

SCIENCES & TECHNOLOGIES

THE PROBLEM OF INFLUENCE OF TECHNOGENIC ACTIVITY FOR THE ACTIVIZATION ON NATURAL PROCESSES

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Ikram Kerimov, professor, doctor phys.-math.sciences, Director of Scientific Center of Seismology of Azerbaijan Academy of Sciences. Author of scientific discovery of new – regularness---- of behavior of weak highfrequency seismic fields admitted in 1988 by the State Committee on discoveries and inventions of former USSR with priority from May, 1979. Author of a new model of Earth structure with the previously unknow layer in mantle at depths from 800 km to 1500 km. Member of many international scientific societies. He was heading scientific investigations on ecological control of technogenic processes of former USSR for many years.

This publication opens a row of articles devoted to the results of research of different aspects of environmental impact of non-controlled industrial (technogenic) activity. The questions discussed include an assessment of negative technogenic effects resulting from development and operation of oil and gas fields, minerals and fossils production, construction and use of water reservoirs, industrial and civil construction, low and high power explosions.

Recently these materials were presented at the International conference devoted to the problem of underground nuclear explosions (UNE) impact on the seismicity and oil production (June 1991, Baku), at the International congress of geodesy and geophysics (August 1991, Vienna), at the Regional meeting devoted to the problems of seismology and seismotectonics of Azerbaijan and Northern Iran (October

1992, Tebriz), at the annual meeting of International council of CIS, devoted to the plasticity physics and materials destruction (March 1994, Sanct-Petersburg), at the International meeting devoted to the problems of seismic-proof construction (June 1994, Berlin) at the meeting of working group, organized by NATO, devoted to the UNE environmental impact and stimulation of earthquakes (November 1994, Moscow).

Environmental aspects are today the most important scientific and social problems. It was understood in the West 30-40 years earlier than in former USSR and countries within its sphere, certain measures were taken to protect the environment, to create methods of industrial control to avoid negative environmental impact.

Another reason that caused such a delay was that more detailed information about the environmental processes was used for military purposes and were hidden. There were created global spacial systems for environment monitoring, and their main aim was to control changes caused by different impacts.

But as the statistical data accumulated and environmental impact had become more intensive, it became clear that the artificial activation aimed to some territory would not be limited with the territory, and after a certain period of time covers larger areas. The most impressive were the results of studies of UNE environmental impact which showed that they practically touched all

spheres of medium - lithosphere, hydrosphere, atmosphere, ionosphere. These and other results have become the most powerful spur for main countries for close studying of the above problems.

Our studies in this field commenced 20 years ago, and their results allowed us to understand, to a certain extent, a physical mechanism of negative technogenic effects and come to the conclusion that environmental problems are more complicated and delicate than they seemed to be at first sight, and that any large scale industrial activity should be controlled to avoid a disturbance of natural balance and a significant economical damage caused by it.

1. Main results.

Many years of our investigations were devoted to studies of weak high frequency noises of the Earth - a microseism. They led to a principally new physical understanding of processes in lithosphere, showed a non-linear character of spreading and interaction with the medium of weak signal of wavy nature, allowed to work out criteria of medium diagnostics. The results obtained can be used to solve, on a new methodical basis, the wide range of problems, in first place, the problem of environment protection.

The scientific background of the studies was an exposure of new, previously unknown regularity of conduction of weak seismic signals of high frequency in real medium, which was acknowledged as a discovery No 8 by the former State Committee of Discoveries and Inventions in 1988, with a priority from May 1979 (author - I.G.Kerimov). The discovery allowed to analyze physics of processes in the earthquake source and energy transformation forms in the medium from a different point of view.

Below are some main conclusions connected with the studies of technogenic effects:

- A new approach of the problem is connected with understanding of a medium as a dynamic, not a static, object, the parameters and characteristics of which change constantly. New terms connected with the development of the idea are as following: "geophysical medium", "active geophysical medium", "tension sensitivity of a medium" etc. Analysis of the medium using permanent testing by means of seismic and other geophysical fields allows to define the dynamics of its changes under the influence of natural or artificial factors.
- The studies proved that even at repeated low intensity external impacts that follow in certain consequence, the medium can change its characteristics and show high dynamic activity.
- Due to certain physical effects technogenic reactions differ from natural by higher power.
- Appearance of induced seismic events can be caused by external impacts the power of which is low in comparison with the power of the earthquake itself.
- One of the most important conclusions is that high power events can appear even in areas that earlier were considered as low-seismic or even aseismic. The intensity of the earth surface vibrations can be hundreds and thousands times higher than forecasted levels. It can lead to huge damages, as seismic-proof construction were considered against less intensive reactions.

Technogenic events cause such a significant economical damage also because they are accepted as natural, no measures are taken to control and prevent them. As they have higher intensity of seismic events, they cause not only direct damages but years after cause additional expenses because of an artificial rise of costs for seismic-proof construction. But necessary measures to control technogenic effects would cost less.

- Another main conclusion of the researches is that changes in a medium of some territory caused by technogenic effects, lead to changes in a medium of an area radius of which exceeds linear size of the territory.
- Other ideas we worked out are connected with an idea of tense sensitivity of medium. Divided into individual large, middle and small blocks, it has a special spatial-temporal reactions to external impacts depending on the degree of tension.

From environmental point of view one of the aspects of control of technogenic effects is the right selection of territory with low tense sensitivity to located industrial objects - water reservoirs, civil and industrial construction, drilling etc.

Non-controlled industrial activity on the territory with high tense sensitivity, i.e. strong reaction to the external fields, leads to significant changes in seismicity reactions, activation of tectonic processes, increase of a medium's tension, appearance of vibration fields caused by elastic and inelastic deformations.

- The researches allowed to define existence of tense sensitive points or sites. The data of seismic

equipment (or any other geophysical equipment) installed in such places are quite effective: the registered signals are intensive and contain information even about remote events.

- The next conclusion is connected with a term "active breaks" proposed by us, conductors of seismic and deformation power. And one of directions of their spreading can be considered as prior.
- There was determined the periodicity of changes in mosaic of active and inactive faults, caused by natural variations in time of intensity of environmental processes influencing on the whole picture of its space distribution. It is necessary to analyze the previous seismicity to define periodicity of activation of tectonic faults and limited by them system of blocks being at given period in the active phase.
- Unlike many specialists involved in the problems of ecology and environment protection such as problems of seismic proof construction or the problems of its physical and chemical pollution, we consider this problem from the point of view of energetical pollution of the medium, accumulation of additional power caused by non-controlled industrial activities. Changes of natural conditions and multiple negative effects afterwards are their consequences. This is the basic point of our proposals for control and management of negative technogenic effects.
- We have worked out special methods to create maps of distribution of

stress fields for a certain territory on the basis of analysis and comparison of seismic, gravymetric and other geophysical data. They are the basis of our proposals for methods of control and management of negative technogenic effects. They also allow to propose most optimal structure of location of industrial objects on a certain territory and the intensity of their activity.

- On the basis of analysis of manifestation of weak high-frequency fields and data of geophysical observations in different

mediums we offered a model explaining the physics of reflecting the processes appeared in lithosphere, variation of fields registered in high spheres, in order to create earth-space geophysical system.

The table below shows typical time and spacial changes of geophysical fields, caused by technogenic effects.

The next chapters will be devoted to the questions of methodology of conducted work, analysis of manifestation of negative technogenic effects and influence of different kind of industrial activity on the state of environment.

TABLE

OF SPATIAL-TEMPORAL INFLUENCES OF TECHNOGENIC EFFECTS

Types of works	Variations of microseismic fields	Observed Geophysical fields	Temporal influences	Distances	Technogenic effects
UNE, large scale explosions	Considerable increasing of noises and variations of background level	Seismicmicroseisms, Gravimetrics, electromagnetism, etc.	From severl days to 6-12 months	up to 3000 km and more	Athmospheric disturbances, strons earthquakes sea starmes, etc.
Weak explosions	Appearance of high-frequency noises	Seismic, microseisms, gravimetrics	From several days to 4-6 months	up to 100 km and more	Strong and weak earthquakes, landslides
Water reservoirs	Variations of background level, periodical emission	Microseisms, seismic plastic deformations	From several months to several years	5-10 linear dimensions	Variations of seismisity, landslides
Fluids pumping and extraction in boring wells	Variations of background level, appearance of signals of different frequency range	Seismic emission, gravimetrics, plastic deformations	From several hours to several weeks	50-100 km	Variations of medium's properties, debit and layer pressures

