How to get highly concentrated acid?
Of course by a fieldbus system of ABB Automation.

NIGU Chemie GmbH in Waldkraiburg / Bavaria, a subsidiary company of SKW Trostberg AG, develops, produces and sells fine and biochemicals for the pharmaceutical, diagnostic and life science industry. The acid mixture resulting in the production of nitroguanidine, also called dilute acid, is processed in an internal cycle by an acid concentration plant (SKA) and fed again to the process in the respective concentration. In technical applications rotary evaporators have proven for the concentration. For reasons of corrosion protection and high temperatures, the materials glass, steel enamel and stainless steels or tantalum are used for devices and pipelines depending on the requirements; this also applies to the design of the product-wetted parts of the measuring and control technology.

Basic conditions
For the reconstruction of the acid concentration plant (SKA), NIGU Chemie had to consider whether to build up the whole measuring technique conventionally with parallel I/O cards or to adopt the new innovative fieldbus technology. Right from the beginning the idea of modernization was prevailing for the optimization of the process, that means also for the measuring and control technology. By the assistance of W. Schäftlmaier GmbH, a company for the construction and planning of electric installations in Aschau/Inn, a solution with PROFIBUS was reached in a very short time. As automation system the compact control system “Freelance 2000” from ABB should be used because already for years NIGU had made good experience with this system in different applications. All field devices of the acid concentration plant have to be designed for Ex Zone in order to meet the Ex requirements in case of a possible production change.

Here, several aspects had to be taken into account:
- Is a PROFINET-DP-Master available for the ABB control system “Freelance 2000”?
- Is the selection of ABB field devices with PROFIBUS-PA large enough for the Ex area?
- Can ABB Remote-IO-Modules be delivered for standard signals for Ex Zone?
- Is the PROFINET coupling of field devices from different manufacturers possible without any problems?
- Is a software tool available for the configuration of all field device parameters?

After all these questions could be answered with “Yes”, the definite planning started.

The advantage of fieldbus. More information.
Within a very short time an invaluable advantage of the fieldbus technology became apparent. Due to the direct connection of PROFINET-PA to the field devices which at present are increasingly intelligent, more and more information from the measuring point are made available to the plant operator whose local presence not being necessary. In this case this would moreover not be possible because the installation is not accessible during operation. Each configuration and parameter setting of the field devices as well as of the ABB Remote IO Stations in Ex Zone is effected in the control room. In the past the acid concentration plant had to be shut down for such service operations. At a standstill of more than 2 hours the buffer tanks are also completely filled and the whole production plant would have to be shut off. Based upon this increased information a better planning of regular service intervals is possible and thus the time intervals of routine checks can be extended. Arising problems are recognized early and can be eliminated at the same time during a regular revision, for example at the weekend. Predictive maintenance management before plant failure!

Short commissioning phase
A further challenge was the short reconstruction time of only 3 weeks from the shutdown of the old installations to the start of production. In this period the reconstruction, the extension and the optimization of the process had to take place. The cable laying phase had to be very short because the optimization of the process was the most important point. Although more than 250 I/O signals and approx. 90 intelligent transmitters of which have been installed, it was possible to connect the whole via 3 PROFINET lines to only one “Freelance 2000” station.
Visitors are surprised when they open a control cubicle and wonder “That’s all!?”. Not any I/O card for the parallel read-in of field signals. This was also the reason why the even more compact Field Controller of “Freelance 2000” has been used here. It is exclusively equipped with a power supply unit, controller, Ethernet card and up to 4 fieldbus master cards. All that at a width and height of only 239x202mm!

The cooling towers
For a better adaptation of the bus topology to the partial processes and in order to divide the fieldbus load, the field devices have been distributed to three PROFIBUS lines. One area is the cooling tower which cools down the hot water steam resulting from the dilute acid due to evaporation. Also in this regard Messrs. NIGU Chemie have consistently chosen the way of modernization. The complete electrical engineering for the 8 actuators (+17 actuators of the acid concentration plant) has been replaced by new motor management modules with a PROFIBUS-DP interface directly in the insert of the MCC installation. They control and monitor all functions of the control system. Where in the past 10-20 parallel cables have been laid for each motor, today only one cable “as thin as a finger” runs from MCC insert to MCC insert and of course the power line.

The acid concentration plant
The second area is the actual multistage acid concentration plant. Subsequent to the use in production, a mixture of diluted acids and residues is left. After intermediate storage this acid mixture is upgraded again in several steps in a continuously running process. This so-called “recycle acid” then is fed back to the NIGU production process. The stages of the acid concentration plant are directly coupled to each other. Regarding the acid concentration and physical conditions during normal operation each stage is in a more or less steady state. The stages 0-3 are closely coupled to each other via a waste heat utilization system. This area is subdivided into 2 further PROFIBUS lines which almost exclusively read in signals from the Ex area Zone. This is effected by 3 Remote IO Stations and more than 70 PROFIBUS-PA field devices. Here, all PA field devices are read-in intrinsically safe (EEx i) via the ABB multibarrier (EEx m [ia] e IIC T4). Due to this, the restriction to approx. only 8 PA field devices for each segment coupler is no longer applicable. Up to 16 multibarriers with up to 31 PA field devices for each segment coupler can be connected. A further advantage is that a possible short circuit of a PA field device does not affect the other field devices of the same segment.

Configuration of the field devices
The large quantity of the used pressure transmitters AFD 800 and temperature transmitters TF 12 from ABB Automation are configured directly from Freelance 2000 by means of DigiTool. Here not only the parameters set in the PROFIBUS profile 2.0 but also the specific manufacturer information are transferred and will be accessible for the control room team. This also applies to the field devices of other manufacturers in this PROFIBUS network.

Quintessence
To sum up Mr. J.M. Brehm, Manager of Technical Engineering at NIGU Chemie, stated: “The decision in favour of PROFIBUS was not only the saving potential for the cabling propagated again and again in the media, because the extension of the acid concentration plant is not very large, but it was definitely based on the increased information available to the control room team. Within a short time this will be reflected by the reduction of the Life-Cycle-Cost of the installation.”

Fig. 3: PROFIBUS topology