Dr Peter Edwards, Global Cement Magazine

Iraqi cement round-up

Iraq has a troubled past that has adversely affected its development for decades. The country now needs foreign investment to (re)develop its cities and wider infrastructure that have seen under-investment for years. Subject to an increasingly stable political situation, the country is likely to be a hot-bed of development, with oil reserves among the highest in the world. Now that the last US military personnel have left the country, has the time come for Iraq to fully exploit its development potential? The cement industry will have a major role to play if it does.

Above: Sinjar Cement Plant is an example of redevelopment in Iraq. Turn to pages 58 - 59 to read Austroplan's account of this ongoing renovation project.

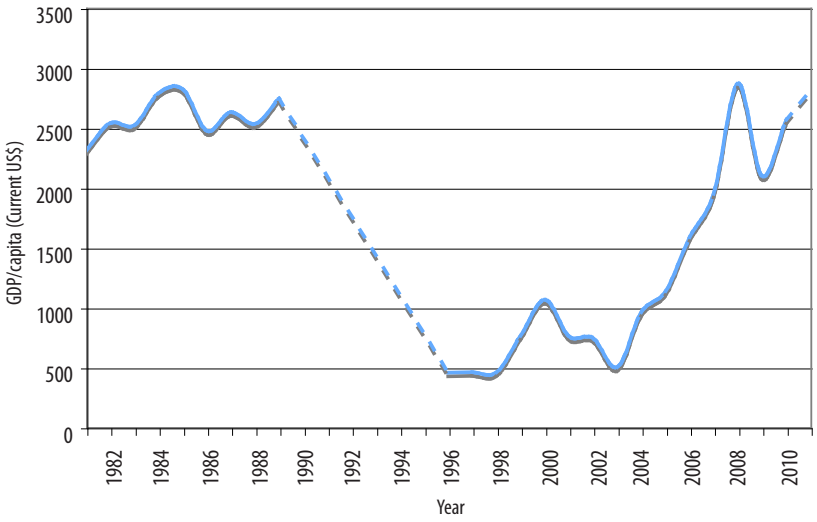
The Republic of Iraq has never been far from the news headlines in the past 30 years. Under the Ba'athist dictatorship of Saddam Hussein it waged war against its neighbour Iran (1980-88) before invading Kuwait in 1990, sparking the original Gulf War (1990-1991).

Throughout the 1990s and early 2000s Hussein increasingly taunted the international governments that claimed the country was developing 'weapons of mass destruction' (WMD). UN weapons inspectors were finally admitted to the country in 1998, the same year that 'regime change' for Iraq became official US foreign policy.

The election of George W Bush as US President in 2000 caused another escalation in international hostility to Iraq, especially post 9-11, and in 2003 the US, the UK, Australia and Poland invaded Iraq, decisively toppling Hussein in just 21 days. Ultimately the inspectors found no indication of supposed WMD.

Current situation

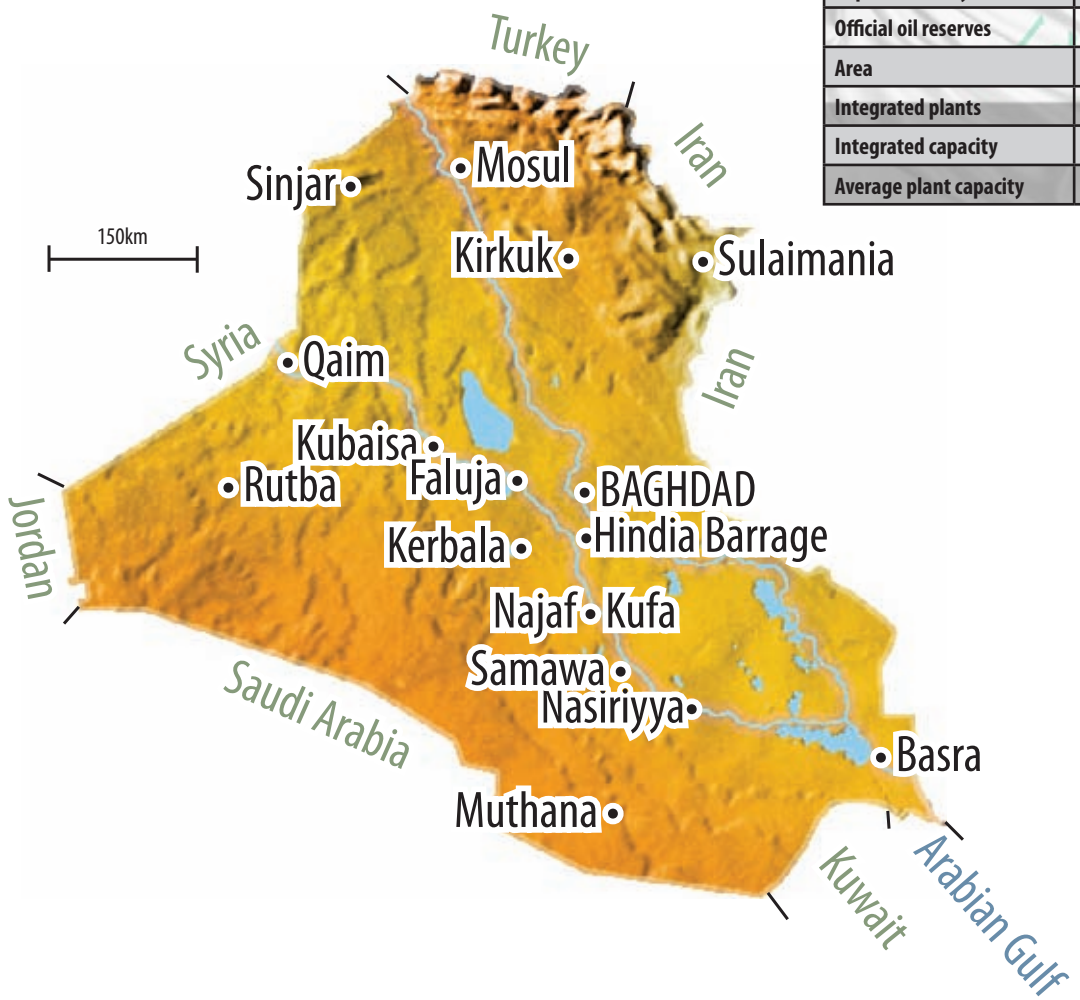
Although it rid the country of a dictator and gave rise to a democratically-elected government, the US-led invasion also gave rise to guerilla attacks against civilian and Allied targets and sectarian violence that continue to today. This has greatly destabilised the country over the past nine years. Despite winning the war against the old Iraqi powers, it was not until late December 2011 that the final US military personnel finally left the 'new' Iraq.



Right: Iraqi GDP/capita (current US$) from 1981-2011 (est.).

The country is in desperate need of rebuilding and new development, which it will likely be able to fund with its massive natural oil wealth. Iraq has the third largest official oil reserves in the world, with estimated

GDP (2011 est.)	US$125.7bn
GDP/capita (2010 est.)	US$2565
Population (July 2011)	30.4m
Official oil reserves	143bn barrels
Area	438,317km^2
Integrated plants	15
Integrated capacity	25.3Mt/yr
Average plant capacity	1.68Mt/yr



Left: Map of Iraq with key settlements, neighbouring countries and areas of water and integrated cement plants.

Company	Plant	Location	Lines	Line 1	Line 2	Line 3	Line 4	Total	Process
Al - Rawi Group	**Qaim**	Qaim	1	3200	-	-	-	**3200**	Dry
	Faluja	Faluja	3	300	350	350	-	**1000**	Dry
	Kubaisa	Kubasa	2	3200	3200	-	-	**6400**	Dry
Iraqi Cement State Co.	**Kirkuk**	Kirkuk	2	3200	3200	-	-	**6400**	Dry
Northern Cement State Co.	**Badoosh - Old**	Mosul	2	300	300	-	-	**600**	Wet
	Badoosh - New	Mosul	2	1250	1250	-	-	**2500**	Dry
	Badoosh - Ext	Mosul	1	3200	-	-	-	**3200**	Dry
	Hammam Al Ali - I	Mosul	2	350	350	-	-	**700**	Wet
	Hammam Al Ali - II	Mosul	1	1200	-	-	-	**1200**	Wet
Private group	**Sinjar**	Sinjar	2	3200	3200	-	-	**6400**	Dry
Southern Cement State Co.	**Najaf**	Kufa	1	700	-	-	-	**700**	Wet
	Al Kufa	Kufa	4	1500	1500	1500	1500	**6000**	Wet
	Muthana	Muthana	2	2500	3000	-	-	**5500**	Dry
	Babil	Hindia Barrage	2	250	300	-	-	**550**	Wet
	Samawa	Samawa	2	3200	3200	-	-	**6400**	Dry
Lafarge	**United**	Sulaimania	2	3600	3600	-	-	**7200**	Dry
	Bazian	Sulaimania	1	7000	-	-	-	**7000**	Dry
	Karbala	Kerbala	2	3200	3200	-	-	**6400**	Dry
MASS Global	**MASS Iraq**	Sulaimania	3	5500	5500	5500		**16500**	Dry

Left: Summary of integrated cement plants in Iraq. **Source:** Multipower International.

reserves of 143 billion barrels. Speculative results from 2011 have led the government to claim that it has the largest reserves in the world.

It can be seen from the graph on page 54 that despite Iraq's current GDP/capita (by Purchasing Power Parity) changing wildly since 1981, it is now at a level similar to that seen in the 1980s. In the 1980s it could not improve because the regime pushed resources into its war with Iran. The Gulf War proved more damaging, with the resultant UN sanctions preventing any meaningful development throughout the 1990s. Since the 2003 US-led invasion the GDP/capita rate has increased once more. Estimated data for 2011 based on a growth forecast of 9.6% indicate that this level is likely to be exceeded in the first half of the current decade.

Above: With increased security, Iraq is attracting new investments from all areas of the cement industry. Left to right: Abdel Hafez Abki (Managing Director, Mondi Industrial Bags - Iraq Project), Yazan Masa (Deputy Sales Manager, Mondi - Jordan paper Sacks) and Issa Azar (Managing Director, Mondi - Jordan paper Sacks) show off sacks manufactured for customers in Iraq at the recent AUCBM Conference & Exhibition in Amman, Jordan.

Below: Shaqlawa countryside in Kurdistan, northern Iraq.

Cement industry - History

The Iraqi cement industry began over 50 years ago with the establishment of the Badoosh cement plant in 1955. In 1963 the Hammam Al Ali I plant was added. In the 1970s and early 1980s many more plants were established. The last of these were at Qaim, which began producing in 1988, and the Sinjar plant, which did not reach its peak output until 1990. Until 2003 all of the plants were run by the state. Many were poorly utilised, although Iraq briefly exported cement in the mid 1980s.

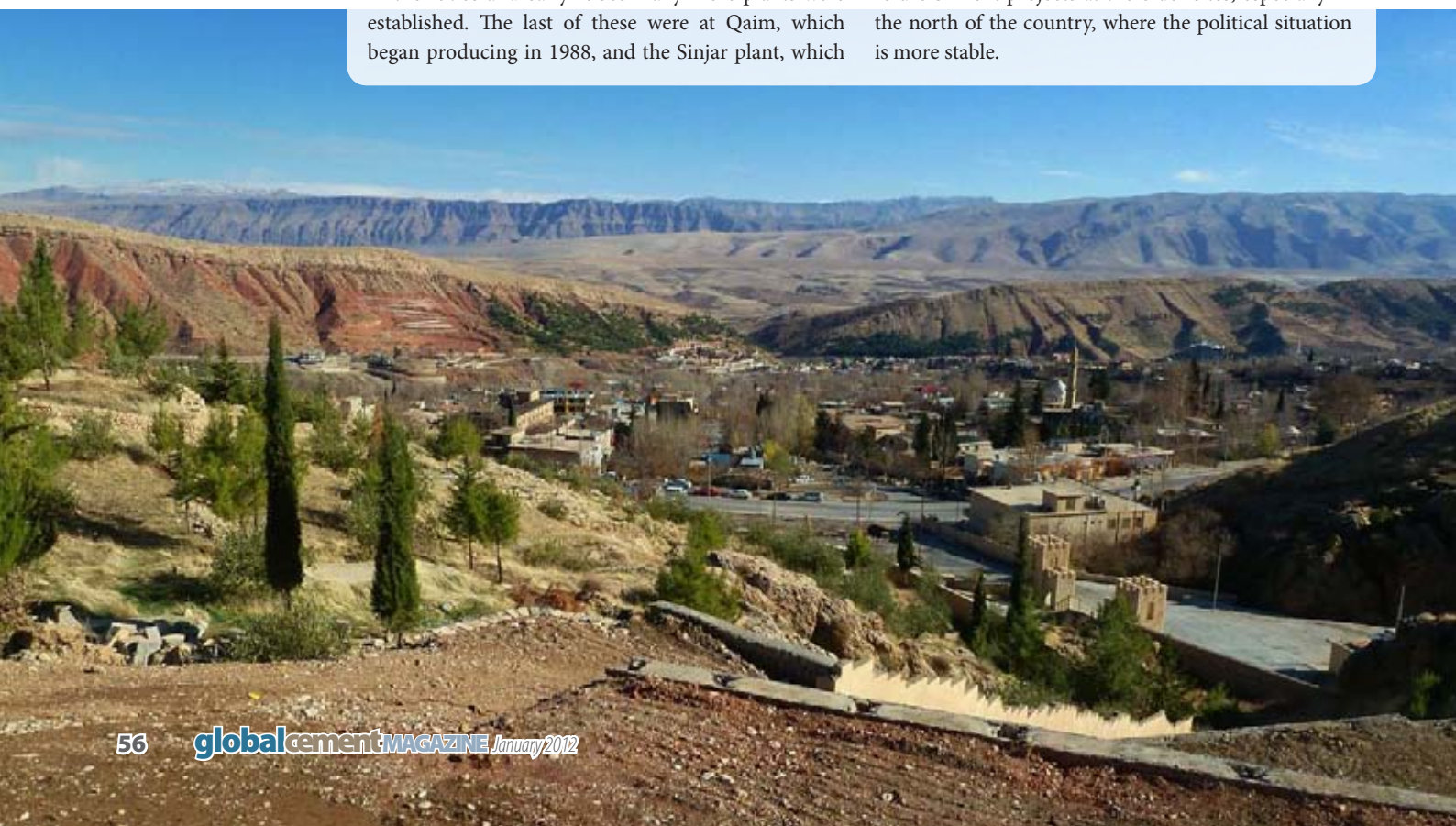
After the US-led invasion in 2003, the cement sector split into two segments, the former state-run plants on one side and new private operators. Lafarge acquired two plants post-2003 and commissioned its own greenfield project in 2008. Other private operators include the Al-Rawi group, which operates three plants and MASS Global, which commissioned its first kiln at Sulaimania in 2010 and a second in 2011. Also under private ownership is the Sinjar Cement Plant, owned by a consortium of family members.

Cement industry - Present

Due to a long term under-investment and insufficient electrical supplies, Iraqi cement plants don't currently produce anywhere near their intended design capacities, which come in at over 25Mt/yr when combined. The estimated combined capacity of the plants that are currently able to operate is around 10-11Mt/yr.

There is a massive drive towards refurbishment at older plants and new projects that is being driven by the high profitability of the Iraqi cement industry and Iraqi cement compared to imported cement. In July 2011 Iraqi cement cost US$58/t to produce but was being sold at US$90-120/t. Foreign cement imports could fetch as much as US$160/t such was the level of demand for building materials for redevelopment.

It is clearly a 'no-brainer' for private operators to increase their cement capacity in Iraq by whatever means necessary. This has led to a great number of refurbishment projects at the older sites, especially in the north of the country, where the political situation is more stable.



The estimated cost to rehabilitate the existing cement plants alone in Iraq is approximately US$175m. The estimated cost of captive power plants to run the expanded capacity almost doubles this to around US$325m.

One ongoing renovation, currently being carried out at the Sinjar Cement Plant with Austroplan Engineering and Perkam Dis Ticaret Ltd Sti. acting as consultants, is described in detail on pages 58-59.

Cement industry - Natural advantages

There is a large amount of work to be done to optimise the Iraqi cement industry but the situation is moving rapidly. The country is fortunate to have a large supply of oil with which it can buy-in foreign equipment and services. The country also has an abundance of two major cement ingredients, limestone and gypsum. Limestone is found throughout the country in several bands that run from the north west to the south east.

In addition to having a lot of limestone, it is also of unusually high quality, in that it has a very high percentage of calcium carbonate ($CaCO_3$). This means that more cement can theoretically be produced per tonne of limestone, enabling more efficient production. Much of the limestone is also close to the surface, allowing low-cost mining practices.

Cement industry - New plants

There are currently three new plants under construction in Iraq. These are being carried out at Diwanyah and Al Mabrouka, both of which are due for commissioning in 2013. GRD Cement is also in the process of building a plant for 2013. Additionally MASS Global will add a third kiln at its plant in Sulaimania in 2013.

These projects, in combination with the countless upgrades and expansions at other plants will add an anticipated 17Mt/yr of cement capacity by 2015. This will remove Iraq's current dependency on foreign cement, lowering the cost for consumers and enabling investors to get a rapid pay-back on their initial investment.

Conclusion

When Iraq acquires the latest technology, its current economic situation and unique set of natural advantages should enable it to gain an advantage in terms of cement production compared to its neighbours.

With sufficient upgrades and a more stable future, Iraq will easily be able to meet domestic demand and export surplus production, either by road, rail or by sea, as it did in the 1980s. The present stumbling blocks include political instability, irregular fuel supplies and outdated cement plant infrastructure.

Turn over for case study from Sinjar Cement Plant.

Dr Anton Eichinger, Austroplan Austrian Engineering GmbH

Rehabilitation of Sinjar Cement Plant

The contract for the construction of the Sinjar Cement Plant, located near to Mosul in Ninevah Governate in northern Iraq, was signed between the government of Iraq and the Romanian company Uzine Exportimport in 1981. The project endured a long period of construction and work was not completed until 1990. Despite being designed with two dry-process 3200t/day OPC clinker production lines, (giving it a capacity of 2Mt/yr), its contractual production capacity was never acheived. The original Gulf War (1990-91) caused production at the plant to be stopped almost as soon as it had begun in 1990.

No cement was produced again at the site until 1993. In 1994 the Northern State Company of Cement started to improve the plant. It operated it at reduced production capacity for the best part of a decade before suffering damage and being the subject of sabotage during the US-led invasion in April 2003. Following the damage it underwent limited repair and maintenance work. Its electrical power supply was limited to 10MW and between 1995 and 2006 it only produced an average of 0.23Mt/yr, around a tenth of its capacity.

Call for investors

The Iraqi Ministry of Industry and Minerals invited possible investors to rehabilitate and operate the plant. As a result of this invitation a group of Turkish and Iraqi investors achieved an agreement with the ministry to present a rehabilitation programme for the works to be executed in the factory.

This group of investors (the client) agreed with the government that they would rehabilitate the plant according to modern cement industry technology, manage and operate the plant on their account against a share of the accomplished production for the negotiated period of time. At the end of time the plant will be transferred back to the Iraqi government. This is known as the Refurbish, Operate, Transfer (ROT) investment concept. The client has chosen Austroplan Austrian Engineering GmbH in collaboration with the Turkish company Perkam Dis Ticaret Ltd Sti. as consultants for the implementation of the project.

From the perspective of the investors the advantages of rejuvenating this particular plant were clear. There is a huge local demand for cement, the availability of trained and experienced manpower, readily available local raw materials, adequate investment legislations, favourable terms of agreement and a very good chance of a solid return on their investment.

However, the project also presented some unique challenges. These are related to the general political environment, uncertainty surrounding future development of Iraq, problems with the safety of personnel and reluctance of specialists to work or live in Iraq. The plant is also fairly remote.

Main targets

The main targets of the project are: **1.** To reach a plant production capacity of 1.8Mt/yr as quickly as possible; **2.** To operate the plant continuously at the targeted production capacity after completion of the rehabilitation; **3.** To minimise the environmental impact of the plant by use of modern equipment.

Within this, a number of smaller targets have been identified including identifying 'weak points' in the processing technology as a rapid way to improve the plant, supplying the required power for plant operation by the installation of a new captive power plant and modernising the quality-control system for a product quality according to applicable standards during continuous operation.

The project will also establish a mode of quarry operation that allows long-time mining in the area and optimal use of the resources available and reduce energy consumption by minimising all production losses and the use of modern energy-efficient equipment. This will enable it to hit various environmental targets. The project will also be used to enhance the skills of the workforce in order to allow the other changes to be implemented successfully.

Progress so far

Initially a site investigation and detailed inspection of the existing plant was carried out by expert representatives from Perkam and Austroplan. The findings of these inspections were incorporated into the ROT programme report for the client and the Iraqi government. The report detailed the existing situation at the plant, the recommended targets of the rehabilitation and details of the work necessary to acheive these.

Austroplan has also conducted on-site management and supervision of repair and maintenance works, maintaining cement production on one line while preparing tenders for new equipment and further rehabilitation works. With its partners it has evaluated the received offers and provided assistance in contract negotiation and contract award with suppliers.

Current status

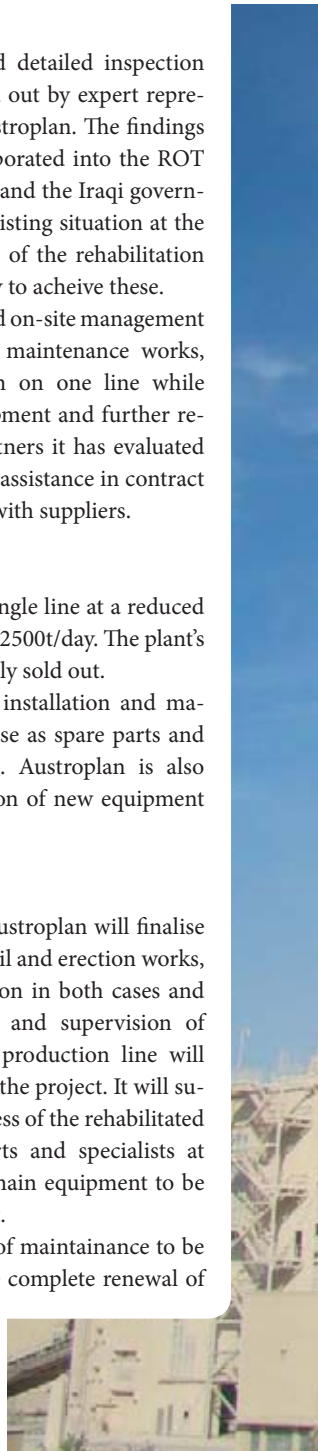
Currently the plant operates a single line at a reduced capacity, between 2000t/day and 2500t/day. The plant's total cement production is entirely sold out.

Various parts of the former installation and machinery are being assessed for use as spare parts and reuse during the rehabilitation. Austroplan is also preparing the site for the erection of new equipment when it arrives.

Work to be carried out

As the project moves forward Austroplan will finalise the preparation of tenders for civil and erection works, assisting with contract negotiation in both cases and providing on-site management and supervision of construction work. The single production line will remain in operation throughout the project. It will supervise the commissioning process of the rehabilitated plant, providing relevant experts and specialists at key points. A summary of the main equipment to be installed is presented above right.

There is also a large amount of maintainance to be completed on site, including the complete renewal of



Scope of refurbishment project

- Two cross-bar coolers (3500t/day each)
- Six cooling air fans for each cooler
- ESP filter for each kiln line
- 10 new jet-pulse type bag filters
- 4 raw mill fans
- 4 raw mill / kiln clean gas fans
- 4 preheater (ID) fans
- 2 clinker cooler clean gas fans
- MV or VF drive units for main crusher, raw mills, raw mill, recirculation fans, ID fans, clinker cooler clean gas fans and cement mills
- 22 slip ring drives for constant speed including all necessary liquid starters
- 12 variable speed drives
- Dosing belt weighers
- Belt weighers
- Flow meters
- Truck weighing bridges
- 3 bucket elevators
- 2 kiln shell scanners
- 2 infra-red kiln camera system
- 2 high temperature camera systems
- Fuel oil supply system for kiln line 1
- High pressure filter/pump station
- Preheater station
- Valve train for calciner burners
- Kiln burner and valve train for kiln burner
- 50 shock blowers

all lubrication systems for the raw and cement mills, repair and possible replacement of wear lining in all ball mills, general maintenance of hoists, conveyor belts, chutes, dedusting pipes and homogenisation/ standardisation of filters and fans.

Austroplan anticipates that the plant should realise its full 1.8Mt/yr capacity for the first time following commissioning in the second quarter of 2013.

Left: The refurbishment being carried out by Austroplan is extensive.

Conclusion

The ROT concept for the rehabilitation of old cement plants is a good way to utilise unused production capacity as long as the terms and conditions are fair for both investors and owners. Operation, repair and maintenance of such plants requires a flexibile approach to working on site. Exact travel scheduling for foreign specialists is important and a good collaboration with the client supports a quick decision-making process. A deep knowledge about the local conditions is needed in order to be successful in this region.

Below: The Sinjar Cement Plant in northern Iraq as it looked before work began. Work is ongoing at the site and is expected to be completed in 2013.

Dr Robert McCaffrey, Global Cement Magazine

A visit to Qatrana Cement

The Qatrana Cement Company was established in 2007 with a total investment of US$400m, and started operation in the first quarter of 2011, with a daily production capacity of 5000t to supply Jordan and regional markets including Iraq, Palestine and Syria. Global Cement recently visited the plant, located 80km south of Amman in Jordan.

Global Cement recently took the opportunity to visit Qatrana Cement's new KHD-built cement plant, around 80km south of Amman, capital of Jordan. The cement industry in Jordan has its origins in 1956, when the government-owned Jordan Cement Factories Company opened its Fuhais cement plant. At the same time, the country passed a 50-year 'restriction agreement' that forbade the construction of any other cement plants or the importation of cement, 'to allow the nascent industry room to grow and gain strength.' In 1998 Lafarge bought an equity stake in the Jordan Cement Factories Company, and it now operates as Lafarge Jordan. However, in 2006 the market was finally opened for competition. Northern Cement established a grinding station, while both Al Rajhi and Qatrana Cement have now built new cement plants in the country.

Qatrana Cement's Sulaiman Maaytah first gave Global Cement an overview of the origins of the company: "Qatrana Cement is part of Arabian Cement, the Jeddah-headquartered Saudi Arabian cement company which claims to be the oldest in the Kingdom. The company took the decision to build a plant in Jordan due to the favourable investment and security situation in Jordan and the availability of good quality raw materials. The plant is situated close to the 'Desert Road,' the main transport artery that runs from Aqaba to Amman and north to Damascus. Construction started in 2007 and was completed at the end of 2010, while operation started in the first quarter of 2011. The total investment was US$400m and the plant's daily production capacity is 5000t of cement. The plant supplies cement to the local market - particularly to Amman - as well as to Iraq, Palestine and Syria."

"The cement plant was designed, supervised and constructed by KHD Humboldt Wedag International.

Right: The Qatrana Cement plant under construction.

Below: A view from the top of the preheater tower, showing the kiln, bypass, clinker silo and mill under construction.

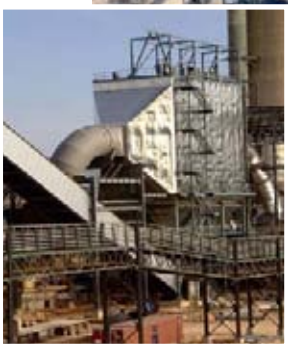
Production at the plant is designed to comply with all Jordanian laws, which in their turn are aligned with European standards: we make good quality products at a competitive price."

Mr Maaytah, the company's recruitment manager, went on to describe the challenges to recruiting workers to the isolated site: "It is not an easy job to attract workers to a site in the desert, but we offer a competitive salary, transport and housing, and good benefits - including a cafeteria and health insurance. Our first priority is to provide a safe working environment for our more than 200 workers. We feel that we have a

social responsibility to provide support to the local area and we have already donated cement to the local schools. All the major positions have been filled with fully-qualified Jordanians. We also benefit from specialist support from the Swiss-Egyptian maintenance and operation company ASEC.

Supply and construction

Global Cement also had the pleasure of speaking with Eng. Waleed Obeidat, the busy process manager at the plant, who gave details on the suppliers of the major equipment at the plant and of the construction of the plant project: "The steel for the civil construction was provided by local companies, while the civil works were carried out by Jordanian company MID Contracting. Holtec of India was the consulting engineer on the project. Due to good planning and professionalism, there were no problems during construction, no safety incidents and - eventually - smooth commissioning."



Above: The Takraf stacker in the stacker-reclaimer hall at Qatrana Cement.

Left: Construction underway of the circular materials storage area.

Left: The Redecam-supplied filter baghouse.

Left: Construction of the plant nearly complete, and **Below:** Qatrana Cement as it is today.

"All the equipment in the quarry is provided by Caterpillar, while the limestone crusher was supplied by Hazemag. After crushing, the limestone is transported by conveyor belt to the storage hall, where all the stacker-reclaimers were supplied by Takraf. Weighfeeders were provided by Schenck and Transweigh of India. We use heavy fuel oil for system pre-heating. Our coal mill was supplied by Gebr. Pfeiffer and is used for comminution of Russian coal, landed in Lebanon and trucked to the plant. Around 60% of the coal is sent to the calciner, with the remainder used in the KHD multi-channel kiln main burner. The plant is looking at the possibility of using more alternative fuels in the future. The plant has a KHD five-stage double-string pyro-processing line with a Pyroclon low-NOx precalciner. Refratechnik and RHI supplied the refractories for the pyro-processing system and KHD has supplied a Pyroflow clinker cooler. We have two KHD clinker mills, and a packing plant from Haver & Boecker. According to government regulations, we are required to have dust emissions of less than 50mg/Nm^3, and to achieve this we have installed a 71-bag Redecam baghouse. Qatrana Cement is supplied with electricity by a special electricity generating station with a capacity of 49MW, consisting of seven diesel generators manufactured by the Finnish company Wärtsila, which will be connected to the national electricity grid in 2012."

"The plant produces OPC, PPC and SRC at 42.5 and 52.5 strength grades, although 42.5 is most in demand. The company sells cement in both bulk and in bags. The Qatrana Cement plant has been designed to be ready for a second line, should market demand increase enough."