

R2 CASE STUDY: WHY COVESTRO INVESTED IN ELECTROLYSIS SAFETY WITH R2 EMOS® SAFETY SYSTEM

WHO IS COVESTRO LLC?

Covestro LLC is a global leader in producing high-tech engineering plastics, including polyurethane (MDI, TDI), coating and adhesives (CAS) and transparent polycarbonate plastics (PCS). Covestro operates multiple chlor-alkali plants in North America, Europe and China. In Baytown, Texas, at one of its major production sites, chlorine is produced to supply all production units with this key raw material.



Covestro, Baytown – Chlor-Alkali Cell Room
(Image Courtesy of Covestro LLC)

CHALLENGE: CONSTANTLY INCREASING PLANT SAFETY

As a technology-driven company, Covestro continuously invests in improving process safety, especially on electrolysis safety. In 2007, a R2 voltage monitoring system was installed at Covestro's Baytown chlor-alkali plant as an additional layer of protection to the differential voltage protection system (balance voltage monitoring system or BVMS / EDI), which was the main safety system. Pinhole detectors have been used routinely to monitor each startup/shutdown. A single fixed value high voltage interlock was used to protect electrolyzers. Voltage data were periodically studied to determine electrolyzer startup conditions, repairs, and rebuilds.



CASE STUDY

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In 2017, Covestro launched an initiative to further boost cell room safety (Project RSE - Revalidation of Electrolysis Safety Concept). The Baytown plant decided to upgrade to R2 EMOS® SIL2 Safety System in order to replace the old strategy of a BVMS/EDI and single cell voltage monitoring with a fixed HI alarm/trip. There were several justifications for this change.

First, the old approach did not provide sufficient protection during load changes, such as ramping up to full production rate, because the BVMS/EDI had to be manually offset to balance the voltages. In addition, during the start-up, one operator had to stay in the cell room for several hours to manually adjust the offset using a voltmeter. This was very inconvenient.

Second, when operating at low current densities, a fixed high alarm (3.8 V) and interlock limit (4 V) only provided limited protection from events such as a brine inlet blockage.

Third, Covestro was concerned that safeguarding was not sufficient against low voltage events.

Fourth, the former pinhole detection only triggered alarms so, out of concern for the accuracy of the information provided, the plant manager and engineers were required to monitor each start-up to make decisions, which was often challenging.

THE SOLUTION:

UPGRADE TO R2 EMOS® SIL2 SAFETY INSTRUMENTED SYSTEM (SIS)

Dr. David Chen, process tech expert at Covestro Baytown, said “Since the differential voltage system is a crucial safety system, any replacement option needs to achieve a high standard in terms of reliability. The solution chosen was to deploy R2’s newest EMOS® Safety System, with safety integrity level (SIL) 2 rating, because it features adaptable alarm/trip limits calculated in real-time that are based on the current-voltage-time relationship and the behavior of neighbor cells. It also includes electrolyzer trips in case of low voltage events, and emergency shutdowns in case of severe pinholes.”

The upgrade was completed in 2019 with onsite support from R2 technicians. R2 EMOS® Safety System is now part of the plant’s safety interlock system. Right after installation, an initial calibration period enabled R2 and Covestro to make a few hardware adjustments to get the best performance from the EMOS® Safety System.



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“The new R2 EMOS® Safety System’s HMI (EMOS® View) has two monitors in the control room, which is very convenient for operators to monitor the start-up of two electrolyzers at the same time,” adds Guorong Shen, the production lead. “The voltage bar chart and trends are very intuitive to operators. With the floating/adaptable LO/HI alarms trips, the plant is now always running in the safe region. If a pinhole warning is ignored, EMOS® will shut down the electrolyzer eventually, which ensures the same rules are applied during all operator shifts.”

In a few instances, the R2 EMOS® Safety System tripped the electrolyzer due to temporary loss of brine feed (for less than 2 seconds). This would not have occurred with the previously-used system. Procedure and training were put into place to avoid this kind of issue.

CONCLUSION

“We are now very confident that the new R2 system will protect our plant in the long term,” explains Dr. David Chen. “We also like R2’s technical support that is very fast via phone, email, and remote connections. R2’s technical expert has provided very good insights for us to resolve some challenging issues.”

“Seeing the values of R2 system demonstrated in Baytown Texas and Shanghai China plants, Covestro is now implementing more R2 systems,” says Dr. Christof Bollmann, Global Cl₂ expert at Covestro. “This includes three German plants in Dormagen, Uerdingen and Leverkusen as well as the new plant in Tarragona, Spain. In the meanwhile, Baytown site is testing other products from R2: Early Detection Engine and Asset Management Database. Covestro is looking forward to further strengthening the process safety and reliability of the electrolysis with R2.”

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