KAPATAY

Use of "pump" wells in uranium ISL mining

(case of block #32, Site 2, Budenovskoye deposit)

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CONVENTIONAL WELL FIELD AND PIPES INTALLATION

The ore body configuration and its layout on the surface determine the following ISL parameters:

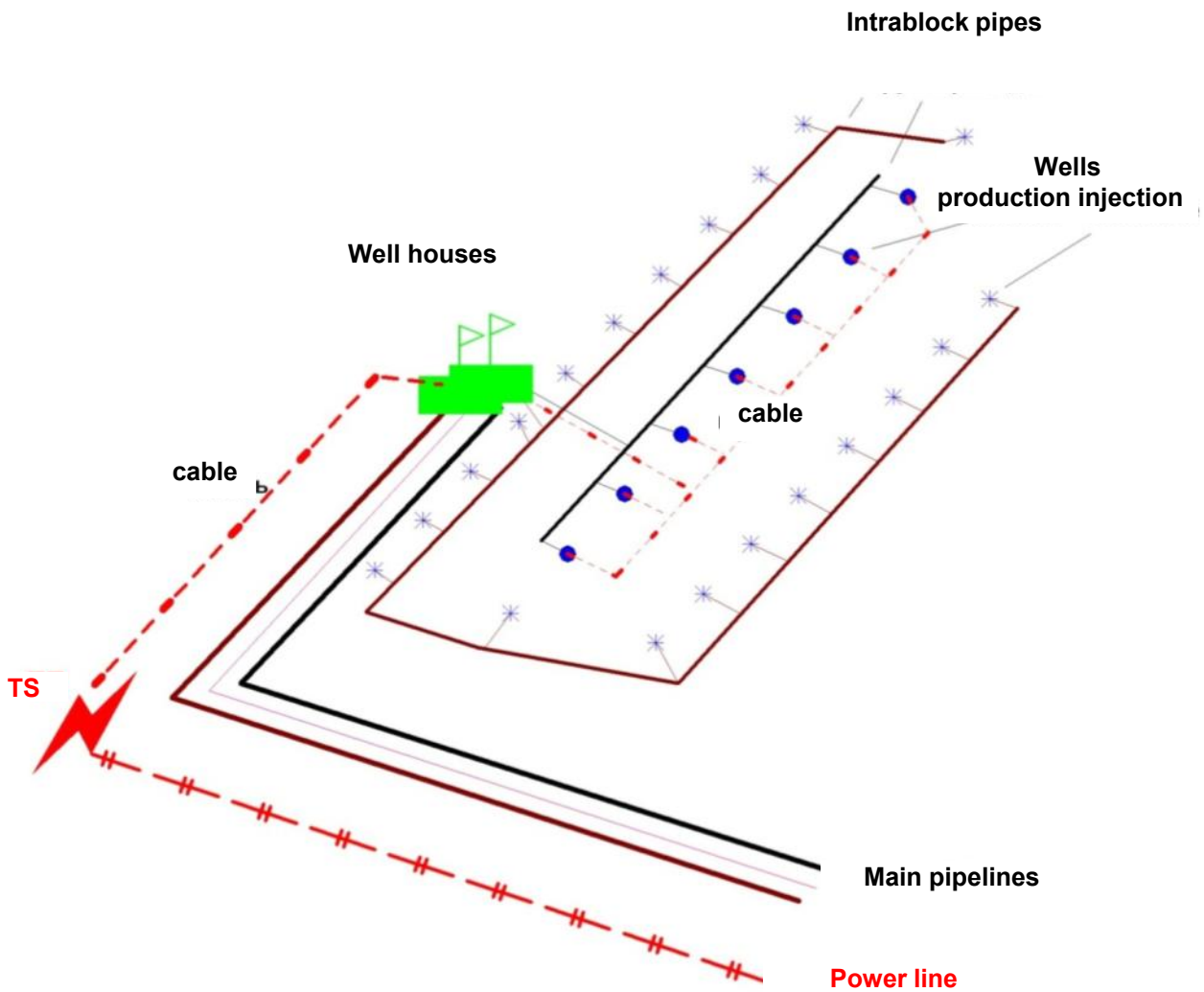
- *The location of wells and required infrastructure;*
- *The specific production capacity of the processing complex;*
- *The number of production and injection wells .*

Submersible pump is placed at the top of production well and that is why the upper part of well has to be drilled with large diameter, cased with bigger pipes and accordingly the well head is more expensive.

Electric cables shall be installed from the transformer station and solution distribution units to the well houses and each of such wells.

All these additional costs seem to be inevitable as the positions of production wells are determined by the configuration of the ore body and the requirement to set the movement vector for the solutions under the ground by using submersible pumps.

LAYOUT OF CONVENTIONAL WELL FIELD AND PIPIES INSTALLATION



PROPOSED WELLFIELD AND PIPES INSTALLATION

The substance of alternative proposal:

1. Production (or recovery) wells are constructed as injection wells;
2. “Pump” wells drilled near the transformer substations at the depth of 50 -100 meters
3. “Pump” wells are equipped with blank casing columns with no screens and submersible pumps.
4. The total pumps capacity to be equal to the optimum capacity under the conventional piping scheme.

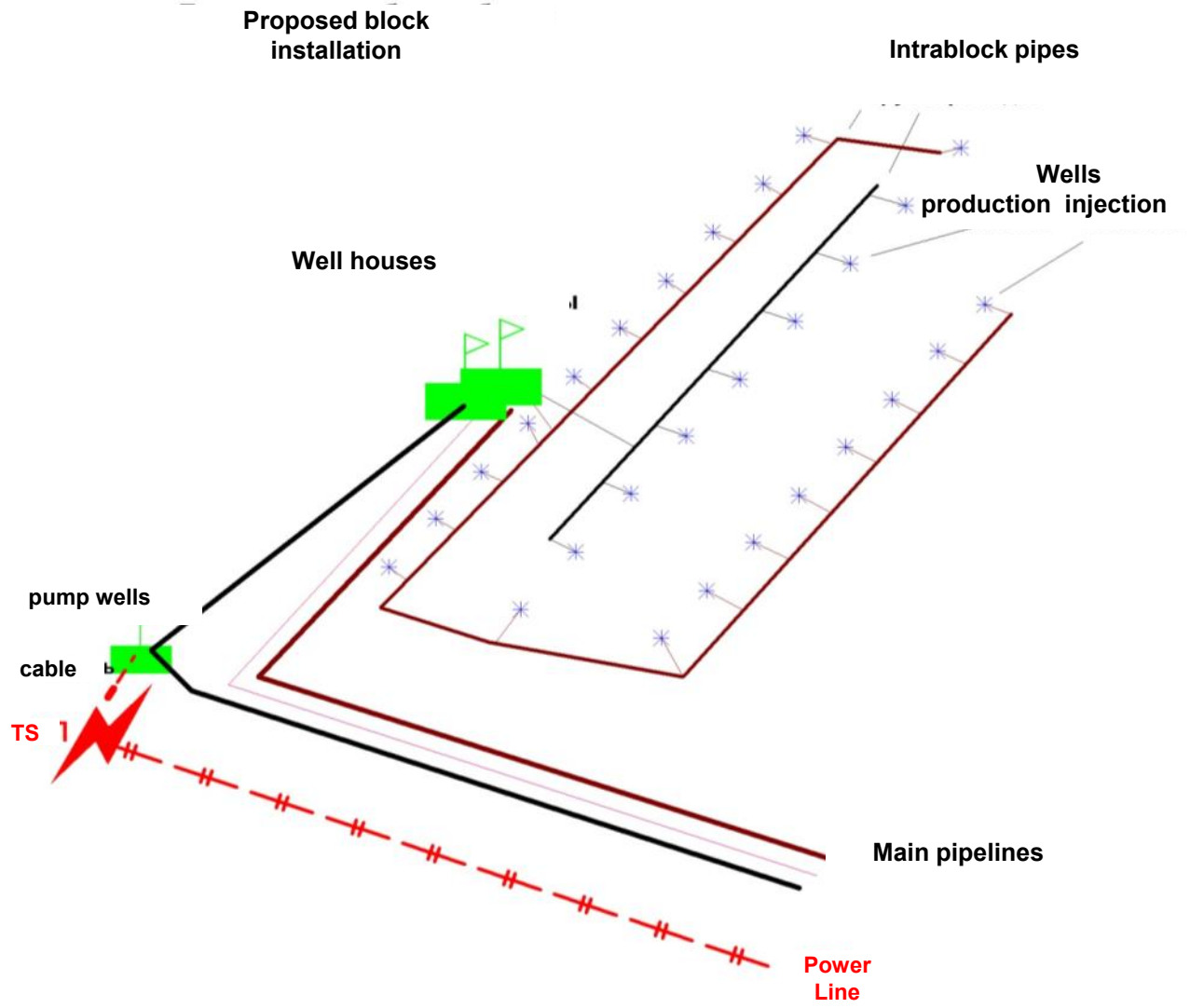
As a result:

1. Cable costs will be reduced many times,
2. Cost of submersible pump purchase will be significantly reduced (the cost of the more powerful pump is much less than the cost of several pumps giving the same capacity in total),
3. Well head costs also reduced.

Pump wells are connected by hoses with recovery wells and form a system of communicating vessels Apparently, the necessary condition for this shall be the positive groundwater pressure over the day surface and pumps positioning below the dynamic level. The minimum number of such pump wells will be one per a production block. The flow rate in production wells will be regulated by stop valves.

The use of pump wells along with the direct economic effect makes it possible to use any combinations of injection and production (recovery) wells during any mining stage.

PROPOSED WELLFIELD AND PIPIES INTALLATION LAYOUT



BASIC RESULTS

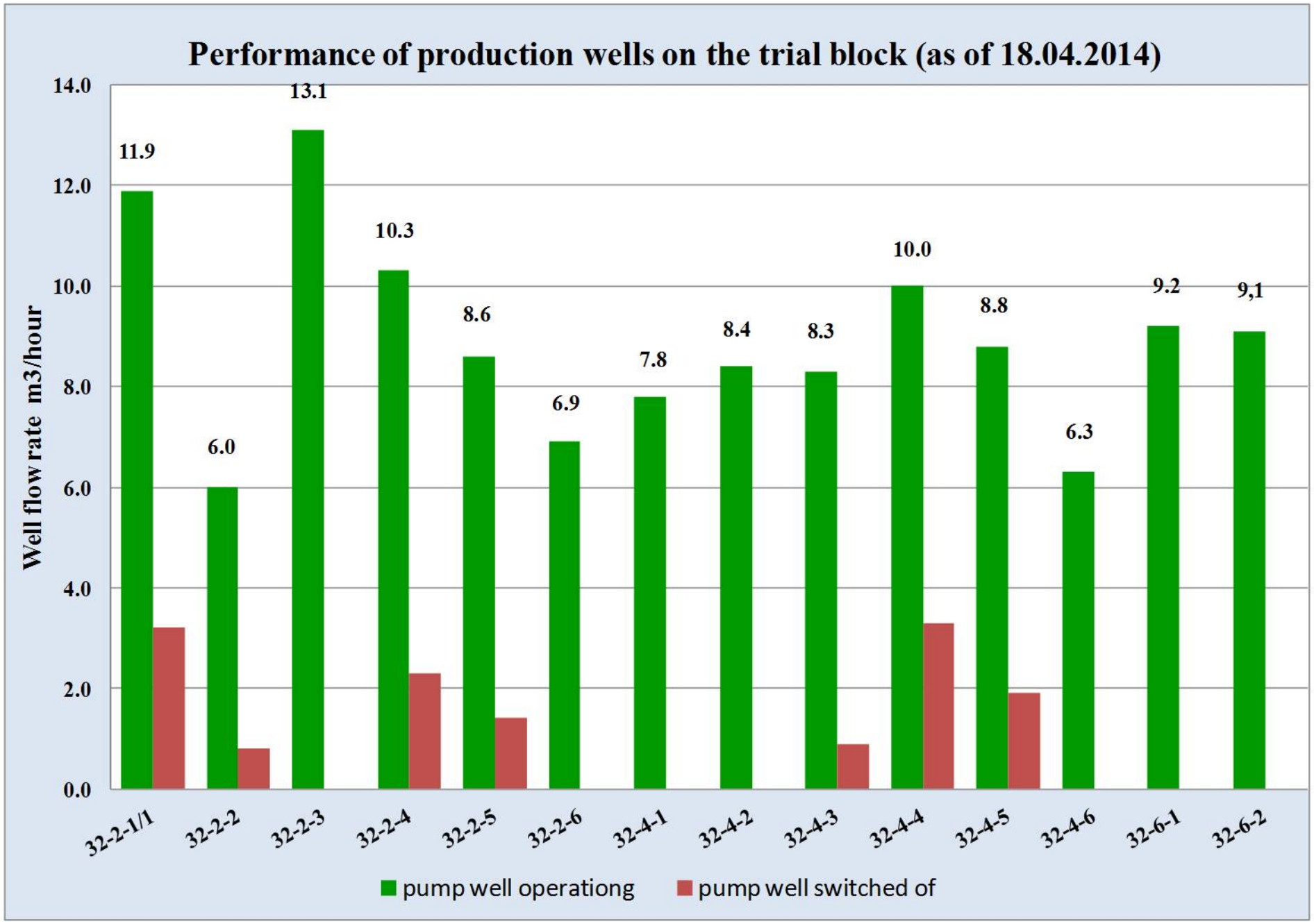
Any pattern of well field is inevitably represented by optimum and non-optimum mining areas.

Optimization of mining ISL parameters is mainly achieved by:
a) pre-acidification through all wells followed by the normal pumping and injection mode;
b) at certain stages and in certain wells it is proposed to combine and reverse functions of production and injection wells.

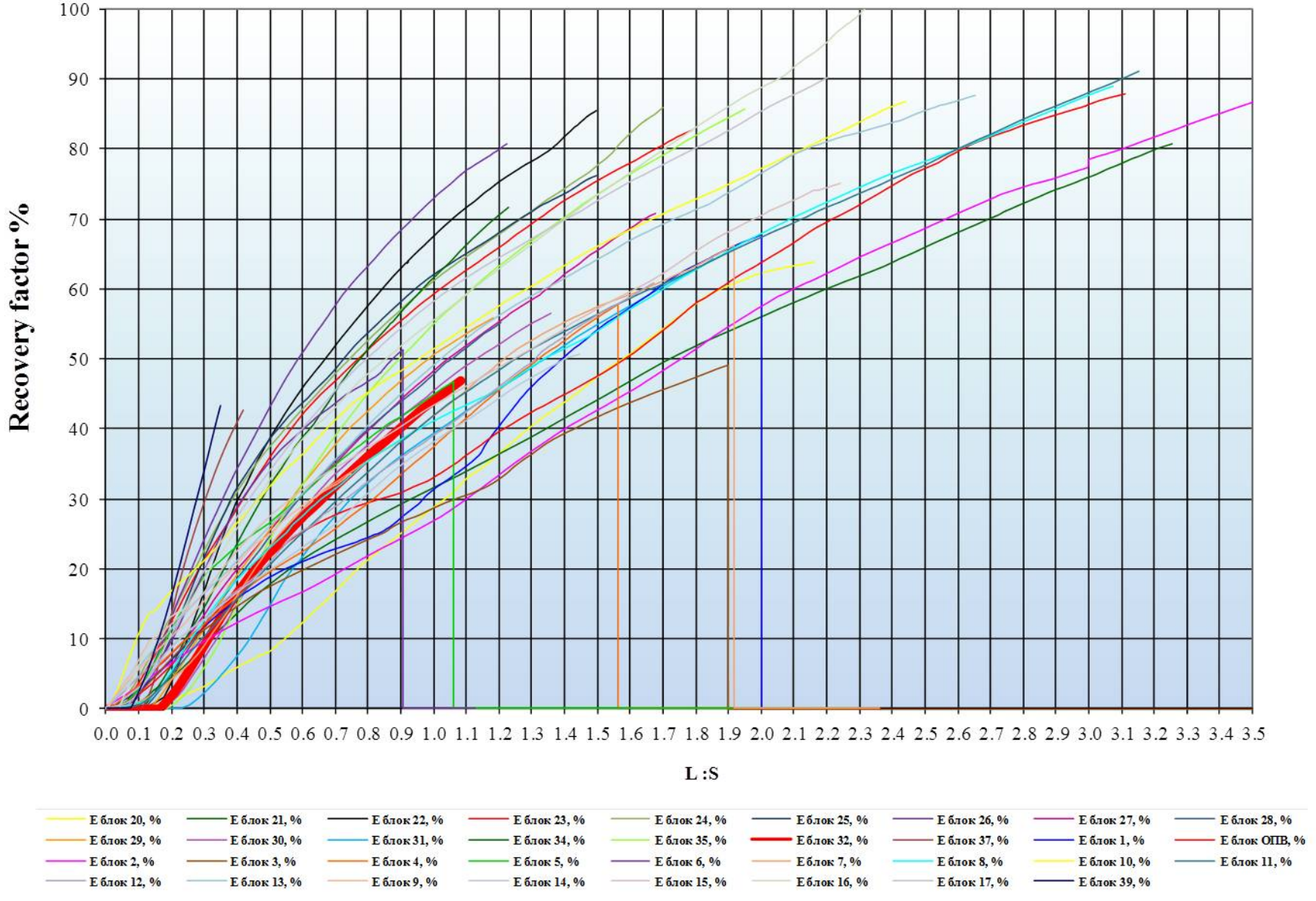
In practice, the use of these methods comes down to the construction of some injection wells as production wells. Along with improvement of block mining parameters it significantly complicates the proposed systems and makes them more expensive.

The new technical solution adds the pump wells into the well field thus creating a power-reservoir system, which does not require a pump to be installed at the required well or infrastructure to be arranged for it.
The required movement vector of ground water at such point is created remotely with the use of pump wells.
This dramatically optimizes the system performance as any wells can be used as production and injection in any proportions and combination at any time plus it reduces the ISL costs.

In 2013, the Karatau mine constructed newly commissioned block 32 in accordance with this invention and achieved significant cost savings.


Performance of production wells on the trial block (as of 18.04.2014)
Well flow rate m3/hour
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
11.9
6.0
13.1
10.3
8.6
6.9
7.8
8.4
8.3
10.0
8.8
6.3
9.2
9,1
32-2-1/1
32-2-2
32-2-3
32-2-4
32-2-5
32-2-6
32-4-1
32-4-2
32-4-3
32-4-4
32-4-5
32-4-6
32-6-1
32-6-2
pump well operationg
pump well switched of

Correlation between recovery factors and L:S (liquid to solid) ratio for mining blocks of Site *2 of Budenovskoye deposit (data as at 15.04.14.)*



CONCLUSION

1. The application of "pumping" wells allows:

   - ✓ to use any combination of injection and recovery wells at any time;
   - ✓ to reverse them at any acidification and production phase for effective uranium recovery;
   - ✓ To perform optimal acidification and well field development with substantial cost savings during wells construction, fields installation and operation.

2. The positive level of pressure ground water is a necessary condition at the current test stage.

THANK YOU FOR YOUR ATTENTION