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BEST info

FOR CUSTOMERS AND PARTNERS OF THE BAUER ENVIRONMENT GROUP

2010 ISSUE

BMU FWS ESAU&HUEBER

Dear customers and partners,

The BMU management team: Johann Mesch and Peter Hingott

We are marking the 20th anniversary of BMU by taking the opportunity once again to tell you about some of our latest activities.

The 20-year history of BMU is just a moment in time compared to the 220 years for which Bauer has existed. Yet it does offer the chance – in our fast-moving, dynamic and globalized world – to take a brief pause for reflection and review.

The early days in Germany were marked by a sense of euphoria at the idea of helping to clean up the environment, including our soil and water, as thoroughly as technically possible, driven in particular by massive market growth in the new federal states of eastern Germany, but that enthusiasm was very quickly dampened by one sobering question: "Who is going to pay for it all?".

In the subsequent more than 10 years of crisis in the construction sector, many companies struck upon the idea of moving into pollution remediation. In doing so, they often ignored the fact that eliminating contamination from water and soil is a highly challenging task both technically and ecologically. Moreover, the technologies employed were subject to frequently changing "fashions". On-site remediation using mobile washing plants, or even thermal plants, demanded high levels of capital investment. Poorly planned and cheaply executed pump-and-treat measures increasingly proved to be a waste of money. High landfill capacities and recultivation demands led to a surge in disposal costs and merely transferred the problems from one location to another. Replacement bores were discussed for many years before finally being established as the state of the art. For a long time, in-situ techniques were rejected, whereas they are now regarded as modern. There were also many new technologies which disappeared back into the drawer, however, not just because they were not right for the market, but because – as one public official put it – "we in Germany need to see proof of 30 years' practical experience before a process is widely deployed".

Operating for 20 years on the pollution remediation market has also meant 20 years of dealing with a forest of legislation which – instead of being made simpler, as promised – has tended to become more and more complicated. We have long been debating the virtues of unified environmental legislation throughout Germany, while practising precisely the opposite.

Remedial environmental protection has fallen entirely out of favour at present, while funds are invested without hesitation when buzzwords such as "energy saving" or "carbon reduction" are mentioned. The result of such an attitude is that funding of millions of euros for an indoor swimming pool built to the "passive house" standard is readily found, yet any commitment to remediating urban industrial brownfield sites continues to demand a great deal of idealism and courage. Has there ever been a carbon footprint comparison that has set the destruction of green fields against the utilization of disused urban brownfield sites? No, because pollution remediation does not attract "glamorous" publicity.

And so it is all the more pleasing that, despite having to overcome adverse conditions, BMU has now evolved into the BAUER Environment Group – an organization which now has six international subsidiaries and two plant construction business units. We are now not only engaged in remediating groundwater and soil; we have grown into a specialist in all forms of water engineering. As this issue reveals, we are also developing large-scale BOT projects in collaboration with our customers. We are carrying out intensive process development work in order to gain a competitive edge on the market. Through all the years, we have retained our flexibility to respond to fast-moving markets and our ability to meet your needs – the needs of our customers and business partners – in an optimum manner.

This issue of "Bestinfo" once again provides a brief overview of what we do.

In conclusion, I would like to thank you for your 20 years of trust in the BAUER Environment Group, and to express my hope and belief that we will continue to prosper in a spirit of mutual cooperation.

With best wishes from the BAUER Environment Group,

Johann Mesch

Peter Hingott

20 years of environmental technology in the BAUER Group

Most stories are founded on prior historical events to some extent. Before BMU (BAUER & MOURIK Umwelttechnik GmbH & Co KG) was founded in 1990, BAUER Spezialtiefbau GmbH had already begun working on environmental projects. Back then, environmental technology was a new and highly topical field. It quickly became apparent that the remediation of soil and groundwater was not something which could be handled by the chemical industry alone, but in fact demanded an interdisciplinary approach managed by the construction sector, primarily in the specialist foundation engineering field.

"Starting an environmental technology company was the first time we had established a business unit entirely in pursuit of a predetermined strategy," recalls Thomas Bauer, Chairman of the Management Board of BAUER AG. The strategic approach included commissioning engineer Claus Brede to seek out a suitable partner. Brede found that partner in the Dutch company Mourik Groot-Ammers. The Netherlands was a leader in the new technology at the time, as the geography of the small, densely constructed country – in which the groundwater extends almost up to the surface – forced it to manage soil and water in a rationalized manner and to clean and re-use contaminated land.

One person involved from the very start – who worked on initial environmental projects under Bauer Spezialtiefbau – is Jürgen Gesslein. He joined Bauer in April 1989, as a graduate in environmental protection engineering from technical college. It was a period which entailed a steep learning curve, not just for the new young staff joining the business but for all concerned. And, as is often the case with start-ups: "In the early days, Managing Director Claus Brede and I had to share one small office," Gesslein recalls.

Bauer and Mourik needed time to establish a working partnership. They were used to employing differing approaches, in terms of their marketing especially. Gesslein explains: "Mourik was the market leader in the Netherlands and, based on the country's geography, employed a different strategic approach to the one required for operating on the much larger German market." In Germany there was tough competition between contractors from a variety of sectors, and other differences: "In the federal system prevailing in Germany, each state has differing pollution control laws; there are almost more laws than states." The widely varying geology and the different groundwater conditions were also new for Mourik.

As Gesslein reports, the Mourik plant was technically first-class and robust, but problems arose with regard to German regulations: "When the plant was installed at Boehringer in Mannheim, the safety department objected to many details." The objections did not stem from lack of diligence on Mourik's part: "These were their first steps on the international market. We now know that when we are launching operations in a new country we first have to find out in detail about all the relevant laws and regulations."

The early orders came from Boehringer; Berlin Spreeschanze; remediation of kerosene contamination at the US Rhine-Main Air Base in Frankfurt; and a biological gasworks remediation project in Karlsruhe – a research project in cooperation with Karlsruhe University. BMU generally enjoyed a successful market launch, particularly after German reunification in autumn 1990, as high demand for remediation work in the new federal states in the east became prevalent.

However, the environmental technology sector has to deal with new legal requirements and regulations to a greater extent than any other area of the construction industry; very few other sectors have to take so much notice of ongoing policy decisions. This also affects the continuity of the environmental business. Policy focus can shift very rapidly – usually depending on budget constraints. This may entail a wide fluctuation in the tendering of public-sector contracts, and levels of environmental subsidy for private contracts also tend to vary. Also, remediation technologies are subject to fluctuating degrees of acceptance, both by public authorities and by consulting engineers. This demands great flexibility, as well as a broad spread of know-how in the various technologies.

Soon after Gesslein, qualified chemist Hans Mesch also joined BMU, becoming a director of the company alongside Claus Brede. The pair steered the business through numerous years of growth until Claus Brede's retirement in 1995. Environmental technology was continually gaining in importance within the BAUER Group. In 1996 Bauer bought out Mourik's shares, and since that time BMU has been a fully owned Bauer subsidiary. New technical personnel were recruited, so that today the workforce of 270 – including the company's international subsidiaries – embraces a wide variety of different disciplines, trades and professions. In "hardware" terms, soil treatment centres were established at Hirschfeld and Bleicherode, and in 2003 the facility in Schrobenhausen was opened. New companies were also acquired: FWS in 2003; and in summer 2008 Esau & Hueber.

Jürgen Gesslein has been involved in Bauer's environmental operations right from the beginning. A man with an artistic bent, he enjoys turning plans into decorative graphics. The work on the wall here depicts replacement bores.

A wide variety: In-situ remediation techniques

In-situ techniques are employed in environmental remediation projects in a variety of forms. In many cases, soil remediation without excavating the material is the best option in both commercial and technical terms. BMU has reported on in-situ projects regularly in the past.

In-situ techniques are deployed when
- a property needs to be retained in use while the remediation is ongoing;
- site conditions make excavation of the material technically impossible or very difficult;
- the solution offers a cost-effective alternative to conventional techniques.

In in-situ remediation, substances such as micro-organisms, nutrient solutions or oxidants are introduced into the contaminated ground in order to decompose the organic pollutants. This method of remediation takes longer than ex-situ techniques, as material transport plays a limiting role. In-situ remediation is always employed as a project-specific solution. For the technique to succeed, contractors must be thoroughly aware of the customer's needs and must collaborate effectively with the government agencies involved. Treatment methods include physical, chemical and biological techniques which remove pollutants from the soil or groundwater and convert them into non-harmful substances, or prevent them from spreading. A number of projects are presented in the following.

Thermo-stripping in Landshut

Beneath a historic building which in earlier times housed a dry-cleaning business, VOCs (Tri, Per) and BTEX were

discovered over an area of some 300 m². As the building was a listed monument and so could not be demolished, BMU – working in close cooperation with the municipality of Landshut and the planner – proposed two special remediation processes: THERIS (thermal in-situ remediation) and TUBA, a thermally assisted soil vapour extraction technique. The method deployed essentially consisted of some 100 heating lances (for the THERIS process), three vapour injection levels and 55 soil vapour extraction levels as well as a vapour/air injection plant and a soil vapour extraction plant with downstream catalytic oxidation. A downstream gas washer to remove the chlorine from the exhaust air rounded off the system, which had to be installed in a space measuring no more than around 70 m². Some 600 kg of VOCs were removed in a remediation phase lasting approximately four months.

Use of nano-iron in Donauwörth

At the Eurocopter location in Donauwörth the subgrade was contaminated by solvents (VOCs). Nano-iron was chosen to remediate the source because it acts effectively on a small scale (Ø range ~ 1.5 metres) and results in direct decomposition of the pollutants with no harmful interim products (vinyl chloride). Pollutants are reduced more quickly with nano-iron particles than by microbial techniques as there is no graduated decomposition from trichloroethene to ethene. Instead, the reactive surface of the nano-iron is used to decompose VOCs directly. The slurry was compacted using a Bauer diaphragm metering pump and 2 to max. 4 bar pressure. To seal the grouting zone at the bottom and top, compacting was first executed through the bottom 5.5 metre wide opening and the top 2.5 metre wide opening. Owing to the immediate proximity of a building that contained highly sensitive helicopter assembly machinery, the LASY laser system was deployed as an automated leveller, with online visualization from Bauer, to monitor settlement during jet-grouting. The success of jet-grouting with nano-iron was based on the use of

Remediation field: air and water treatment plant with metering unit

Systematic illustration of various in-situ techniques

SPT testing. Four probes were arranged at distances of 0.3 m, 0.6 m, 0.9 m and 1.2 m from the injection bore in the direction of flow of the groundwater.

Heating oil pollution in Neustadt/Aisch

Some 2,000 litres of heating oil leaked out of the storage tank room of a residential building in Neustadt on the river Aisch, seeping into the ground through a joint in the floor slab. The pollution was revealed when heating oil was noticed in the immediate vicinity of the Aisch. Following a comparative analysis of various potential remediation techniques by an independent consulting engineer, the Enhanced Natural Attenuation (ENA) method proposed by BMU was recommended. The aim of this was to activate and optimize the natural decomposition of the mineral oils in the subgrade by means of in-situ remediation involving the addition of a vaccine solution consisting of bacterial suspension and nutrient salts. For this purpose, three groundwater measuring points were installed: one at the building; one at the river; and one in-between. After adding the vaccine solution there was a temporary rise in CSB at the measuring point close to the building, indicating that the intended biochemical conversion of the mineral oil into its non-toxic decomposition products of alcohols and fatty acids, through to complete mineralization, had taken place. The mostly consistently low chemical oxygen consumption and the normal PHC concentrations at the outflow measuring points were evidence that the pollution had not been transported towards the river. The bacteria had, as intended, been spread around the subgrade area and had begun biological decomposition in the original pollution zone. The CSB levels at the building measuring point have now also normalized, and are below the limit. One follow-up vaccination with nutrient salts has been carried out to date. The remediation is still in progress, and is being monitored by a groundwater monitoring system. All values are in the normal range.

Former NATO air base at Lahr

VHH, PHC and BTEX contamination had been discovered on the site of the vehicle maintenance hall at the former NATO air base in Lahr. After preliminary partial excavation and back-filling, the saturated ground was remediated by a biological in-situ process. In view of the primary pollutants cis-DCE and VC, an aerobic, oxidative dechlorination process was selected. According to trials carried out so far, the best results have been achieved with methane as the co-substrate and oxygen (added by way of hydrogen peroxide). So as also to promote the growth of autotrophic, nitrifying micro-organism bases, a parallel and time-sequenced metering of nutrient salts (urea) was undertaken.

The system consisted of five sampling wells and 10 infiltration wells, each 5" in diameter. It also included a mobile groundwater treatment plant with metering units for oxygen and nutrients, a sand filtration/biology stage, carbon filtration, stripping, and a carbon exhaust air cleaner. The treated water was re-infiltrated on the inflow and outflow sides at a ratio of 70:30.

The microbiological activity is monitored by checking the pollutant content at selected control levels in the centre of pollution and in the outflow.

The pollutant limits will be monitored in this way for three years.

Replacement bores: now state of the art

Where conditions are tight, or work is being carried out close to buildings and remediation needs to be restricted to hot-spots, replacement bores are a potential solution.

The advantages of this method lie in

- its precise recording and control of the documented pollution/remediation balance;
- its minimized application thanks to adaptation to the specific pollution contour;
- its low volumes of pollutant release (degasification, odour) in recovering the soil material based on small-scale, controlled work steps;
- very low volumes of contaminated groundwater thanks to depth-controlled groundwater tapping;
- its reduced groundwater lowering measures compared to wide-area excavation techniques.

Massive soil and groundwater pollution was recorded at a former chlorobenzene production facility in central Germany's "Chemical Triangle" region. The aim of the remediation project was to reduce the contamination in the floor to protect the groundwater and to lower its degasification potential.

The site was divided into two zones. In the former benzene chlorification area, a hot-spot covering approximately 385 m² is being treated down to a depth of 15 metres. The maximum pollutant content consisted of chlorobenzenes (monochlorobenzene and 1.2-dichlorobenzene) in the gram/kg range.

In the former chlorobenzene distillation area, covering some 800 m² and down to a depth of 12 metres below the surface (as much as 11 metres into the groundwater), the expected maximum pollutant content consisted of chlorobenzenes (1.4-dichlorobenzene, 1.2-dichlorobenzene and monochlorobenzene), likewise in the gram/kg range. The groundwater contained high concentrations of chlorobenzenes, BTEX, VHHs and nitrochlorobenzene.

In addition to soil exchange by means of large-bore drilling, hydraulic measures were implemented to recover chlorobenzene from the groundwater. The replacement bores had a diameter of 1,800 mm and were for the most part sunk with overlaps. The accuracy of the bore positioning and the deep-level overlapping was monitored by Bauer's proprietary tachymeter system.

In the casing replacement bore method applied here, a large-diameter rotary drilling rig first sinks a casing into the ground ahead of the drilling tool. Drilling-out in the casing is then executed section by section using a drilling bucket as the tool, which after being sunk is sealed by a lock and withdrawn.

The drilling work is being carried out by the "pilgrim step" method, so as to ensure stability of the ground. Independent primary bores are first sunk, and the secondary bores in between are then executed as joining elements.

In the present case, the bores were executed under water load in order to avoid hydraulic ground break-up. A side-effect was a reduction in odour from the open bore hole. When the final depths (as specified by probing) were reached, the water in the bore hole was exchanged by way of the water treatment plant. The depth-controlled water tapping system specially devised by Bauer Umwelt was used in this. The system extracts contaminated water and replaces it layer by layer with fresh water.

The content of the drilling buckets was transferred to a specially constructed air-tight lockable shovel of a wheel loader, loaded into likewise air-tight containers and transported away. On completion of the bore, uncontaminated soil was installed while the casing was being withdrawn.

Replacement bores were executed with Bauer rotary drilling rigs

Dangerous munitions: CLARK II in Traunreut

Traunreut – The area around the town of Traunreut in Upper Bavaria was home to the Muna St. Georgen munitions factory during the Second World War. The factory produced various kinds of munitions, as well as filling and storing chemical weapons – primarily mustard gas shells. After the war, the Allies used the site to destroy munitions such as CLARK, LOST and Sarin. Most was incinerated on-site, though not without leaving some residues.

The town of Traunreut as well as commercial and industrial estates were built, in part, on the contaminated ground. In recent years, suspect areas have been cordoned off and subjected to further testing. These investigations revealed a burial site for detoxification residues – the so-called CLARK pit, containing "CLARK II", a highly aggressive munition, as well as decomposition products containing arsenic and prussic acid.

The chlorine/arsenic-based weapon CLARK, a diphenylarsine cyanide, also known as "Blue Cross", had been deployed as a "gas mask breaker" as far back as the First World War. The filters of the time provided no adequate protection against it. The severe irritation it caused forced soldiers to remove their masks and rendered them vulnerable to other weapons.

In view of this history, safety was a major factor in this munitions clearance and soil remediation project. Project manager Herbert Mesch comments: "Never underestimate these poisons; there is no room for error when safety is at stake!"

Enclosure over the CLARK pit in Traunreut

The client was also aware of the dangers. At the end of the Europe-wide prequalification procedure, only three bidding consortia were approved to submit a tender. Based on a largely functional tender invitation, a consortium under the technical leadership of BAUER Umwelt GmbH was contracted to recover and clear the contaminated material.

Handling of the barrels using a specially developed glove box

Working together with Esau & Hueber and FWS, special equipment was developed to excavate the munition residues and contaminated soil and transfer it to barrels. "It's a big advantage to have such bundled expertise at our disposal within the BAUER Resources group," asserts project manager Michael Karius.

Once the CLARK pit had been enclosed with sheet piles and a hall built over it, the hall had to be ventilated. FWS installed an exhaust air treatment plant which exchanged some 15,000 m³ of air per hour and reduced the pollutant concentration in the air with the aid of special activated carbon. "It would otherwise have been absolutely impossible to carry out remediation work inside the housing," states Herbert Mesch.

Direct contact with Clark II is life-threatening even when wearing modern-day protective suits. Consequently, the recovery and disposal operation was planned with appropriate care and attention. This included establishing a complete emergency system, with specially trained staff in attendance and the local fire service on permanent standby, as well as a helicopter to enable any casualties to be flown without delay to hospital in Munich.

A munitions expert monitored the recovery of the crystalline CLARK pure substance using measuring equipment. Then the CLARK pure substance and the slurry containing CLARK had to be transferred to specially approved barrels. For this operation, BMU together with Esau & Hueber devised a funnel system whereby the personnel working on site did not come into contact with the toxic material. Staff stood behind Plexiglas screens while the sealed excavator, complete with its own independent oxygen supply, filled the barrels. The barrels, complete with additional inliners, were closed down by hand, and remaining soil adhering to them removed, by the staff using special gloves reaching through the barrier. Approximately 110 m³ of highly contaminated spoil was processed in this way, filling some 5,400 barrels.

The barrels were continuously monitored by measuring equipment so as to keep a check on contamination levels. This was key to the transportation and disposal process. In view of the enormously high disposal costs, the separation of the various wastes is of vital importance. Work on the highly contaminated area was completed in mid-January 2010. By mid-March the entire project was complete. BMU Managing Director Hans Mesch regards the most important factor in the whole operation as being "that we were able to guarantee the health and safety of all staff in an optimum manner!" Such projects also illustrate the key importance of the company's DIN-ISO and SCC certified quality management system.

Three Bauer companies carry out soil remediation in Lübeck

Lübeck – The site for the new Bauhaus DIY store was a metalworking location both before and during the Second World War. In the late 1990s VHH pollution of the groundwater was identified. Soil remediation was vital. A major part of the work was carried out by Bauer Umwelt together with Bauer Spezialtiefbau and FWS.

Excavated material is sorted

The preliminary surveying and planning was carried out by consulting engineers "Ingenieurbüro Boden & Wasser"; BAUER Umwelt GmbH assisted the planning procedure. The preliminary surveying was difficult because of the scale of the site. The developer is Gutenbergstraße Grundstück-& Vermögensverwaltung GmbH Handelscenter Lübeck.

The Bauer companies drew up a detailed remediation plan and implemented it step by step. Preparations for the remediation work revealed a number of obstacles, such as the foundation stone for a railway turntable, various other foundations and an old solvent tank, all of which was dismantled and professionally disposed of.

For classification and subsequent loading of the exchanged soil, an enclosed 800 m² collection area and an extractor system to protect against emissions were set up. Two wells in the groundwater outflow zone were intended to collect the pollutants activated by the remediation work, with the water treatment process required to guarantee a throughput of approximately 5 m³/h.

Bauer Spezialtiefbau executed replacement bores in 1,800 mm diameter using a Bauer BG 40 drilling rig. In 14 working days, drilling a length of 930 metres, over 11,150 tonnes of contaminated material was exchanged and – after being classified into various contamination classes – shipped off for disposal. Soil exchange was executed over an area of 400 m² down to a depth of 6 metres under a working platform, socketing 0.5 m into the till. After partially backfilling the remediation zone and sealing the surface, the area was handed over to the developer.

Replacement bore drilling with a high-performance Bauer BG 40 rotary drilling rig

Consistently top drinking water quality for Paderborn

Paderborn – Water company EGGE-Wasserwerke GmbH supplies a number of communities in the district of Paderborn and parts of Bad Driburg in the Höxter district from its Hossengrund waterworks in Altenbeken. The plant's maximum processing capacity is 250 m³ per hour or 6,000 m³ per day. It supplies drinking water to 25,000 people.

The untreated water comes from a well and a surface-influenced spring water catchment area. Spring water, in particular, is regularly susceptible to turbidity in the event of heavy rain and during snow melt periods. As a result, many utilities – including EGGE – choose to retrofit an ultrafiltration plant to treat the drinking water.

Ultrafiltration is the only process capable of removing all pathogens and turbidity from the water with minimal energy input – regardless of the quality of the untreated water. Even the specified turbidity of the untreated water at the Hossengrund waterworks of a maximum of 400 NTU (according to German regulations, drinking water must have a turbidity of < 1 NTU; beer has a turbidity of 40 NTU) is easily captured by the ultrafiltration membranes. This is no great surprise, as the pore width of the membranes is specified as just 20 nanometres. To illustrate the point further: if an ultrafiltration pore had a diameter of one millimetre, it would correspond to a human hair with a diameter of five metres. The membranes capture over 99.999 percent of all bacteria and viruses (separation limit 100 kDa).

The specialists from Esau & Hueber, part of the BAUER Environment Group, employ technology from Bavarian company Inge Watertechnologies AG for their ultrafiltration membranes. Inge membranes are practically indestructible thanks to their unique structure, and so guarantee maximum possible safety. The material is modified polyether sulfone (PESM). Judicious selection of all the components of a water treatment plant is of great interest to Esau & Hueber too, as the plant manufacturer has to give far-reaching guarantees in terms of water quality and pure and flush water volumes.

The ultrafiltration plant for Hossengrund is executed as a twin-tract system. The resultant redundancy ensures maximum possible safety of supply. A flat-bed aerator was installed downstream of the ultrafiltration plant to de-acidify the now crystal-clear water. In this process its pH value is raised from 6.9 to over 7.7. To achieve this, several thousand cubic metres of air every hour is compressed and distributed in the water by way of ceramic cells. The compressed air strips carbon dioxide out of the water.

The BAUER Environment Group's drinking water specialists use a speed-controlled rotary piston blower in place of the specified side-channel compressor to generate the necessary compressed air. This unusual combination delivers an annual energy saving of more than 50,000 kilowatt-hours compared to the standard method.

The EGGE water company places great value on the durability of plant as well as on cost-effectiveness. This was a further factor in the decision to award the contract to the BAUER Environment Group. The stainless steel components and the pipes were subject to the highest quality standards. BAUER's impressive manufacturing quality and adherence to completion deadlines also helped to ensure problem-free acceptance of the plant in March 2010, following the three-month run-in and trial operation period.

Securing against risk in project development

Dr. Dietrich Mehrhoff, LANDPLUS GmbH

The amendments to the German Building Code, urban renewal programmes and – not least – the assessment criteria for sustainable building have created previously unseen opportunities for the development of brownfield sites and disused land.

Nevertheless, such locations do not really offer the same opportunities as greenfield sites, despite their position, their level of development and their infrastructure links. Even if the estimated demolition and remediation costs can be deducted from the purchase price, there are additional risks relating to the ultimate actual cost of removing pollutants from buildings, from the ground and, perhaps, from the groundwater; the foundations below ground requiring clearance; and the safety and marketability of the site even after it has been redeveloped. These factors cause many investors and developers to shy away from such projects.

And then there is the ongoing impact of the banking and real estate crisis: it will be even more difficult to finance such risky projects in future because of their worsened risk ratings.

We are expert assessors and consulting engineers who have been working for over 20 years – and under the logo of our LANDPLUS GmbH unit for the last five years – on areas including the possibilities for identifying and assessing such potential risk and making it more transparent, as well as pointing out ways in which such risk – often of "deal-breaker" magnitude – can be largely isolated from the process of project development.

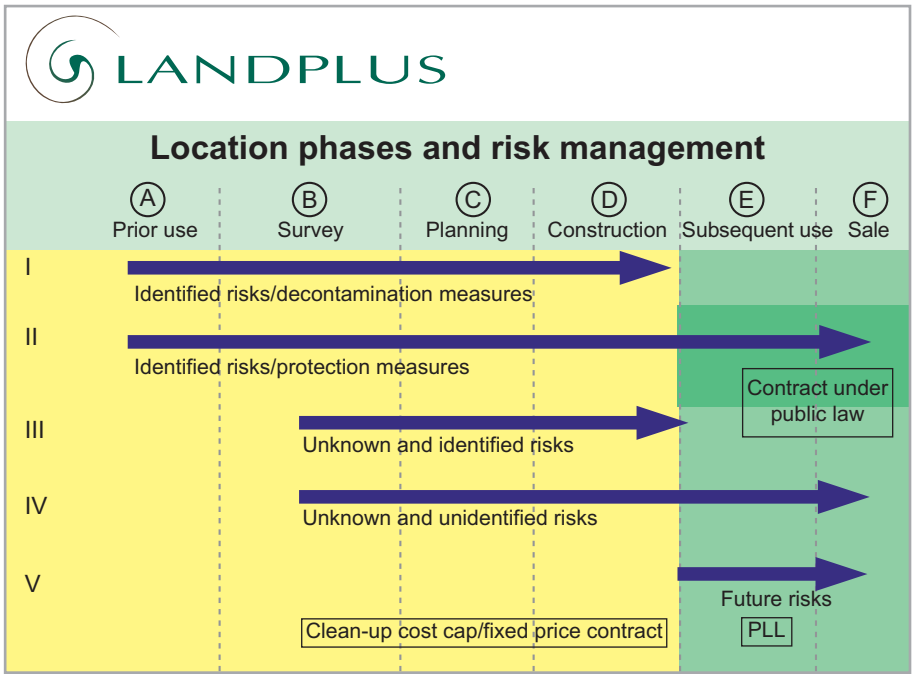
For this purpose, we analyzed the life-cycle of a property requiring renovation in terms of various renovation scenarios. The result can be summarized quite simply:

Until completion of the construction phase (yellow area) the inherited pollution poses a purely financial risk. There are already enough highly qualified companies on the market, such as the BAUER Environment Group, who are willing and able to assume the execution risk involved, where appropriate also with regard to exceeding of masses, on a fixed-rate contract basis.

The situation with regard to the green highlighted area is more critical: there are a wide variety of reasons why residual risk may still arise – despite having renovated a site, apparently successfully, if it has not been fully decontaminated – which may not come to light until much later after the construction phase. This may relate to previously unknown contamination which is only found in the second construction phase; pollutants which have not been investigated at all; or remediation and protection systems or components which will not be effective in the long term and so endanger the apparently successful renovation project subsequently.

There are also future risks, such as that limits will be made more stringent; that new pollutant parameters may require investigation; or that the legal framework conditions may change. In such cases – and where there are new findings as to the pollution situation – the competent authorities may require further remediation, even if the remediation measures have been laid down in a contract under public law. That is to say, the legal basis for the business might be voided.

However, there is now a solution even for those risks: they can be covered by insurance.



Operational planning system for re-use of a formerly contaminated site

Such insurance policies usually run for a term of 10 years – perfectly adequate for the external financing phase, for example, or to complete the actual project development and to sell on the rented-out property. And the new owner would then of course also profit from the cover, even if the property is parceled.

Premiums work out generally at less than EUR 5 per square metre as a one-off premium, with cover adaptable to specific needs. That is on a scale which can be compensated, at least in part, merely by obtaining better financing terms (or in-

Project development with Landplus: Dr. Dietrich Mehrhoff

deed is such as to make financing possible in the first place) and in many cases is probably less than the "price discount" achievable in contract negotiations based on the pollution issues...

Another important aspect is that the property remains insured even when sold on, making this an ideal concept for fund transactions too.

This enables cover to be provided for:

- the success of the approved remediation variant;
- liability claims of third parties (under public and/or private law);
- changes to environmental legislation (such as new pollutant parameters, different limits, etc.);
- unidentified inherited pollution and new contamination.

This means, for example, that the basis of a remediation contract under public law can also be secured or mercantile value reductions can be incorporated into the property valuation.

The property thus again provides security for the lender and so, perhaps, makes it possible to develop a project in the first place.

If you have any questions, or need more information, visit the Landplus website at www.landplus.com and contact us as required.

Remediation of the former gasworks in Plauen

Plauen – From August to December 2009, BMU carried out a comprehensive soil remediation project on the facility of the Wärmeversorgung Plauen utility. The site housed a gasworks from 1912 to 1976.

Pollutants entered the soil and the groundwater during the period of gas production. In the early 1990s this pollution was surveyed across the entire site. To attain the remediation goals, the pump-and-treat groundwater remediation which has been ongoing since 1997 would need to be maintained over the long term.

Now enviaM has engaged consulting engineers Arcadis Consult GmbH as the general contractor to handle the pollution remediation. The decision was made in favour of a combination of in-situ measures and remediation by soil exchange. The remediation concept was developed and technically implemented jointly with BAUER Spezialtiefbau GmbH, ARCADIS Deutschland GmbH and Bauer Umwelt.

The contaminated areas were divided into three pits, enclosed using three different techniques: with a bored pile wall, sheet piles and soldier pile wall. The excavation depths were between four and six metres.

The largest of these excavation pits, covering an area of 1,000 m², was sunk four metres deep. Working from this level, a double-row retaining wall was constructed around the pit. Under the protection of the retaining wall, a further two metres were excavated and back-filled, all accompanied by continuous lowering of the groundwater.

The smallest pit, covering an area of 100 m², posed a particular challenge. A two metre wide cable harness, comprising more than 60 single cables, ran through the pit. This had to be suspended and undermined. Employing a great deal of manual work and small equipment, 400 cubic metres of soil was removed and back-filled. Over 16,000 tonnes of soil material in total was disposed of. The work was carried out subject to stringent health and safety requirements, with a black/white system, tyre washer and continuous air monitoring.

The pits in Plauen had to be divided into multiple areas

Bauer Umwelt in Oman – Nimr Water Treatment Plant

Oil well in Oman

In Oman, Bauer Umwelt is constructing a gigantic reed-bed treatment plant – covering 235 hectares – capable of processing 45,000 m³ of waste water per day from oil wells. This project – the largest of its kind in the world – is scheduled to run for an operating period of 20 years.

The plant is being constructed to dispose of "produced water" – that is, water which is transported along with the oil out of the ground. It will replace deep wells currently used for disposal of the contaminated water. On average worldwide, oil and water are produced at a ratio of 1:9. The Nimr oil field produces some 240,000 m³ of produced water a day. It is forecast that in future this figure will even rise to 270,000 m³. The existing deep well disposal (DWD) capacities have reached their limits, and the system is also expensive and energy-intensive. The Nimr Water Treatment Plant (NWTP) will provide the necessary additional capacity and effect a shift away from disposal of the water to recycling.

Bauer Umwelt, with its naturally-based concept for the NWTP, emerged as the winner of an international prequalification and bidding procedure lasting a year and a half. At the end of 2008 it was awarded a DBOO (Design, Build, Own, Operate) contract by Petroleum Development Oman (PDO).

The concept underlying the plant is based on largely energy-free operation, underscoring its ecological character and sustainability. With its planned capacity of 45,000 m³/d, the plant will treat over a fifth of the site's produced water. The plant essentially comprises seven sections:

1. **Transfer point and measuring zone:** This is where the water volume, temperature, pressure and oil-in-water content are measured online. There are also water sampling points for chemical analyses. The steel pipes in the infeed area, with their special oil- and salt-resistant coating, are 813 mm in diameter.

2. **Oil separator:** A 5.50 metre deep steel-reinforced concrete circular basin in 25 m diameter is being constructed upstream of the oil separator. The automatic separator consists of eight spirals, and is built into a steel- reinforced concrete rectangular basin.

3. **Buffer basin:** The buffer area of the plant, sealed by a plastic strip, is 1.8 km long and 60 metres wide, and provides a two-day water buffer.

4. **Distributor structures:** The distributor structures regulate the water level in the buffer area. From there the reeds are loaded or dried. Waste water, slurry or fertilizer for the reeds can additionally be added here.

5. **Reed beds:** The reed beds comprise six parallel lines, each made up of four terraces. They biologically clean the constituents of the waste water. This will produce approximately 9,600 tonnes per year of dry biomass for recycling. The 24 reed beds have a total surface area of 2,340,000 m². The outflow volume from the reed beds will be 20,000 to 25,000 m³ per day, feeding into the salt bed.

6. **Salt bed/evaporation area:** This area is divided into three terraces, designated respectively as the reservoir, evaporator and concen-trator, and covering a total area of 285 hectares.

7. **Salt bed/salt production:** Finally, salt crystallization takes place here. The plan is to produce approximately 60,000 tonnes of salt (NaCl) per year, with a purity of over 99 percent.

One of a total of 12 infeed structures distributing the 45,000 m³/d over 1.8 km

The first tests for planting of the reed basins have been running since February 2010

In the course of the project, test beds were constructed to test the mineral packing and the planting method. Both tests were completed successfully. The greening, in particular, has never before been realized on this scale and under such conditions. One of the test beds was planted in early February 2010. The reed growth has far exceeded the high expectations, delivering a complete success and representing a key milestone on the way to completion of the overall plant.

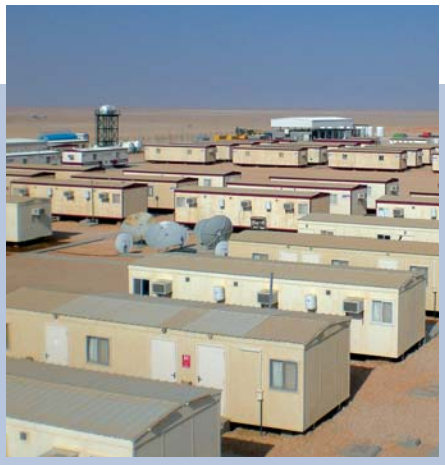
Living and working on the edge of the desert

Six-day weeks and temperatures in the summer reaching 50 degrees in the shade – conditions that in Europe would be considered very undesirable. But those are the conditions under which anyone working on the large-scale reed-bed treatment plant in Oman has to operate. Dr. Roman Breuer, director of the Nimr Oman undertaking together with Alexander Dittmar, has overseen the construction works for a period of many months since 2008.

Living and working in the conditions under which a project of this kind is carried out is anything but a life of luxury. "It really is very barren out there. It's like being on the proverbial desert island," comments Roman Breuer. A camp has been set up for staff at the edge of the site – a container village providing the basic amenities. There is a canteen with a buffet, for which users can suggest new additions and variations; a small shop; two TV rooms; and there is a little bit of greenery around the camp too.

The site staff has been gradually built up over the last 18 months. In the early stages there were as many as 12 Bauer specialists on site; now there are only four. Of the total staff of almost 50 people, some 40 percent are Omanis, 20 percent European, another 20 percent Indian; the rest is made up of workers from Nepal, Pakistan, Australia, Indonesia, Lebanon, Sri Lanka and Sudan. As the work has advanced, some unskilled workers have been able to progress gradually to more challenging tasks. "The team has the potential to develop," says Roman Breuer.

Dr. Roman Breuer has been overseeing the construction work on the reed-bed treatment plant in Oman for many months



The camp is temporary home to between 150 and 450 workers, depending on the construction phase and the work at hand

There is also entertainment at the end of the working day, though the choice is not very wide. A football pitch and a volleyball court do at least offer the opportunity for staff to get some exercise. On days off – in accordance with Islamic law, Fridays – workers can drive an hour to a nice beach on the coast. And for expats from Europe and elsewhere looking to delve into the mysteries of Oman, there is also the chance to experience the country's ancient culture, visiting the cities of Masquat – where the Bauer office is located – or the old capital Nizwa.

The nodding donkeys of the oil wells, which have been in operation since 1978, are barely visible from the construction site, being 5 to 20 kilometres away. Nimr is the richest oil field in Oman. The reed-bed treatment plant is scheduled to be essentially complete in autumn 2010, and will begin its 20-year operation phase in early 2011.

After fire in tyre store: Extinguishing agents place drinking water at risk

Groundwater remediation of PFT damage

Rodenbach – A major fire at the tyre store in Rodenbach in the Pfalz region of Germany in October 2008 entailed consequences for the environment, and in particular the groundwater: to quell the flames, specialist extinguishing agents were deployed which, in addition to water, contain low concentrations of so-called perfluorinated tensides (PFTs).

PFTs are organic surface-active compounds which do not occur in nature; they are purely technical in origin. They pose a particular environmental hazard because they do not decompose sufficiently; they enrich in human and animal tissue; and they are suspected to be carcinogenic. Even minimal concentrations in the groundwater cannot be tolerated.

During fire-extinguishing, these substances penetrated the ground and entered the groundwater, where they threatened the nearby drinking water source. Defensive measures were taken immediately: a barrier comprising eight wells assures safe use of groundwater and drinking water around the region. Just a short time after the fire, BMU constructed a treatment plant.

The plant treats the contaminated groundwater from the wells, employing a special activated carbon which cleans the persistent chemicals so effectively that they are no longer detectable even by high-tech measuring instruments. The question as to how much longer the treatment plant will have to operate remains open.

Natural-based slurry treatment

Hirschfeld – In a large-scale trial in conjunction with UFZ Leipzig, natural-based processes are currently being tested. Sediment has been taken from the Elster basin in Leipzig and fed into a BMU treatment basin at the Hirschfeld soil treatment centre. The test basin is divided into five different planted sections: 1 and 2 contain pre-cultivated reed canary grass (RCG), with 5 and 10 plants per square metre respectively; 3 contains conventional sowing of RCG seeds; 4 contains no sowing or planting, for spontaneously occurring growth; 5 contains "hydro-seeders" for sowing of RCG seeds.

Welcome from Bernd Hubricht, Mayor of Reinsberg, at the "Natural-based processes" symposium

Sediment analyses and plant studies were conducted before, during and after the vegetation period. At the end of the first vegetation period half of the area was harvested and the cuttings were composted.

The findings from the first vegetation period can be summarized in brief: the pre-cultivated RCG, with its deep rooting in the sediment, proved much more effective than the shallow-rooted spontaneous growth; the sowing method was successful, but the pre-cultivated grasses planted by hand were "ready" faster by virtue of their early growth advantage; the redox potential in the sediment (oxygen supply through the roots) increased; the organic dry mass in the sediment decreased by around 20 percent (increasing storage capacity).
The overall test will continue through the second vegetation period until October 2010.

Plants in the test bed

New management team at FWS

FWS Filter- & Wassertechnik GmbH has expanded its management team with effect from mid-2010. Joachim Huth has joined existing director Peter Amler on the board. The company has also recruited additional engineers and project managers.

The new FWS management team: Peter Amler and Joachim Huth (right)

Contribution to FRAPORT extension project

For the FRAPORT project, extending Frankfurt Airport, FWS has supplied a number of plants for groundwater retention and treatment in various segments of the construction works. The company's responsibilities included consultations with the competent public authorities and obtaining the necessary approval for the infiltration system. Key challenges on the project, alongside assuring high system availability, were posed by the need to install and operate units on the airport apron, subject to extensive security controls and access restrictions.

FWS supplies gas treatment plant

Following the amendment to the German Clean Air Regulations ("TA Luft"), new limits now also apply to emissions from combined heat and power stations (CHPs) with effect from January 1, 2010. Compliance with the new, more stringent limits can be attained by means of an upstream cleaning stage. And it is well worth the effort! Under the terms of Germany's Renewable Energies Act (EEG 2009), operators of CHPs who elect to install the system and comply with the new limits can receive the so-called Emissions Reduction Bonus.

Site acquired

At the end of 2009 FWS succeeded in buying the site of its head office premises, Schafwiesenstrasse 5 - 11 in Dunningen-Seedorf. The company had merely rented the premises previously. The purchase marked the first step in a long-term plan to redevelop the facility.

Dr. Roman Breuer making his presentation

Dr. Roman Breuer at Oman Business Day

Dr. Roman Breuer from the Bauer Environment Group was a guest speaker at the Oman Business Day held in Hamburg in spring 2010. He reported at first hand on the economic situation in Oman, and his presentation was much appreciated by the organizers, EMA e.V.

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