakbulak farm and to the central part of the deposit. The nearest railway station "Temir" is located on the right bank of the Syrdarya river, 105 km from the Zarechnoye deposit.

Rotational village includes: 22 cottages for 10 people each; a hotel cottage for 7 people; a utility block with a laundry room with utility rooms and a sauna; boiler rooms for 3 boilers; two wells with drinking water intake-submersible pumps and a reserve water tower; AKSA APD 200S emergency diesel power plant.

JSC "Akbastau" BV, "Kulandy" mine belongs to the III category of potential radiation hazard as an object whose radiation impact is limited to the territory of the enterprise.

JSC "Akbastau" BV, "Kulandy" mine is located in the southwestern part of the Shu-Sarysu lowland, in a deserted, difficult-to-reach, sparsely populated area on the territory of the "Budenovskoye" deposit in the Suzak district of the Turkistan

region. The nearest settlement “Bakyrly” is located 40 kilometers from the mine. The Budenovskoye deposit is also being developed by a neighboring enterprise, “Karatau” LLP, at site No.2 (Karatau deposit). The distance from the territory of sites No.1, 3, 4 of “Akbastau” JSC to site No.2 of “Karatau” LLP is approximately 1.4 km.

Under the Akbastau agreement, the joint venture is serviced by “Karatau” LLP.

The prevailing winds blow from the northeast over the territory of the mine. In this regard, the residents of the Karatau village are not at risk from possible radiation accidents.

The closest settlements to the Budenovskoye deposit are the villages of Suzak, Karagur, Karatau and the Aksumbe subdivision, located 40 km south of the deposit at the foot of the Karatau ridge.

The work method is shift work. The total number of employees is 47 people, including: 7 engineering and technical personnel, 40 workers.

There are 9 facilities in the Suzak district – “Appak” LLP (“Batys Mynkuduk” mine), “ORTALIK” Production Enterprise” LLP (“Ortalyk Mynkuduk” mine), “Inkai” JV LLP, “Katko” JV LLP, “Karatau” LLP, “Kazatomprom-Sauran” LLP branch “Taukent” mine, “Kazatomprom-Sauran” LLP, “Stepnoye-RU”, “OTKHK” JV” LLP Akdala mine, “OTKHK” JV” LLP South Inkai mine.

The settlements are located far from the deposit and the production of radioactive substances, therefore, the inhabitants of these areas are not at risk from possible radiation accidents. In the zone of possible contamination there is an industrial zone with a total number of more than 1.500 people working and non-working, where situations may arise.

It covers an area of about 1.4 km², has 236 workers and a population of 7.180 people, including irrecoverable losses of 1.237 people, sanitary losses of 126 people.

Conclusion.

The Turkestan region, like other southern regions, is considered seismically dangerous, where earthquakes can occur up to 8-9 points. The formation of seismic waves can lead to complete or partial destruction of engineering networks. Based on the information above and taking into account:

- human losses (1363 people);
- economic losses (material and technical losses) we understand that the role of emergency rescue and emergency restoration work is great.

In addition, it is urgent to develop safety measures taking into account the population of the settlement and local characteristics.

The next step is to develop an optimal, universal safety measures methodology to reduce human losses, taking into account the mentality of the residents of the southern region to accept natural and man-made disasters.

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