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GEO-DYNAMIC ZONING AS ONE OF THE BASIC SOLUTIONS FOR RATIONAL EXTRACTION OF COAL DEPOSITS, INCLUDING SAFETY AND ECOLOGICAL ASPECTS

(Submitted by the Government of the Russian Federation) 1/

The growing depths at which mineral deposits have been worked in recent decades have made many aspects of engineering activity significantly harder and pose obstacles to improvements in efficiency and safety.

Since the early 1950s, the average depth of coal workings in CIS countries has increased from 188 to 517 m, i.e. by a factor of 2.8, and the maximum depth attained has increased from 800 to 1,307 m. As a result, the number of pits too gassy to fall within the normal classification has increased by a factor of 2.7, pits at high risk of sudden outbursts of coal and gas have increased by a factor of 3.5, and pits at a high risk of rock bursts by a factor of 10. The maintenance of mine workings has become markedly more difficult.

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Thanks to the endeavours of mining science and the mining industry, Russia has made serious efforts over the past few decades to counter the adverse influence of these difficulties on pit operations. These include, in particular, advances in the theory of rock bursts and gassy outbursts, a collection of measures for forecasting and preventing bursts, and a collection of regional measures for managing rock and gas pressure which has been introduced at 40 mines. This latter makes it possible to confront the large-scale challenge of moving to a system of regulated rock and gas pressure at all deep mines (not only those at risk from dynamic phenomena), the effect of which would be equivalent to reducing the actual depth of working by a half or two thirds with all the attendant benefits.

These advances have also shown that in order to manage stress and gas pressure it is essential to be able to assess and forecast them reliably and routinely during prospecting, the opening up of individual mines, and pit construction and operation. It has been necessary to develop a systematic and methodical scheme for these operations, making use of the results in planning regional preventive methods for the successful operation of deep mines.

In the early 1980s, earth science and the geomechanics of mining took off in a new direction under the combined heading of geo-dynamic zoning. The object of this discipline is to study the structure and mechanical state of the rock mass, and to forecast changes over time and distance.

Geo-dynamic zoning was developed in the early 1980s; it is now in use in various industries in Russia and other countries. It provides an objective and workable method of:

- determining the structure of the rock mass around a deposit and in adjacent areas;

- identifying active faults and tectonically stressed and unstressed zones;

- producing scientific calculations of rock stresses, permeability and gas and moisture content in each element of the mass, both when undisturbed and at each stage of mining operations as the deposit (field) is worked, and producing forecasting charts to match;

- developing an effective combination of regional and local preventive measures, taking account of stresses, gas and hydrodynamic conditions, so that the state of the rock mass can be purposefully managed in order to improve the safety and economic viability and reduce the environmental impact of coal workings at great depths.

Geo-dynamic zoning has found application in the exploitation of a number of deep deposits of coal, iron ore, non-ferrous metals and oil in Russia and in isolated coal and oil fields in China. It is also used in prospecting work for planned pipelines, railway lines and other civil engineering projects as a method capable of revealing dangerous spots on the Earth’s surface and in the rock mass, and in deciding on measures to prevent accidents as such installations are operated.

At its 1992 session, the ECE Working Party quite rightly decided, at the suggestion of Russian experts, to incorporate into its sphere of activities the promotion and dissemination of geo-dynamic zoning as a method for use in the working of deep coal deposits in and outside Europe.

A number of steps are, in our view, necessary in settling on a programme for coming to grips with and making widespread use of geo-dynamic zoning in the working of deep coal deposits and in tackling safety and environmental issues in other sectors of the economy.

First, the book "Geo-dynamic Zoning" must be published in English, German and Spanish, 2/ it being understood that the authors will make any necessary additions to reflect the latest advances in zoning theory, methods and practice.

Second, a seminar on the theory and practice of geo-dynamic zoning for experts from various European countries should be given at the VNIMI (mine geomechanics and surveying) Institute in Russia or at another institute, such as INERIS in France. The Russian experts undertake to prepare a lecture series and a programme of practical classes for the seminar.

Third, one of the most difficult deep coal deposits in Europe from the mining and geological point of view should be selected as a test site where a full complement of geo-dynamic zoning operations, including the formulation of practical recommendations to match, should be conducted with assistance from the Russian experts. These operations could be completed within six to nine months.

All in all, these steps could be completed by the end of 1994, provided the necessary financing is made available.

The ultimate aim might be to set up a specialized geo-dynamic zoning service serving coal-mining and other industrial and agricultural facilities with an interest in improving safety and economic viability and reducing the environmental impact of mineral exploitation. Such a service is being set up in the Russian coal industry in 1993, as part of the Russian State Seismological Service.

Notes

1/ Pursuant to a decision taken by the Meeting of Experts at its twenty-second session, in September 1992 (ENERGY/WP.1/GE.1/3, para. 48 (b)).

2/ It is being published in Chinese in 1993.
