The batch-specific traceability and documented quality of the raw materials are essential nowadays – not least in the chemical industry. Only then can natural fluctuations be detected in time and factored into the processes. As demonstrated by means of RFID at one of Germany’s oldest salt mines, where it is employed in the largely automated quality control of the salt delivered.

At the suggestion of Frederick William IV, King of Prussia, the Stetten salt mine near Haigerloch – south of Stuttgart, Germany – was opened in 1852, and six years later, started with the production of "royal Prussian evaporated salt". At that time, the most important final products were table salt and animal feed salt. After World War I, the Prussian Mine and Foundry Company (Preussag) assumed ownership of the mine. In 1924, the Dr. Alexander Wacker Gesellschaft für elektrochemische Industrie (consortium for the electrochemical industry), the present-day Wacker Chemie AG, leased the mine to satisfy the steadily rising need for rock salt consumed by its manufacture of chemicals.

In 1960, Wacker purchased the Stetten salt mine. Today, 60 highly qualified people produce about 500,000 metric tons of industrial salt, deicing salt, brine, commercial salt, and salt licks per year. The final use of the mined rock salt in industrial and commercial applications is determined by samples, which are taken from below ground and analyzed in a laboratory above ground. To assure that the assignment of sample to bunker is free from mistakes, Wacker has been using a contactlessly operating RFID system by Siemens Automation and Drives since August 2006.

Salt from the Earth

“As main product, we are supplying high-quality industrial salt to the Wacker plant in Burghausen for the manufacture of silicones, hyperpure silicon, organic intermediate products, and pyrogenic silica,” explains mine director Alfred Höllerbauer. “The second most important recipient is Vinnolit, one of the world’s leading PVC manufacturers. Depending on the weather, about a third of our annual production ends up as deicing salt on wintry roads. Due to the increased demands made by the customers on the quality and traceability of our products, we decided to automate the collection and analysis of the salt samples.”

Quality Control in the Salt Production made easy

Wacker Chemie AG

SIMATIC Sensors

Answers for industry.
Breaking, crushing, screening: The processing of the rock salt takes place completely below ground, and is controlled by an HMI system based on SIMATIC WinCC flexible.

Because the rock salt was created approximately 240 million years ago through the drying up of primeval oceans, it is subject to natural fluctuations in the salt content and contains impurities – particularly anhydrite – depending on the mining location. Industrial salt and commerical salt must show a sodium chloride content of over 98%, with a respective maximum aggregate size of 5 or 2 mm and a dust percentage of less than 5%.

To save transport costs, these grades are produced right in the mine below ground and stored in bunkers for the interim. Another advantage in doing so is the extremely dry air in the mine, since salt is hygroscopic. Above ground, rock salt would absorb humidity and fuse together within a few days – losing its free-flowing ability. The salt is therefore crushed, screened, and then conveyed to underground storage bunkers.

Likewise taking place below ground is the sampling with the aid of a MOBY D RFID system consisting of data storage (MDS) media, attached to the bottom of the sample containers, and a read/write device (SLG), which writes the respective sample data onto the data storage medium. The system was configured in-house by Wacker and initially installed and tested at the Burghausen plant before being put into operation at the Stetten mine.

Rugged System for reliable Data

Wilhelm Storfinger, at Wacker responsible for engineering in the field of fine chemicals, attests to the high reliability of the RFID solution: “In the past, the samples were marked with numbers by hand. These labels often did not ‘survive’ for very long in the dusty, salt-containing atmosphere of the mine, frequently became smeared, etc. A precise assignment of the sample analysis to the respective silo – corresponding to a specific mining area – was not possible with that. Today, we can universally get this data for each individual delivery, which greatly helps us in running stable processes.”

The sampling system is directly linked with the seven industrial salt silos in the mine, and features a rotary table with eight sample containers. In the first table position, the respective sample container is filled. For that, the sample is continuously diverted right from the conveyor stream and placed in the container. Below the filling station, a MOBY D SLG 75 with integrated antenna is mounted, which contactlessly writes the sample-related data onto the mobile data storage medium. Saved are, among other things, the bunker number as well as timestamps with the beginning and the end times of the sampling. With 124 bytes of available memory, the MDS D124 offers plenty of space for this.

Making the MDS especially qualified for the use in the salt mine are its high IP68 protection rating and hermetic housing – suitable for harsh environments with temperatures up to 125 °C. For the read/write device as well, ruggedness was an essential requirement. Peter Blümlhuber, plant engineer responsible for electrical engineering, measurement and control technology at Wacker in Burghausen, on this: “The RFID system by Siemens proved to be absolutely impervious to the unavoidable salt dust present here. Moreover, the high reliability of the contactless technology gives us the necessary documentation assurance for our quality data, and further eliminates potential input errors.”

Integrated Solution throughout the Mine

The SLG is connected via an interface module ASM 475 and an intelligent I/O module SIMATIC ET 200 to the decentralized operator control & monitoring system of the mine, which primarily consists of diskless and fanless multi panels SIMATIC MP 370 Touch. Conventional computers with a mechanical drive and keyboard would be unsuitable long-term due to the prevailing high salt dust exposure. The operating statuses of the equipment as well as the data of the samplings can basically be viewed on any of the panels below ground and on the connected computers above ground.
The same applies to the analysis laboratory of the mine. There, the mobile data storage media are read and the relevant quality data is determined, e.g., sulfate and sodium chloride contents. Once the quality of the stored salt has been ascertained, the analysis values are placed together with the production data (date, silo number) in a database, which in turn can be accessed from the Wacker company network. Finally, the person in charge of quality approves the corresponding silos for the delivery to prospective customers.

Since the installation in the mine, the system has been operating flawlessly, and also adds advantages to the mine’s quality policy, as stressed by Michael Schulz, overall operations manager of Stetten: “Nowadays, we are testing more frequently than in the past, since the more test results we obtain, the more specific we can plan the further tapping of the salt deposits from a quality point of view. And of course, we are much better informed about the quality of our products.”

Following the approval of the delivery, the transportation of the salt from the respective silos to the awaiting freight cars via a withdrawal conveyor can be started. Here, too, state-of-the-art Siemens technology is in play: The employee receives the approval and the order-related data via a unique screen of the HMI system, and can then remotely control the proper slide gates and conveyors by radio via an Industrial WLAN access point SCALANCE W788-1 PRO. The access point still functions with absolute reliability, even if it is covered – as is typically the case – by a thick salt crust. The radio remote control is not only advantageous for the hauling, it also saves costs when cleaning the bunker, since a second worker usually required at the bunker control in the past is now no longer needed.

Optimally prepared

Stetten is looking to the future with confidence. Not only regarding quality is the salt mine fully up-to-date. Only two years ago, a modern magnetic processing facility for the removal of impurities from the salt was installed, which drastically lowered the energy consumption of the mine. And the salt deposits explored so far in Stetten will – at the present annual production rate – be enough for many decades to come.