

lifecycle of a gas analysis instrument” says Heaton. “Our services begin with product selection proposals, equipment installation, commissioning and training. In the operational phase the focus shifts to spare parts, consumables, maintenance, technical support and repairs. As time moves on, extensions, upgrades and retrofits are the order of the day. And, when twilight finally comes it’s time to consider replacement and end-of-life services”. The ABB Measurement Care packages are a modular framework which allows each refinery to customise a service package from all the available options that focuses on their needs. That means service is there, when the refinery or storage terminal needs it the most and costs are simultaneously contained.

### Digital trends

Augmented reality, cloud computing and QR Codes are not just buzzwords. David Lincoln, Global Digital Lead at ABB’s Measurement & Analytics Division explains why digital solutions matter: “the right combination of digital technology, service delivery and high-tech hardware puts us in the sweet spot to provide unrivalled value for money to our customers”.

As part of the ABB Ability™ suite of digital solutions, ‘Remote Insights’ allows an operator’s instrument technician to communicate directly with an expert remotely. It is a two-way augmented reality video and voice interaction enabled by a hand-held device such as a tablet computer or mixed reality headset. It means that the instrument technician can share, what they are seeing directly with their counterpart at ABB and get instant feedback about the best course of action. Lincoln says that “in the past, training, maintenance, troubleshooting and repairs all meant a service call-out. With Remote Insights, there will be much less travel required – saving time, cost and CO<sub>2</sub> emissions”.

‘Remote Assistance’ is ABB’s new collaborative cloud-enabled operations concept. Many refineries operating within a large company have implemented ‘Remote Operations Centres’. These are like the ‘Remote Assistance’ model. The concept relies on Condition Monitoring health diagnostics in the gas analysers, which can inform the operator’s instrument engineer, or the service team at ABB about the status of the gas analyser. This data can be used to diagnose consumable materials replacement require-

ments or trouble shoot equipment faults. The goal is to guide the local operations team towards a speedy resolution.

Dynamic QR codes are a digital innovation that is being integrated into the ABB Measurement Care service offers to help operators get closer to 100% uptime availability for their gas analysis instrumentation. This uptime target is important for many process control applications but has special significance in regulated CEMS. In many countries, emissions measurement data must be reported 98% of the time to avoid shutdowns and penalties. The Dynamic QR code displays the latest system configuration data and the real-time analyser status. The instrument owner can transmit real time information so that an ABB engineer can offer advice immediately or follow up with a site visit to fix the issue.

Lincoln adds that “data privacy and data security are key topics in this digital age. The Dynamic QR code technology is sensitive to this issue because there is no permanent physical connection needed to transfer data from the gas analyser to our systems”.

Gundula Harrison, Managing Consultant, sbh4 GmbH ■

## Refinery

### Ingolstadt ex-refinery site environmental remediation hits key milestone, meeting safety, budget and performance targets

Throughout the year, 500 people have been active with environmental remediation and building work at the 75 hectare IN-Campus development in Ingolstadt. “Safety has always been the number one priority at the IN-Campus site” said Dr. Rüdiger Recknagel, Chief Environmental Officer at Audi. “The workforce has just achieved the milestone of 250,000 hours of incident-free op-

eration since work began in 2016”.

“My team is very proud to be involved in this project, which we believe is the largest ex-refinery remediation task ever undertaken in Germany” adds Recknagel. During more than four decades of operation of the refinery which previously existed on this site, there were occasional spillages of oil and other chemicals. This is the legacy

which the IN-Campus team are now working to remediate. “Our environmental management experts know that it is a once in a lifetime opportunity to return such a beautiful piece of land bordering the river Danube to its pristine condition. And I am immensely proud of them because they are working so responsibly and achieving all our milestones”.

“The excellent safety statistics are just one example” continues Recknagel. “We are also working within our budget and proceeding according to our timeline. Up to now, we have cleaned-up about 400,000 tonnes of contaminated soil from the site, which is fractionated into sand and stones in the washing process. That is about 65% of the total requirement. And the technologies that we have chosen are performing as expected to return the site to a very high environmental standard: up to now, they have successfully captured and disposed of 450 Tonnes of hydrocarbon pollutants”.

Safety and respect for our natural environment are the heart of the project concept. IN-Campus GmbH, a joint venture between AUDI AG and the town Ingolstadt, is responsible for the site development. The Managing Director Thomas Vogel explains, how these concepts are also core to the long-term vision: “The innovation campus that will be created on this site will be used



Photo: AUDI AG IN-Campus Environmental remediation of legacy refinery at Ingolstadt - air sparging unit

to develop emissions-free driving systems such as Audi's range of battery electric vehicles. There will also be a state-of-the-art crash test facility to ensure that our cars offer the highest standards of safety for their occupants and other road users".

In the 1960's an oil refinery was constructed on this site. There were five refineries built close to Ingolstadt. After more than 40 years of operation, the activities at one of those refineries were consolidated into two of the others and it closed. That is, when Audi had an opportunity to invest in this site and transform it into a technology park.

In 2017 the consortium consisting of the companies ZÜBLIN Umwelttechnik GmbH, STRABAG Umwelttechnik GmbH, Geiger Umweltsanierung GmbH Co KG and Wilhelm Geiger GmbH was awarded the contract for the site remediation and preparation for construction. The consortium has been responsible for selection of suitable measures, planning, operation and for obtaining the necessary regulatory approvals. Bernhard Volz, Senior Engineer at ZÜBLIN Umwelttechnik manages the remediation project for the consortium. He explains, that: "every site has different soil, pollution and target environmental conditions. The technology needs to be selected and the process units must be sized and adapted accordingly. Most of the large-scale remediation projects that we have undertaken have returned landfill sites to high environmental standards. We have also been engaged in other in-situ refinery and refined product storage terminal environmental remediation projects".

ZÜBLIN Umwelttechnik contributed to the clean-up of an abandoned Pemex refinery site in Mexico. The soil at that site was saturated with pollutants such as MTBE and chemicals in the BTEX group. Pollution was at an average depth of 3.5 metres but reached a depth of 9m in some locations, resulting in the need to excavate and remediate 1.1 million cubic meters of soil. The groundwater was also heavily contaminated, and a 1,100 m long permanent barrier was sunk into the ground to a depth of 2.5m to ensure that groundwater does not flow to Mexico City's water distribution system.

In Romania ZÜBLIN remediated a whole OMV tank farm, which has since been developed to become Petrom City in Bucharest. The refined products storage terminal was a 20 Ha site on the banks of the Dâmbovița river. It was heavily bombed in 1944 during the second world war and several tanks were damaged, which resulted in severe contamination of the soil and groundwater. When the site was remediated in 2009, the main contaminants were petroleum hydrocarbons (TPH), polycyclic aromatic hydrocarbons (PAH) and volatile BTEX group chemicals. More than 2,000 t of oil phase was extracted from the groundwater surface and handed over to Petrom's refinery for recycling.

Volz says that "those experiences ensured



Photo: Bayernoil Raffineriegesellschaft mbH Ingolstadt Refinery

that we designed suitable processes for this project and have helped us to make good progress with the remediation work here at Ingolstadt". He continues to say that "at this site the main pollutants are heavy oils, lighter fuels and PFCs. Much of the soil is a mixture of gravel and sand. This means that it is highly permeable, and the remediation project is using a combination of technologies, which are suited to the local conditions to return the site to an acceptable state for future use as a technology park".

Air sparging is used to release volatile pollutants from 10 hectares of land where the refinery and its associated storage tanks once stood. These chemicals are either incinerated using a flare or catalytically oxidised. To remediate the ground water, it is pumped to the surface where it is purified using a water treatment system, which relies on a combination of filtration and adsorption processes.

1,200 Tonnes per day of sand, gravel and stones from the ground are excavated and thoroughly washed on site in a purpose-built unit constructed and operated by the consortium, which is responsible for the site remediation operations. After this washing and settlement process, 90% of the excavated gravel and sand can be returned to the site to form a clean and stable foundation for future building construction. A minimal amount of the sludge from the washing and settlement process is left. This material is compressed to a cake containing most of the hydrocarbon pollutants from the legacy refining operations. It is taken offsite for incineration or landfill.

One of the unique aspects of the site remediation work is that most of the activities take place on-site and almost all the excavated material is returned to the site. Only a small percentage of material is removed from the site for further processing or disposal. Most of the remediation is completed using equipment that will remain on the site until

the clean-up work is complete.

In Bavaria, where the site is located, PFC contamination is taken extremely seriously. During refinery operations, fire fighters practiced using foams, which contained PFCs. These contaminated the soil and groundwater close to the fire-fighting exercise area. The 'Guidelines for assessment of PFC contaminants in water and soil' requires on site treatment of PFC contaminated materials. This guideline is the strictest in Germany and could potentially become a Germany-wide or European guideline and may also be written into national or European law at some point. Therefore, this remediation project in Bavaria may serve as an example that future ex-refinery clean-up operations may be able to learn from in the future. The necessary remediation of soil and groundwater is planned to be completed by the end of 2022. Ultimately, 15 acres of the ex-refinery site closest to the Danube River will be returned to a natural habitat. The meadows that form the natural riverbank are home to many rare species and the additional habitat will help to secure the future survival of valuable and diverse flora and fauna. By 2023 the technology park is scheduled to open. IN-Campus will not only be for use by Audi, it will also become the home for many automotive sector suppliers and service providers. Innovative digitalisation concepts such as autonomous driving and the car-driver user interface will also be developed. With the broader energy transition, industry mega-trends and employment shifts in mind, it's a sign of the times, that a European refinery is making way for battery electric vehicle development, a car safety testing centre and automotive focused high-tech ventures.

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