



## IMPACT OF RESEARCH CENTERS ON ENVIRONMENTAL FACTORS

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**Abstract:** This paper examined the impact of research centers on environmental factors. During the research, the creation and activities of research centers were analyzed. It has been determined that depending on the areas of activity in scientific centers, various wastes are generated. This waste can be environmentally harmful. Methods for creating special conditions for working with chemicals and radioactive materials are shown. It has been determined that the construction of science cities is important for ensuring environmental safety. The possibilities of creating these cities in Azerbaijan are shown.

**Keywords:** research centers, environmental factors, nanomaterials, radioactive materials.

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### Introduction:

Environmental issues are one of the common issues currently discussed in the world. Environmental change is one of the factors that most influences the health of living things. Therefore, solving these problems is one of the urgent tasks of modern science. Measures are being taken to address environmental problems. The use of alternative energy sources has helped solve a number of problems. It is known that during oil extraction and refining a large amount of waste is generated, causing soil pollution. When oil is used as fuel, a large amount of gases is formed, causing air pollution (Benton & ets, 2007; Efendiyeva, 2000; Nikolaichuk, 2016).

It is known that one of the main causes of environmental pollution is the problems arising in large cities. Therefore, it is considered advisable to form large enterprises around the city where people gather. One such institution is scientific institutions. Recently, higher education institutions are mainly built on the outskirts of cities. However, in this case, certain difficulties arise. Thus, proximity to the city center is important for solving the economic and social problems of employees of

scientific institutions, as well as students and teachers of higher educational institutions. As you move away from the center, problems arise in solving a number of issues. The most suitable model for solving these problems is the creation of science cities. In the science city it is possible to create research centers, as well as the creation of higher educational institutions, sports complexes and recreation centers. The proximity of students' and researchers' places of residence and work forces them to engage in more useful work. These facts indicate the impact on the growth of scientific indicators. The most important of all these factors are environmental factors. They must be organized in such a way that environmental pollution is minimal. Because as a result of the influence of anthropological factors, environmental problems begin to arise in places where people live. Human activity causes additional problems. Therefore, when addressing these issues, it is necessary to take into account environmental factors and monitor environmental protection (Hall, 1997; Pickett & ets, 2016, Ellis, 2015).

Although the influence of a number of factors on the environment has been studied,

the impact on the environment during the activities of research centers has not been studied enough. Because there are areas of science where harmful materials are used in research. Great care is required when conducting research using chemicals. In some areas of science, the expiration date of used instruments and equipment leads to the formation of harmful materials. Recently, the rapid development of nanotechnology has caused new environmental problems. So, because nanomaterials are very reactive, they can interact more quickly with materials in the environment. At this time, the formation of harmful substances may occur. Therefore, it is necessary to study environmental problems that may arise in research centers and take measures to prevent them. This paper shows the environmental problems that arise during the activities of research centers. To minimize these problems, issues that should be considered when establishing research centers have been mentioned.

#### **Material and methods:**

Studies have been conducted to examine the impact of research centers on environmental factors. The study analyzed research centers. Various research centers were selected as model objects for analysis. These centers were compared and analyzed on similar and different aspects. The processes that can occur in these centers, including accidents, have been studied. Study sites were grouped according to the results obtained during the analysis. For centers of a similar nature, appropriate models have been created. Proposals have been put forward to prevent the occurrence of environmental problems. Two methods have been proposed to study environmental problems. One of them is related to taking into account the main factors when creating a research center. It should be proposed to build the center in such a way as to ensure environmental protection with minimal damage to the environment. The second method is that the waste generated during the operation of the center must be controlled. They must either be reused or disposed of. By applying the mentioned methods, the influence

of research centers on environmental factors can be studied.

#### **Results and discussion:**

It is known that research centers can work in different directions. When creating and operating these centers, environmental factors must be taken into account. It is known that when building cities and creating settlements, one should choose suitable places in nature. Therefore, many cities are built on the banks of rivers or seas. Because water pools support the protection of a clean environment. It is known that when building cities, aesthetic factors should also be taken into account. These factors should also be taken into account when establishing research centers. For this reason, centers were analyzed that can be used as model objects in the creation and operation of scientific centers. One such center is the Joint Institute for Nuclear Research, located in Dubna, Russian Federation (<https://www.jinr.ru/>). Although the institute primarily conducts nuclear research, it also conducts research in materials science, biological mathematics, and information technology. When creating this center, environmental factors were taken into account in 2 areas. The first direction is that the center must be environmentally friendly and located in a place where scientists can live comfortably. The second direction is that waste generated during research should not cause environmental problems. Each of these factors was analyzed separately.

A general view of the city of Dubna, where the Joint Institute for Nuclear Research was created, is presented in Figure 1. As can be seen in the figure, the city of Dubna is located on the right and left banks of the Volga river. The research center is located on the left bank. As you can see, the city is covered with greenery. There are many trees around the buildings and on the banks of the Volga. Environmentally friendly conditions for people to live and work have been created here. Therefore, this place was chosen to create a science city.



**Figure 1. Dubna city of Moscow region, Russian Federation.**

In accordance with the nature of the city of Dubna, research centers are also being built in dense forest areas. The entire territory of the Joint Institute for Nuclear Research is located in a forest zone. In recent years, a number of new international projects have been implemented at this institute. One of such

projects is the NICA project (Nuclotron-based Ion Collider facility). This project aims to conduct research by accelerating various particles. A schematic description of the laboratory in which the project is being implemented is presented in Figure 2.



**Figure 2. NICA project of the Joint Institute for Nuclear Research.**

These centers conduct research both with chemical materials and under the influence of

radiation. During research at the IBR-2 reactor, high-intensity neutron radiation occurs, which

creates certain dangers. The center has taken a number of measures to minimize environmental damage. A biological shielding system was built in the reactor to protect against exposure to neutron rays. Remote control is used for radiation protection during research. The amount of radiation during experiments depends on the type of research being conducted. If during research the structure of solids is studied by neutron diffraction, then you can touch the samples immediately after the experiment. However, in neutron absorption studies, samples may remain active for a long time. Therefore, after the end of the experiment, the activity of the samples should be monitored. These samples must be stored in special chambers for a certain period of time.

We need to be more careful when researching with chemicals. Because these substances can cause certain complications.

Chemically active substances must not be touched. Nano-sized materials can enter the body through the pores of human skin. Therefore, caution should be exercised when conducting research with these substances.

In the course of the above-mentioned studies, it was determined that the creation of science cities is the most optimal method for creating research centers. To conduct scientific research, calm and favorable living conditions are necessary. These conditions can be ensured in science cities. The possibilities for using this model in Azerbaijan are wide. It is known that the research centers of Azerbaijan are mainly located in Baku. However, some regions have universities or university branches. Therefore, research centers can be created at these universities. For this purpose, the Guba city was explored and the possibilities of this city as a city of science were determined. Figure 3 shows a general view of the Guba city.



**Figure 3. Guba city of Azerbaijan Republic.**



From Figure 3 it can be seen that the Guba city is located on the banks of the Gudyalchay River near the Caucasus Mountains. It is possible to create research centers in this city. It is known that a branch of the Azerbaijan State Pedagogical University operates in the Guba city (<https://adpuquba.edu.az/>). Figure 4

shows a general view of the university. As you can see in the photo, the university territory has a beautiful natural landscape. Students of various specialties study in this department. Professors and teachers participate in the educational process. Therefore, there is scope for creating a research center.



**Figure 4. Guba branch of the Azerbaijan State Pedagogical University.**

The study determined that in order to address the environmental problems of research centers, two main issues should be addressed. Firstly, to create a research center it is necessary to select suitable natural conditions. Because depending on natural conditions, there may be more or less environmental problems. In big cities it is difficult to solve these problems. However, it was easier to solve these problems in small cities, including science cities. The second issue is that safety regulations must be followed when conducting research in research centers.

#### **Conclusion:**

Environmental problems arising in research centers are analyzed and ways to solve these problems are outlined. It has been determined that one of the ways to solve environmental problems in scientific centers is the creation of

science cities. Because it is easier to solve environmental problems in science cities than in big cities. The Dubna city in the Russian Federation and the Guba city in Azerbaijan were compared as a model object. It is shown that the possibilities for creating research centers in these cities are wide. The nuclear center created in the city of Dubna was analyzed and it was considered expedient to create a similar center in the Guba city.

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