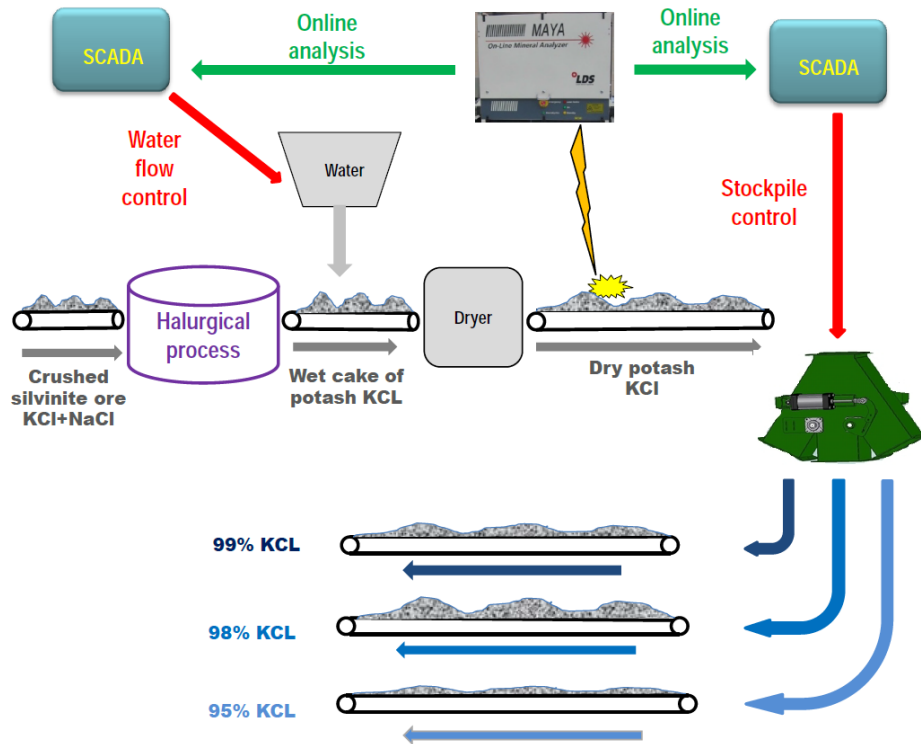




## CASE STUDY POTASH

1. **Technological task** is the quality control of the final product - potash (with 95-99% KCl concentration), obtained in the result of the halurgical process (halurgical method - the processing of potash ores by hot leaching with further crystallization of potash salt from saturated salt brines). The main impurity in potash is NaCl. Additional impurities are insoluble (clay) components Fe, Si, Ca, Al etc.
2. **Methods to resolve** the technological task. The following problems should be resolved during the production process:
  - a. Promptly control the amount of water for washing the obtained product from impurities. Increasing the water flow increases the quality (grade) of the final product, but reduces its amount by dissolving therein.
  - b. Obtaining of the products with the specified quality by adjusting the water flow.
  - c. Determination of the quality of the final product to analyze the possibility of its supply in the frames of different contracts with different grades and different tolerances.
3. **Potential sources of payback**
  - a. Reduction of claims connected with the off grade product supply.
  - b. Reduction of the positive tolerance (i.e. a reduction of shipments of the product with a higher quality than stipulated in the contract)
  - c. Saving the process water.
  - d. Reduction of the waste quantity and consequently reduction of the waste disposal costs.
4. **Flow scheme**, potential installation places and control scheme

The grade of the product is determined on the base of the data about the content of impurities in the final product (dry or wet). In the same time, the amount of water for washing the wet product after halurgical process is adjusted.



*This scheme is approximate and is provided to illustrate the material flows and control scheme. Some items in a particular place of installation may have a different implementation and appearance than it is shown on the scheme.*

**5. Installation site description:** The environment and the segregation of the material



- a. MAYA is mounted on a conveyor with a dry finished product coming after stoving on an inclined (12 degrees) conveyor, located approximately 11 meters above the nearest concrete base.
- b. The dropouts from the cyclones with a high content of impurities, first of all NaCl, are supplied on the surface of the finished product.

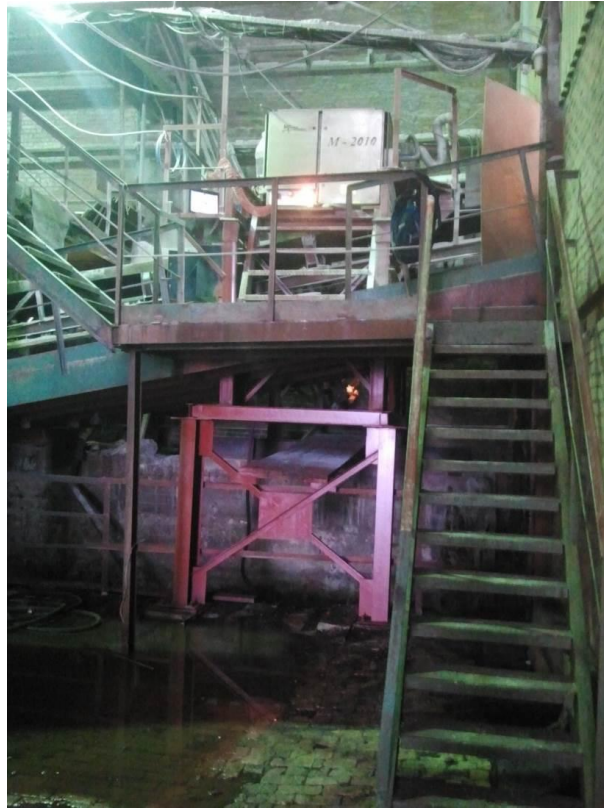
- c. The height and the surface profile of the material may vary depending on the condition of equipment and its reconditioning.
- d. Material temperature is up to 200 degrees, the air temperature around the installation site can be changed (depending on the season) from -15 up to +35 degrees.
- e. There is an extreme dustiness at the place of analyzer installation due to the vibration of the conveyor transporting dry powdered material.
- f. The humidity above the surface of the material at the installation site may be up to 100% due to the formation of condensate at the point of contact of hot material with the cold air. The steam containing chlorides and impurities (including Fe) may occur between and the analyzer and material in a cold season.

6. **Solving** the installation location **problems** (adaptation to the installation)

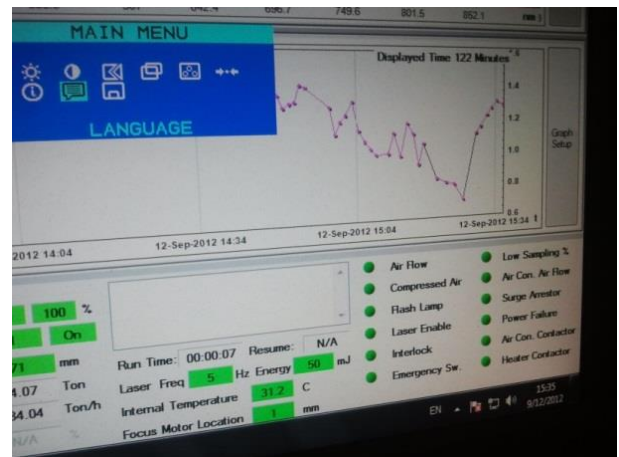


- a. The stirring device was installed on the conveyor to provide a representative volume of the material and its surface (which periodically receives cyclone dust with high content of Na).
- b. Due to the steep angle of the conveyor (practically at the edge of the limiting range for this particular model of analyzer), the analyzer was located on the maximal possible (for the laser beam focusing) height above the conveyor (37 cm).
- c. The simple mechanical device that provides minimum allowable height of the material, regardless of the load, was installed on the conveyor. This device provides necessary surface height of the material that permits the laser to focus on material correctly.
- d. The fabric "screens" were installed to reduce the level of evaporation below the analyzer from the main directions of the cold air stream.
- e. Another "screen" was installed to reduce dust level from the feed point of the conveyor.

## 7. Analyzer description

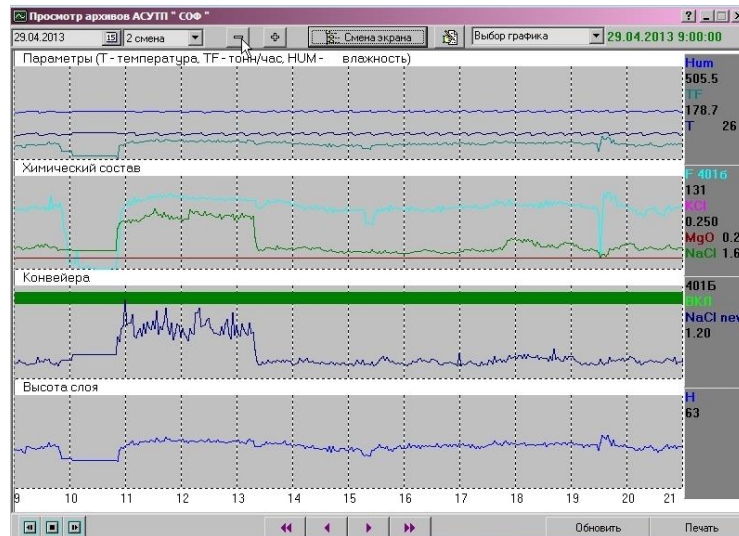


- a. The analyzer was installed on a special frame with 11 m height. This frame was placed on a concrete base that has no contact with the metal structures of the conveyor to reduce the vibration that would probably come from the conveyor.



- b. Air intake for the dust protection system was placed at the distance about 10 m from the installation site. Air intake for air conditioning was placed in the neighboring areas with lower levels of dust.

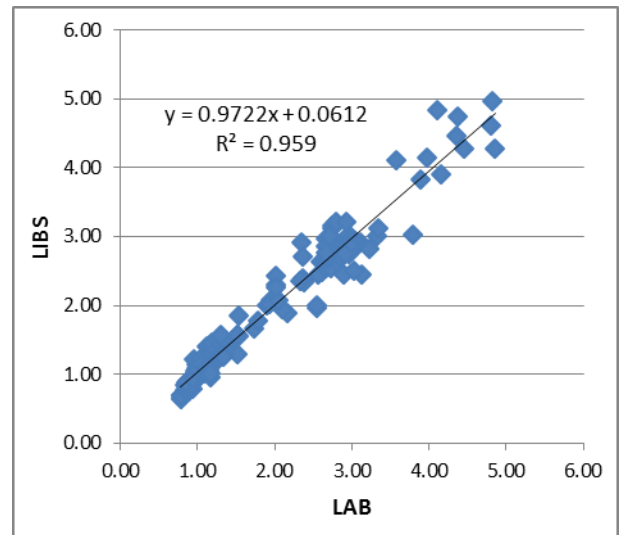
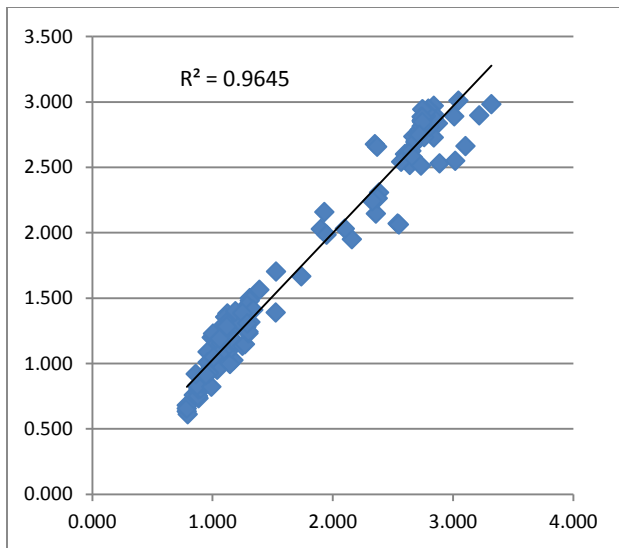
- c. The analyzer frame provides the possibility to calibrate (selected or standard) samples in a static mode, as well as the possibility to maintenance analyzer without stopping the conveyor.
- d. The analyzer housing is made of stainless steel.
- e. The screen forms allow the operator to track the level of NaCl in the final product and to take the prompt decisions about changing of the wash water dosing.



- f. The information from the analyzer goes to the customer SCADA and is used to automatically control the process.

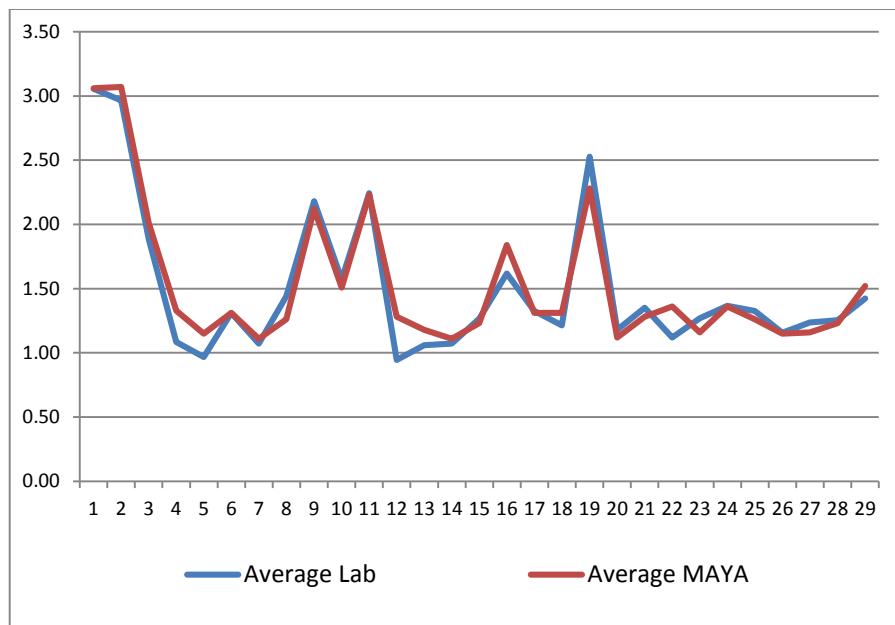
## 8. Analytical results (calibration) on conveyor

- a. Due to the nature of the production technology the material fed to the conveyor with installed analyzer has strong nonlinearities in the chemical composition and spectral parameters. To resolve this issue 2 algorithms was developed and installed on the analyzer: One with better accuracy in the range form 0 up to 3% NaCl is used in the production quality control for materials with content of KCl equal to 98-99%. The second algorithm has lower accuracy but more wide range of NaCl content (up to 6%). It is used in the production quality control for materials with content of KCl about 95%. Since these products have significant differences in the production technology, they are produced at different times, and the customer definitely knows what kind of material is currently used production process. Therefore, the use of 2 algorithms is permissible in this case. Besides this, it allows to improve the accuracy in the production of the high quality products.
- b. The calibration diagrams for both of the used algorithms with about 100 samples taken from a conveyor belt with the simultaneous operation of the analyzer are given in below:



9. The long-term trends and the comparison with the average data of the customer's laboratory

Average Lab	Average MAYA	Error	Average Lab	Average MAYA	Error
3,05	3,06	0,01	1,62	1,84	0,22
2,96	3,07	0,11	1,33	1,31	-0,02
1,89	2,01	0,12	1,21	1,31	0,10
1,08	1,33	0,24	2,53	2,28	-0,25
0,97	1,15	0,18	1,18	1,12	-0,06
1,31	1,31	0,00	1,35	1,28	-0,07
1,07	1,11	0,04	1,12	1,36	0,24
1,44	1,26	-0,18	1,27	1,16	-0,11
2,18	2,12	-0,06	1,37	1,36	-0,01
1,57	1,51	-0,06	1,33	1,26	-0,07
2,24	2,23	-0,01	1,16	1,15	-0,01
0,95	1,28	0,34	1,24	1,16	-0,08
1,06	1,18	0,12	1,25	1,23	-0,02
1,07	1,11	0,04	1,42	1,52	0,10
1,27	1,23	-0,03			
<b>Average error</b>					<b>0,10</b>



10. Solved customer problems and a **source of economic benefit**

- a. Now it is possible to efficiently manage the supply of water to wash the finished product from the impurities (NaCl + insoluble).
- b. The tolerance of the supplied product was decreased. Reduction of KCl to the limits specified in the contracts without relatively big reserve of quality, which requested additional costs.
- c. The possibility take orders with the higher content of KCl (99%) with the higher price. The possibility to keep high quality due to the operational control of the washing quality (water metering) and selection of the material with the high quality from the total flow with slightly lower quality (98%).

11. **Environment** – decrease in water consumption, waste reduction and decrease of harmful impurities in fertilizers.

12. **Customer's feedback**

- a. Payback period is about 3-4 months due to the factors described above.
- b. Currently, the customer purchases additional analyzers on the other conveyors with the same material, but with the installation site before a drying oven (for wet material).
- c. The customer is considering the installation of MAYA analyzers for the analysis the content of insoluble in the crushed ore to provide the immediate response to the growth of the contamination in the initial crude ore.