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**TECHNICAL AND TECHNOLOGICAL DEVELOPMENT
OF PA BELARUSKALI**

by

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Technical and Technological Development of PA Belaruskali

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Technical and technological development of the Republican Unitary Enterprise “Production Amalgamation “Belaruskali”.

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Republican Unitary Enterprise “Production Amalgamation “Belaruskali” is one of the biggest producers in the world and the biggest producer and supplier of the potash mineral fertilizers on the territory of the Commonwealth of Independent States.

The operations of “Production Amalgamation “Belaruskali” are based on the Starobin potash salt deposit and comprise four mines and refinery complexes, auxiliary shops and servicing units that employ about 20 000 persons. Each of four mines and refinery complexes consists of a mine to extract potash ore and a dressing factory to process it and to produce mineral potash fertilizers in the form of fine, crystallized and granulated concentrates of the potassium chloride as well as mixed potash salt. Above these products, the Amalgamation also produces technical, edible and feeding salt products.

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Having a sufficient natural base of raw material, high production potential, highly qualified workers and engineers the Amalgamation has all the possibilities for further raising the production efficiency, introducing new equipment and technological processes, and providing the high quality of all operations and the final product.

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The production of RUE “PA “Belaruskali” (mostly granulated muriate of potash) is delivered to Europe, East Asia, Mediterranean countries, South Africa, India, China, South and North America –all in all, to more than 50 countries. On average, exports constitute 80% of the production produced by PA “Belaruskali”.

In order to stay a competitive enterprise, PA “Belaruskali” pays attention to the technical re-equipment, production modernization, and introduction of new processes for mines and plants. PA “Belaruskali” carries out works to increase the quality of the products.

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The structure of the Starobin deposit presents a gently dipping seam bed, which consists of four potash levels. The seams of the second and third potash levels are exploited (the second and the third seams). The potash seam of the 1st level in the mine of the 1st mining and refinery complex was opened and is prepared for extraction by the end of the year 2003. The potash seam of the 4th level is considered as a perspective for the further exploration.

The deposit exploitation was started by the chamber method under which losses of the potash salt in the subsoil reached 65-70% and the KCl content in the extracted ore was 24 – 25%, i.e. 1.5 – 1.8 times lower than in the sylvinite levels.

The geological structure of the potash seams that presents the alternation of sylvinite and halite seams as well as presence in the roof the powerful water-resisting rocks give the possibility to use the pillar method with roof collapse.

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Nowadays approximately 70% of the ore is extracted by the longwall extraction system with the length 150 – 250 m (extraction by the pillar and longwall method with roof collapse). All in all, there are 52 longwalls in the PA “Belaruskali”. All longwalls are equipped with hydro – mechanized complexes, which include modern mining machinery produced mostly by well-known European companies. For many years a successful co-operation has continued between these companies and PA “Belaruskali”.

Thus in order to mine potash ore, we use the two ranging arm shearers of the following companies:

“EICKHOFF” (Germany) [These are the shearers SL 300 and EDW300/760L]

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DBT GB Ltd. (previously – “Long – Airdox”) (the UK) ... [shearers “Electra 700 sol]

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“FAMUR” (Poland) [KGS800S/2BP, KGS 570S/2B/SOL]

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In such mining faces, the hydro-mechanized roof supports of different producers are used: for example the hydro-mechanized roof supports of the “DBT Mining Engineers” company (previously – “SaarTech”) (Germany) [Roof support STS15/23L and STS16/24L]

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The hydro-mechanized roof supports of the polish company “FAZOS” [Roof supports FAZOS – 12/28-OZ, FAZOS-13/20Poz, FAZOS –16/24-Poz]

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The hydro-mechanized roof supports of the “WESTFALLIEN LUNEN” company (now “DBT”) – [roof support BS 2.1 P]

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For seam mining (due to the low thickness) the following shearers are used: EW200/230LN, SL300NE – “EICKHOFF”

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“ELECTRA340SOL” – “DBT GB Ltd.”

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In such faces the hydro-mechanized roof supports of the following type are used: Hemscheidt 2400-7/14, Hemscheidt 2400M, FAZOS – 08/13 – Poz, Fazos – 09/15,5 –Oz.

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The main type of the conveyer is EKF-3, which is supplied by “EICKHOFF”. The following conveyers are also used: ”Joy”(the UK), “DBT GB Ltd” (the UK), “Ryfama” (Poland), “Valbot” (Poland), Foundry and mechanical plant “Universal” (Soligorsk, Belarus), Soligorsk institute of problems of resources' saving with experienced production (SIPR) (Soligorsk, Belarus), “Svet Shakhtera” (Ukraine).

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Specialists of the Amalgamation always faced the problem to bring to the surface as less waste rock as possible. This is done by selective extraction practice. In this direction the unique technological schemes and equipment (there are no analogues in the world) were worked out and integrated. Advantages of the selective extraction of sylvinitite and halite are obvious.

First of all, the KCl content in the extracted ore increases considerably, because only sylvinite seams are extracted and the halite is left in the mine. For the same reason there is no necessity for extra expenses for transportation of the waste rock and for enrichment by KCl and NaCl separation. The earth surface deformation and related expenses also decrease, as well as the expenses related to storage of enriched wastes.

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Since 1997 the shearers used for the selective extraction are the Type SL500S produced by the German Company “Eickhoff”. The design of the shearer is the result of the co-operation of PA “Belaruskali” and “Eickhoff” engineers.

During selective extraction the front cutting drum, which diameter coincides with the thickness of the upper sylvinite seam, extracts the upper seam with advance 0,8 m relative to the standard position of the cutting drum. Simultaneously, the back cutting drum in the standard position extracts the lower sylvinite seam. To provide the extraction according the mentioned technology both gearboxes of the shearer foreseen the possibility to advance to the face side for 0.8 m.

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In the 4th quarter 2003 the mining of the 1st mine and refinery complex on the 200 m level (potash seam of the 1st level) will start with the mounting of the hydro-mechanized complex in the face No.1 to proceed with the selective extraction of sylvinite. The extraction technology in this face depending on the operation cycle foresees the simultaneous extraction of three sylvinite seams or two halite seams. The shearer and the three ranging arm selective shearer was bought by “DBT GB Ltd.” Company.

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By the chamber method of exploitation and tunnelling the development roadways the following machines are used: PK-8mA (Ukraine), Ural-10KC, Ural-10A, Ural-61 (all-Russia). They work simultaneously with shuttle cars 5BC-15m (Russia) and conveyer hoppers BP-14.

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In July of 2003 the SIPR (Soligorsk), for the first time in our country, manufactured our own continuous miner PKC-8. As a PK-8mA machine it's a combine with the front cutting drum but technically it's a better machine. At the present time at the same plant, take places three-party discussions for the manufacture of the first shearer (together with “Eickhoff”).

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During several years SIPR has produced for our Amalgamation, besides combines, other mining equipment, for example scraper and belt conveyers, skips for hoisting machines, scraper-cranes for warehouses and other.

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SIPR is not the only one manufacturer in our town that produce equipments for the Amalgamation. For example the Unitary Manufacturing Enterprise “Niva” produces hydraulic controlling equipment for all types of the hydro-mechanised roof supports used underground and other mining equipment. This enterprise also repairs and sophisticates roof support equipments. This year the UME “Niva” produced the first roof support for the Amalgamation: its K3 for seams is designed for seams with a thickness ranging from 1m to 1.55 m. Besides the UME, “Niva” made the first attempts to produce underground shuttle cars.

For many years the Soligorsk foundry and mechanical plant “Universal” have been producing technological equipments for the enrichment plants and the scraper conveyers for the mines of our Amalgamation.

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To repair the mine workings the Amalgamation uses the combines “Ural-70”, “4PP-2c”, “KSP-22” and the soil cutting machines “Ural 60”, “Ural 60c”.

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To keep the mine safe, the Amalgamation uses for compensation slot cutting the machines ESF-70 (co-operation production of “Eickhoff” and “Paus”) and “Ural 50”.

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As mentioned, each mine and refinery complex comprises, except the mine, a dressing factory to process and produce mineral potash fertilisers. At the present time RUP PA “Belaruskali” uses the floatation method (the dressing factories of the first three complexes) and the hot-leaching method (the dressing factory of the fourth complex).

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The floatation method of sylvinite ore dressing is carried out in saturated salt solutions. It is based on the selective hydrophobization of the potash mineral surface with the help of reagent-collectors. It provides the conditions for fixing the particles on the air bubbles and extracting them into the foam product.

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The floatation method of dressing includes the preparatory operations for the size specification of mineral ore (crushing and classification) and for the segmentation of clay-carbonate slimes (slime removal). The final concentrate with the appropriate KCl content 95.3-96.2% is dewatered and dried. With the floatation method, the extraction ratio of the efficient component is close to 84-85 %.

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Hot-leaching method: This process of treating the potash raw material is based on dissolving KCl from the ore by hot solution at the temperature 120°C and on a selective crystallisation of salt components from the treated ore. The technological process of the hot-leaching method consists of crushing the sylvinite ore, dissolving the sylvinite by hot solvents with screw mixers and bucket elevators, cooling (to crystallize KCl from the clarified saturated solution) and thickening in settlers.

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After, the thickened suspension goes through the intermediate mixer to the centrifuges. Drying of the filtered KCl is carried out in dryers of rotary type or fluid bed type. The KCl content in the concentrate constitutes 95-98 %, in halite wastes – 2.5-3.0%, overall extraction rate is 86.5 – 87.5%.

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At the present time in the Amalgamation much attention is paid to technical re-equipment, production modernization, integration of new technologies for the dressing factories. The work is conducted to improve the quality of the final product. Within the last several years some measures were conducted to carry out the scientific research works and to change the equipment. All this work led to improving the quality of the product.

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As the above-mentioned measures the followings can be mentioned:

In the granulation section of the dressing factories of the 1st and the 3rd mine and refinery complexes were mounted and put into operation new compactors of the “Hosokawa Bepex” with the capacity 100 t/h.

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- ◆ The commissioning of filtering centrifuges in the 4th dressing factory enhanced the concentration of KCl in final products to 98%;

- ◆ At the 1st, 2nd and 3rd dressing factories were mounted the dextrin-gluing installations, which maintains the economy of reagent-depressors;
- ◆ At the 2nd and the 3rd dressing factories was solved a problem regarding the use of the dust fraction of the fine-grained KCl.

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The reagent treatment of fine crystallized potash with the high dissolving degree was assimilated to guaranty the export deliveries in accordance with the customers' requirements.

We developed schemes to improving the reagent treatment of granulated fertilizers, for ensuring the conservation of the physical and mechanical properties for deliveries to the regions with the high moisture climatic conditions (Brazil, India, China).

At the present time investment is also made in production development. At this stage the reconstruction of the reagent department of the 1st dressing factory is in process, which would allow guarantying the economy of the reagents and their qualitative preparation.

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This year at the 4th mine and refinery complex will be put into operation the scheme to treat the hot-leaching granulated fertilizers, that will allow increasing the deliveries to the Republic of South Africa.

Specialists at the Amalgamation and colleagues of Russian and Belarussian institutes are carrying research on new reagents which production could be available to the enterprises of our countries.

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In 2003 the following measures are planned to decrease production expenses and to provide environmental protection:

- ◆ To provide gas supply to the 4th mine and refinery complex;
- ◆ To develop and improve the scheme of collective warehousing for non-utilizable and clay slimes.

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Nowadays in accordance with the present programme, some investment projects are being developed and realized:

- ◆ Maintenance of manufacturing capabilities of RUE PA "Belaruskali";
- ◆ Technological improvement of potash ore treatment based on technical re-equipment and application of new treating methods;
- ◆ Construction of the fifth mine in Krasnaya Sloboda;
- ◆ Decreasing the effects on the environment;

- ◆ Re-equipment of mining and refinery machinery including production of such equipment on the enterprises of the RB in accordance with the “Program for PA “Belaruskali” to interchange the machinery, equipment and materials of foreign producers”;
- ◆ Design and research works and projects.

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On the 29 of August 2003, one of the greatest events in the history of the Amalgamation happened: one billion tonne of potash ore has been brought to the surface since the starting of mining at Belaruskali! It happened the day before the professional holiday of the Belarussian miners and also the Day of the town. Soligorsk is 45 years old!!!

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We look with confidence into the future and we are always ready for serious mutually beneficial co-operation with our partners. If you have opted for our products, you can be sure that high-quality goods from the Amalgamation shall be delivered where it is needed and in due time.