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UPDATE ON THE STATUS AND ACTIVITIES OF THE TASK FORCE ON THE ECONOMIC BENEFITS OF IMPROVING MINE SAFETY THROUGH THE EXTRACTION AND USE OF COAL MINE METHANE

Description of a project for the extraction and use of methane from the former Kapitalnaya mine and the operating Osinnikovskaya mine in the Kuzbass

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1. In 2005, the Moscow State Mining University (MSMU) designed a project for the extraction and use of methane from spent workings in the former Kapitalnaya mine (closed in 1998) and the Osinnikovskaya mine (opened in 1998), as well as from future working areas in the latter mine. The work was done at the request of the State Agency for the Restructuring and Closure of Unprofitable Deep and Opencast Mines.

2. The coalfield in question is within the confines of the town of Osinniki (Kemerov oblast) in the central part of the Ossinikovsky hard-coal deposit in the geological and economic region known as the Kuzbass. The aggregate productive thickness (680 m) includes 34 seams and

partings of coal of grades Zh (fat) and KZh (coking fat) up to 3.4 m thick, 21 of which are worked. The methane content of the seams varies from 7-14 m^3/t at a depth of 100 m to 16-25 m^3/t at a depth of 600 m. The seams are worked downwards; until 1998 this was done at the Kapitalnaya mine. When Kapitalnaya was closed, reserves totalled some 600 million t of balance reserves and 150 million t of off-balance reserves. The absolute methane yield (average flow of methane) from the mine was 96.9 m^3/min. Following the closure of Kapitalnaya (by the dry method) and the sealing-off of the worked-out upper horizons, mining began at the Osinnikovskaya mine. The methane in the worked-out blocks totals at least 115 million m^3, the calculation having been made only for an area lying beneath thick, wet Jurassic deposits thought to act as a barrier preventing methane reaching the surface. This explains the potential interest in the zone.

3. The first stage of the project, to be carried out in 2006, calls for the drilling of five trial methane boreholes, four of them (holes 1-T, 2-T, 3-T and 4-T) in worked-out parts of blocks Nos. 1 and 2 of the coalfield. The fifth (hole 5-T) will be sunk in block No. 1 and will be used to degas the workings and the coalbed stress-relief zone when the Osinnikovskaya mine begins working seam E-5 in 2006. The planned depths of holes 1-T, 2-T, 3-T and 4-T are 500, 600, 550 and 630 m respectively, for a flow-string internal diameter of 132 mm. Hole 5-T is planned to have a depth of 670 m and a greater flow-string internal diameter, of 140 mm, since gas flow into the hole is expected to be high, for the following reasons:

(a) Heading at the Osinnikovskaya mine has shown the area to be very gassy, mainly because of the presence of a dislocation (upthrow fault);

(b) The natural gassiness of seam E-5 is high (20-25 m^3/t);

(c) Development of coal seams with a total thickness of 18.5 m, six by overcutting and five by undercutting.

4. The minimum amount of extractable methane within the range radius of an individual well is estimated to be of the order of 1.8 million m^3. It should be noted that this figure is based on current normative documents, which recommend spacing wells 150 m apart (giving a range radius per well of 75 m). However, these recommendations were drawn up for active coalfaces and are intended to ensure safe working conditions by precluding potentially explosive concentrations of methane. When wells are sunk into spent workings, whether at closed or operating mines, the spacing can be increased, thereby increasing the range radius of each of them. Consequently, the methane yield from each of the planned holes 1-T, 2-T, 3-T and 4-T may significantly exceed the figure shown above. That would sharply reduce both the total number of wells and the outlay needed for the efficient drainage of residual methane from the coalfield and would improve the project's profitability. The table below shows the relationship between range radius and the number of wells that would be required.

Number of wells required in the worked-out section of block No. 1 depending on their range radius

Well spacing (range radius of a well)	Number of wells required for efficient degassing
150 m (R = 75 m)	87
200 m (R = 100 m)	49
300 m (R = 150 m)	20
400 m (R = 200 m)	12

5. As Russia has no practical experience of extracting methane from closed coalmines, indicators such as well production rate and methane concentration in the extracted methane/air mixture have been derived, for the purposes of the first stage of the project, from experience of degassing spent workings at functioning mines. Account has also been taken of experience in drilling a variety of holes through old spent workings (some 20 years after they have been mined) which shows that drilling-mud losses on redrilling such intervals are very high, a fact that indicates in turn that previously worked rock is heavily fractured and remains highly permeable over time. As a result, individual wells are expected to flow at not less than 5-8 m^3/min with a concentration of 60-80 per cent. Given that the average distance between each of the five wells in the trial zone will be 1,500 m, the mean expected methane yield per well is of the order of 24 million m^3.

6. The gas dynamics during the drilling and the indicators developed during the first phase of operation of the trial holes will be used to refine the parameters for siting of the proposed production wells.

7. In siting the trial holes account has been taken of all the existing theories concerning methane infiltration and accumulation in spent workings and the possible influence of the Osinnikovskaya mine's ventilation system on methane concentrations in the former Kapitalnaya mine. By proving or disproving these and other ideas, the trial will help to bring much nearer the successful exploitation of a hydrocarbon resource that currently goes unused in Russia.

8. Once the results of the trials are known, the MSMU specialists' next steps as part of the project will be to define the most important criteria and devise methodology for identifying promising areas for the siting of degassing (methane drainage) wells and assessing the amounts of residual (i.e. extractable) methane in worked-out areas and to develop technology for the efficient extraction and subsequent use of the gas.

9. The main problem holding back implementation of the project is a shortage of private-sector investment. To make it more attractive to large investors, the project needs a sound business plan, which could perhaps be developed by foreign specialists through the Methane to Markets Partnership.
