

## Report

### **The technology of remote underground fire limits reduction with the usage of synthetic resins.**

Slide 2

On May 8<sup>th</sup> 2010 an air-methane mixture explosion happened in the Raspadskaya underground mine's entries. Supposedly, the accident originated at a longwall face.

There were 359 miners underground when the accident took place.

At their arrival, mine rescuers were ordered to conduct mine entries' reconnaissance with the priority of searching for the injured, providing them with first aid and evacuating them to the surface.

The headframe above the ventilation shaft was completely destroyed by the second explosion.

As the result, 296 miners were saved, 91 people died, among them were 20 mine rescuers. The bodies of 11 miners have not been discovered.

Slide 3

The fire blocked access to many of the mine's roadways.

The hazardous zone crossing, followed by its isolation was one of the options granting access to those roadways.

At every hazardous roadway's crossing, blast-proof stoppings were to be constructed at the both sides of a crossing point.

The nonflammable foaming bicomponent phenic resin “Carbofill” supplied remotely through the bore holes drilled across the pillar was used as the stoppings' carcass.

Slide 4

The nonflammable foaming bicomponent phenic resin “Carbofill” is a foaming white mass.

Is used for:

- filling cavities and cavings
- filling cracks in pillars
- deformed rocks' weakening

- stoppings construction and strengthening
- fires prevention and extinguishing.

#### Slide 5

A pneumatic bicomponent gear pump was used for supplying the mixture. The components' proportion is 4 to 1.

#### Slide 6

In order to try out the technology, a number of tests divided into two stages were conducted.

The first stage took place at a specially equipped testing ground. A stopping was being constructed in a mine roadway model with the length of 15 m and the cross section of 11 m<sup>2</sup>.

#### Slide 7

The cross section was completely filled in 1 hour and 19 minutes. The width of the foaming resin stopping varied from 2,5 to 3 meters.

Based on the conducted experiments, the following conclusions were made:

- The technology could be applied to remote blast-proof stoppings construction in a mine.
- To ensure efficient carcass erection supervising, video surveillance had to be organized.

#### Slide 8

The second stage of the experimental trials ensued inside the mine. A stopping was being constructed in the tailgate remotely from the maingate using a bore hole with the diameter of 100 mm.

#### Slide 9

The phenic resin “Carbofill” was being supplied through a tube placed inside the bore hole which had been drilled near the roadway's ceiling.

#### Slide 10

As the supply of the bicomponent phenic resin “Carbofill” was continuing, the intake tube was being moved by 0,5 meters steps to ensure smooth distribution of the material along the cross section.

#### Slide 11

The intake of the material stops when the supplied quantity reaches its predetermined limit, or when it is deemed necessary based on the video surveillance results. A “Carbofill” stopping provides satisfactory filling of an entry's cross section with minimal air leakage.

#### Slide 12

To supervise the “Carbofill” supply to the entry through the borehole, a video endoscope was being used.

#### Slide 13

As the distance between the face of a breakthrough and a hazardous entry approaches 10 meters, a surveying borehole is drilled in the direction of the entry that is being crossed. Using a video endoscope put through the borehole, the condition of the hazardous entry is determined. Slots are cut to the left and to the right of the breakthrough at a 60-degree angle.

After the slots' preparation, bore holes are drilled from them. The video endoscope is put through the boreholes and the spot for “Carbofill” carcass construction is surveyed. The intake of the material stops when the supplied quantity reaches its predetermined limit, or when it is deemed necessary based on the video surveillance results.

Afterwards, the space between the “Carbofill” carcasses is filled with the concrete mixture “Tekblend”.

Next, the slots are isolated from the breakthrough with blast-proof stoppings.

#### Slide 14

In order to ensure the safety of the breakthrough construction works when it crosses the hazardous entry, an airlock and a pressure equalization chambers are set up. An airlock

Slide 15 consists of a blast-proof stopping and a tube. A pressure equalization chamber consists of a stopping and a tube and is used for minimizing the change of pressure between the active entries and the hazardous ones. Gas nitrogen is been supplied to the point before the airlock chamber.

After the hazardous entry is crossed, it's cleaned and blast-proof stoppings are erected.

Slide 16

This technology was practically applied during the construction of additional stoppings at the “Sakhalinugol-6” mine in October 2012. Two blast-proof stoppings were constructed in the auxiliary incline and the slope with the purpose of the hazardous zone limits reduction.

This allowed safe crossing of the entries within the active fire limits and continuation of the mining process.

Slide 17

Thank you for your attention.