



# Testing and inspection operations at the refinery "TOTAL Raffinerie Mitteldeutschland": A planned shutdown to increase safety and reliability

By Dr. Peter Seliger

Every five years, as stipulated by the legislative body, refineries and large chemical plants are put to the test. Production comes to a standstill, cleaning and maintenance tasks are carried out, and the Technical Inspection Agency as well as other inspection agencies test machinery and equipment for safety and integrity. In May 2008, TOTAL Raffinerie Mitteldeutschland GmbH was up for such an inspection. The refinery, which is located in Leuna, Central Germany, refines approximately 10% of the crude oil needed in Germany into mineral oil products. During the inspection, Siempelkamp Prüf- und Gutachter-Gesellschaft Dresden (SPG) was solely responsible for the condition assessment and the lifetime monitoring of important components including the process facilities, reactors, containers, controls and instruments, and pipelines of a total of eight production lines.

## Component metallography on a fitting

It was to be the most extensive inspection ever for TOTAL Raffinerie Mitteldeutschland. The costs for the general inspection including the necessary investments amounted to approximately 200 million Euros. The investments focused mainly on the upgrading of the distillation system and the upgrading of the POX/methanol facility with a new measuring station. The investments also included a fourth dust filter for the cracker and the integration of a new sulfur removal system. Approximately seven weeks of downtime were estimated to complete the inspection. Accordingly, all the company's reservoirs were filled to the brim in order to sustain customer deliveries. Vehicle drivers as well as fuel and mineral oil dealers in Central Germany did not have to worry about supply bottlenecks during the planned shutdown.

Without the help of the neighboring communes this large project would not have worked out. With a temporary exit ramp from the Autobahn close to the city of Großkorbetha, a direct route to the refinery was established. An additional parking lot as well as a new light signaling system also contributed to relieving traffic congestion. More than 3000 additional workers from more than 150 companies provided excellent work at the refinery during the shutdown. 1500 containers with changing rooms and showers were set up especially for these additional workers. Also, two additional bus routes and two on-premise cafeterias were established to accommodate the extra workers.

The necessary hardware was also available. More than 25,000 spare parts were readily available at the start of the project. The tasks proved to be complex. For 1500 containers pressure tests were pending and more than 500 heat exchangers had to be cleaned and inspected. 40 reactors and 14 furnaces also had to pass the inspection. Furthermore, 1500 controls and instruments had to be disassembled, inspected and reassembled.

## Certified and approved

In order to qualify as a contractual partner, SPG had to acquire the Safety Certificate for Contractors (SCC). This certificate is indispensable when performing works in refineries, chemical plants and, in the future, power plants. The certification process concentrates on the development of a management system for subcontractors which focuses on health, safety, and the environment. The objective of the SCC standard is to reduce the accident rate during maintenance, repair, and inspection operations as well as to prevent work-related health impairment and environmental and material damages. In order to keep this standard up to date, the German Technical Inspection Agency reassesses the system annually.

The official tendering for the lifetime monitoring services took place in summer 2007. Following the submittal of the offer, several contract negotiations were carried out. The contract was signed in March 2008, the inspection operations could commence in May 2008.

## Testing inside a boiler drum



Radiographic inspection of a pipe elbow

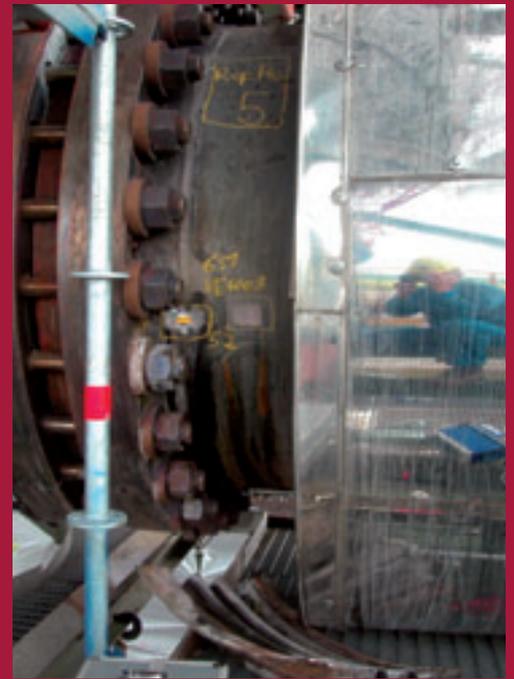
Surface crack testing of a welded seam



Replica testing of an elbow pipe



Replica testing of the welded seam of a flange



### Concentrated forces – cooperative teamwork

A detailed time schedule challenged us to concentrate our reserves and to increase our staff for the testing and inspection operations. Next to the nine staff members of the SPG team, we brought personnel from partner companies aboard. In the end, SPG was responsible for a team of 23 people and their professional and safety-related matters. Project coordinators and operative executives had to carefully watch over upcoming inspection operations on the different production lines, evaluate test results daily with the employer, identify potentials for improving operational procedures, and answer safety-related questions. Without teamwork nothing would have worked. The good cooperation that existed between the employer and the involved subcontractors from the beginning contributed immensely in creating the foundation for a successful project handling by Siempelkamp Prüf- und Gutachter-Gesellschaft!

Our testing and inspection services included visual examinations, for example by means of video endoscopes, ultrasonic wall thickness measurements, geometry inspections, as well as testing for inter-crystalline stress cracking corrosion. Non-destructive testings such as penetrant testing, magnetic particle inspection tests, ultrasonic and radiographic inspections detect possible cracks in the

surface or inside the material of pipes and welded seams. Another service we offer is the ambulant component metallography and hardness measurement of pipes, pipe elbows, fittings, and welded seams. It allows conclusions about the structural conditions and possible damages due to service conditions. The onsite findings excluded such abnormalities. The material samples removed on location also gave no reason to suspect such damages. They were examined for their chemical composition, tensile strength and impact strength as well as for their micro and macro structural conditions. The results were consistently satisfactory.

Due to the unerring implementation, all testing and inspection operations were completed according to schedule within four weeks. After only one month we were able to submit to the customer a total of 31 inspection reports.

### Conclusion

Again we have implemented comprehensive programs consisting of engineering and testing services to the satisfaction of our customers. New orders and inquiries regarding lifetime monitoring services during the planned shutdowns at the Raffinerie MiRO Karlsruhe and the DOW Chemical Böhlen already exist for 2010. We are looking forward to these new tasks!

Testing and inspection operations outside the TOTAL Raffinerie

