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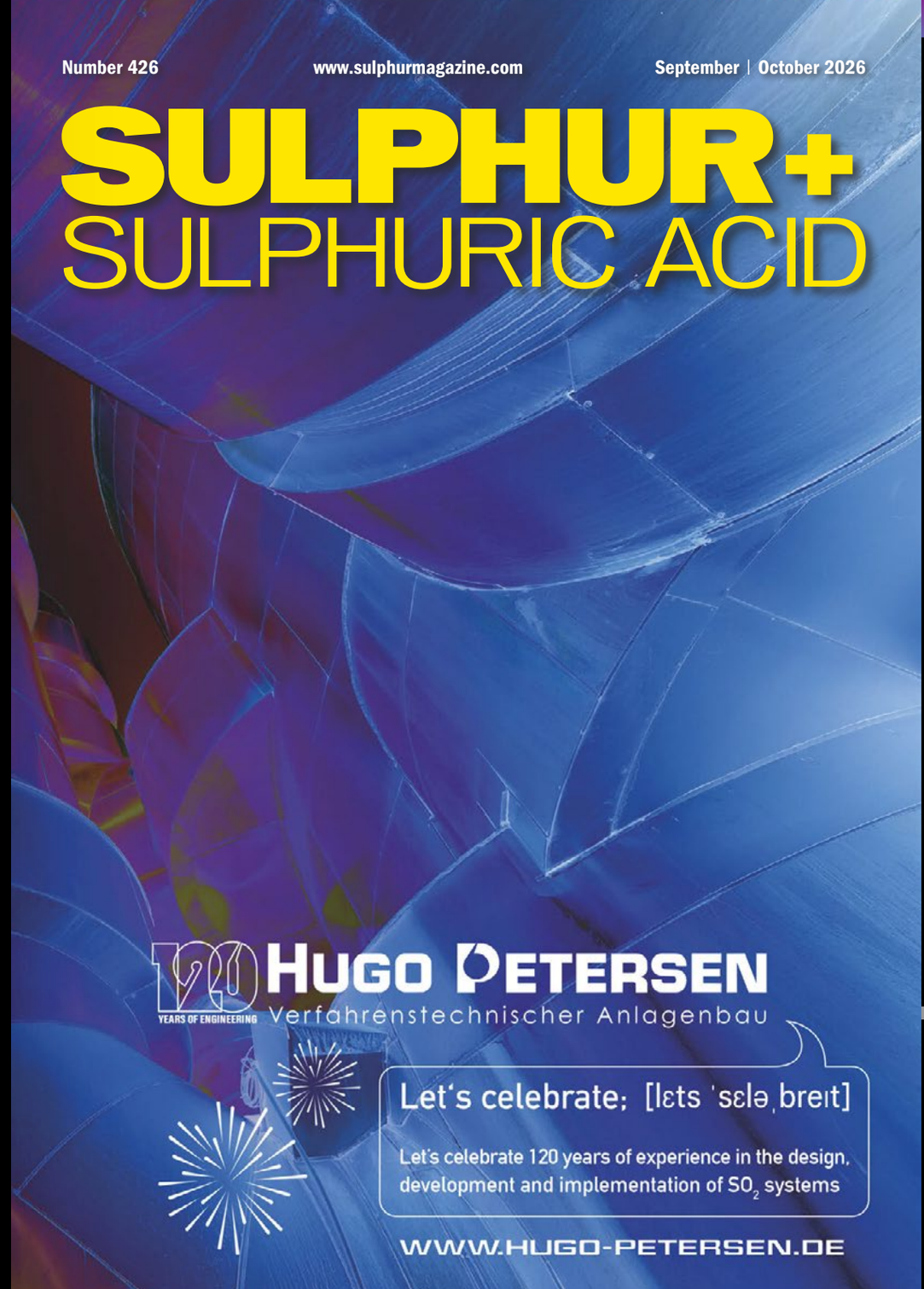

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SULPHUR + SULPHURIC ACID
ISSUE 426
SEPTEMBER-OCTOBER 2026

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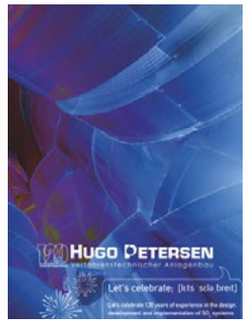

Cover: *HUGO PETERSEN*



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A significant contraction in supply and demand



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Published by:

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SULPHUR+ SULPHURIC ACID

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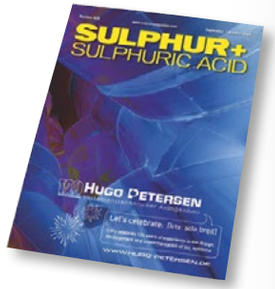

Introducing Sulphur+Sulphuric Acid Magazine

"The new title ... makes explicit what has always been true: these are two closely linked industries, ..."

Dear readers,

Sulphur magazine is evolving to reflect what it has always represented: the close and enduring connection between the sulphur and sulphuric acid industries, and the wider value chains they support.

For many years, Sulphur has been a trusted source of market intelligence, technical insight and authoritative commentary for professionals across both sectors. In its earlier form, the magazine carried the strapline "Journal of the World Sulphur and Sulphuric Acid Industries" – a clear signal of the breadth of its coverage. While that strapline was later lost in a redesign, the editorial focus remained unchanged.

Today, we are restoring that clarity in a way that better reflects the magazine's role and relevance. The new title, Sulphur+Sulphuric Acid, makes explicit what has always been true: these are two closely linked industries, and both deserve equal prominence in our pages. It also acknowledges the critical role that sulphuric acid plays across metals, mining and energy transition value chains – including copper, gold, nickel, battery materials and other sectors where sulphuric acid is central to production, processing and decarbonisation.

The new name brings the magazine into closer alignment with CRU's Sulphur+Sulphuric Acid conference brand, strengthening consistency across CRU's market-facing offer. It gives readers, advertisers and prospects a clearer understanding of the magazine's relevance across the full industry landscape.

As part of CRU, the magazine also benefits from the backing of wider market data, analysis and intelligence across the sulphur and sulphuric acid value chain. That foundation strengthens our ability to deliver authoritative coverage of market developments, technology, operations and end-use demand.

At its heart, this is not a change in editorial mission, but a refinement of identity. We remain committed to delivering high-quality, relevant and insightful coverage for professionals across the sulphur and sulphuric acid value chain – now with a title that more clearly reflects that shared focus.



Lisa Connock, Managing Editor

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Price Trends

SULPHUR

Most key sulphur import markets remained stagnant in late August due to weak demand. A premium is being paid for cargoes with guaranteed delivery schedules, driven by ongoing logistical risks in the Middle East. This has firmed prices in North America and Indonesia, but the potential return of supply from Russia and Kazakhstan may add some downward pressure.

The Middle East spot market was quiet, with prices holding at a three-month low of $865-900/t FOB as severe logistical constraints continue to limit new business. Loaded backlogged vessels totalled around 400,000 tonnes of sulphur. Q3 North African contracts were settled at a record high level of $990-1,010/t CFR. Morocco's sulphur imports in the first half of 2026 fell 12% year on year to 3.12 million tonnes, representing the lowest H1 volume since 2023. The decrease was largely driven by a reduction in supply from Kazakhstan and lower purchasing activity in the second quarter. Shipments from the UAE, Morocco's top supplier in H1, fell 19% to just over 1 million tonnes. The most significant drop came from Kazakhstan, with volumes falling 43% to 971,711 t. In contrast, supply from Saudi Arabia rose 24% to 471,512 t. Morocco also continued to diversify its procurement, sourcing significant volumes from Turkmenistan (119,117 t), Kuwait (105,000 t), and the US (96,438 t) during H1.

Potentially offsetting market tightness, however, was the rumoured return of supply from the Baltic. Kazakhstan sulphur is rumoured to be re-entering the market via the Baltic Sea, a month after officially lifting its export ban on 4 August. This follows confirmed reports of Kazakh material moving from the Black Sea port of Poti while the primary Baltic route was closed. Compounding this, Russia has partially relaxed its own export ban, creating a quota for 300,000 tonnes of low-grade material.

The demand for reliable supply was most evident in North America. The Vancouver assessment firmed $50/t on the upper end to $1,100-1,200/t FOB on a confirmed sale to Southern Africa, as some buyers paid a premium to avoid the delivery uncertainty of Middle East cargoes. This premium, however, was not reflected in all major CFR markets, where weak demand remains the dominant theme. In Brazil, the market remains at a stalemate with prices at a three-month low amid poor phosphate production economics. Similarly, the Indian market has ground to a halt as participants await a government decision on a proposed subsidy. Indonesia was a notable exception, with prices firming to $1,050-1,150/t CFR, driven by a premium for cargoes with guaranteed delivery schedules rather than a surge in underlying demand.

In China, in contrast, the impact of weak downstream demand was stark, leading to a significant drop in domestic port prices. China's sulphur arrivals rebounded in July, following a temporary easing of transit through the Strait of Hormuz. This came after imports in June hit just 147,104 tonnes, the lowest monthly volume on record. China imported 385,403 tonnes of sulphur in July, a 162% increase from June but still 65% lower than in July 2025, according to Global Trade Tracker (GTT). Despite the monthly rebound, China's sulphur imports in the first seven months of 2026 totalled just 2.65 million tonnes, down 59% on the same period in 2025 and the lowest level since 2002. Supplies were mostly from South Korea (516,000 t), Oman (472,000 t) and Canada (400,000 t), with Gulf volumes down 60%. The steep decline reflects China's continued withdrawal from the international spot market, as buyers are deterred by high global prices and logistical risks, leading them to draw from domestic inventories. Chinese port inventories had rebounded to 947,000 t in late August from a low of 730,000 t on July, but remain low by historical standards. Despite tight global supply and low port inventories, sulphur prices at Chinese ports have fallen significantly in recent weeks. This is being driven by weak demand resulting from poor affordability for buyers. China's weekly average domestic sulphur price reached a record RMB 9,875/t ($1,469/t) on 11 June, but had fallen to RMB 7,625/t ($1,135/t) by late August.

Moving into the start of September, there were indications that sulphur prices might be moving lower due to thin demand, in spite of continued supply disruption, including 600,000 tonnes of sulphur on 13 vessels still waiting to transit the Strait of Hormuz. Fresh Houthi attacks on Saudi energy facilities have added further uncertainty, including reported disruption at facilities in Jazan. Nevertheless, Middle East values were unchanged at $865-900/t FOB, although expectations for October pricing moved into the $800s/t FOB.

Kazakh material is also beginning to return through Ust-Luga, where a third vessel has loaded since late August. These volumes are expected to meet outstanding contractual commitments first, including into Morocco, rather than immediately increase spot availability. OCP is understood to be awaiting Kazakh contract tonnes and has therefore stepped back from spot buying, though this was not confirmed.

Price Indications

Table 1: **Recent sulphur prices, major markets**

Cash equivalent	April	May	Jun	July	August
Sulphur, bulk ($/t)					
Adnoc monthly contract	600	760	860	1,000	1,000
China c.fr spot	830	925	1,100	1,100	1,070
Liquid sulphur ($/t)					
Tampa f.o.b. contract	655	655	655	705	705
NW Europe c.fr	508	508	508	875	875
Sulphuric acid ($/t)					
US Gulf spot	385	385	385	385	370

Source: various

SULPHURIC ACID

Global sulphuric acid prices continued to soften at the end of August, with key benchmarks in Europe and Brazil hitting their lowest levels since April. The strong downward momentum seen in recent weeks is now meeting resistance, as prompt spot availability begins to dry up, with market players expecting this to begin to slow the pace of the decline.

In the Atlantic, European FOB prices slid $10-20/t to $300-320/t, its lowest level since late April. The downward pressure stems from offers into key import markets, particularly Brazil. While offers as low as $350/t CFR were reported for October loading, these fall outside the prompt 30-day delivery window. For September delivery, offers into Brazil were widely heard in the $360-370/t CFR range. Based on a freight cost of around $62/t, this supports a prompt European FOB assessment in the low $300s/t. This sustained pressure has dragged down notional prices in other import markets where buying interest is absent. In North Africa, the notional CFR price is now assessed at $330-350/t, down from $350-360/t CFR, based on a freight rate of around $30/t. In the US Gulf, the CFR price has moved down to $345-365/t from $365-375/t CFR, based on a freight cost of approximately $45/t. Prompt Brazilian spot prices reached $370/t CFR, with offers for forward deliveries in October reaching $360/t CFR. Bids fell to $350/t CFR, pushed lower by the result of Bunge's purchase for Argentina at $350/t CFR. While downward pressure persisted, vessel availability has begun to dry up.

Turkish producers are now understood to be sold out until the second half of October. This comes as Saudi Arabia's Maaden purchased around four cargoes for delivery from August through October. Prices were reported at $340-350/t CFR, although not confirmed.

Elsewhere in South America, the Chilean market remained in a holding pattern at $370-390/t CFR. Buyers were looking for direction from the TFI conference and, more immediately, the results of Nexa Resources' tender offering 58,000 t of its 2027 surplus production. No awards were heard at the time of writing.

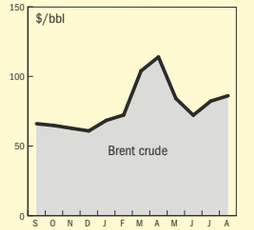
In Japan/South Korea, prompt FOB prices softened to $310-320/t, with bearishness demonstrated by a forward-dated tender. A sale from South Korea's GS Caltex for November loading was rumoured to have closed in the high $200s to low $300s/t FOB, sending a clear signal of significant price weakness expected in Q4. Japanese sulphuric acid exports for the first seven months of 2026 rose 1.6% year on year to 1.95 million tonnes, driven by strong growth in shipments to the US and Chile. In the January-July period, volumes to top partner the Philippines rose 4% to 817,332 t. Meanwhile, shipments to second-largest outlet India dipped 10% to 312,520 t, followed by Chile, with exports there up 19% to 234,323 t. Shipments to the US underwent a significant surge of 39% to 169,462 t. The data also show a major realignment away from previous customers, with exports to Saudi Arabia, Mexico, and Morocco falling to nothing from a combined 71,850 tonnes in 2025. These volumes were partly redirected to new markets, including Australia and Papua New Guinea, which took 19,950 t and 10,998 t respectively. For July, total exports stood at 338,021 tonnes, a 38% increase on July 2025 and the highest monthly export level in 2026. The Philippines was the largest single export destination in July with 154,489 t, followed by Chile with 51,279 t. Limited availability in the Asian market, following China's export ban, has seen Japanese exporters redirecting volumes to meet demand in key markets such as the Philippines and Chile.

This forward weakness is influencing sentiment in import markets. In Indonesia, prices held at $340-350/t CFR, but the market was focused on the outcome of the recent Petro Jordan tender. Unconfirmed reports suggest it was awarded to a trader at a price below the initial $340-360/t offer range, leading many to believe the true market level is now closer to the $330s.

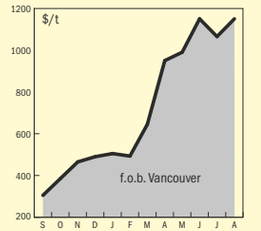
India saw its assessment soften to $370-380/t CFR, highlighting a wide gulf between buyer expectations, shaped by domestic deals around $330/t, and the higher reality of import parity pricing.

END OF MONTH SPOT PRICES

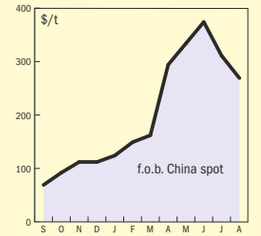
oil



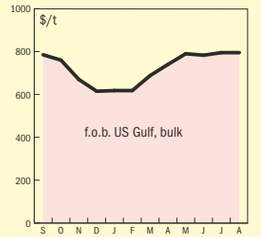
sulphur



sulphuric acid



diammonium phosphate



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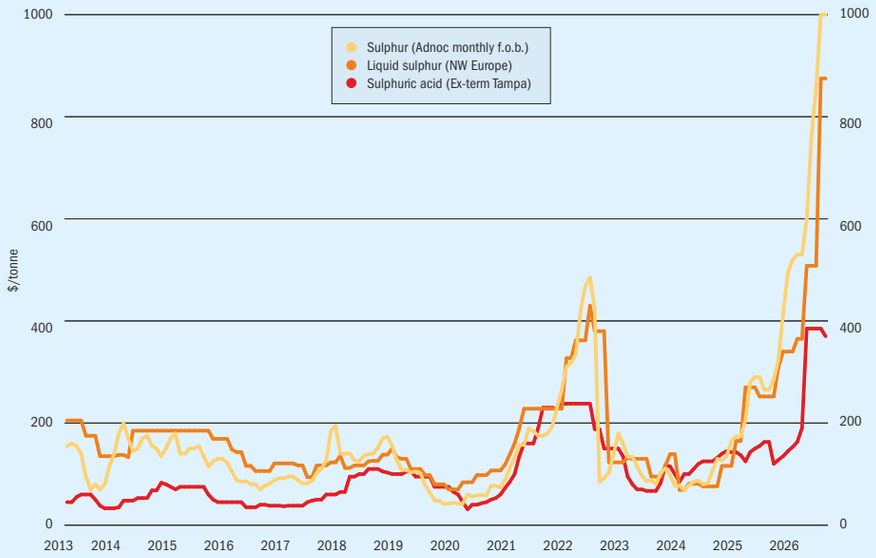
Market Outlook

Historical price trends $/tonne



Source: CRU

SULPHUR

- The global sulphur market outlook is flat to soft in the near term: most benchmarks were unchanged, with declines in the Mediterranean and Chinese port market reflecting limited spot liquidity and cautious purchasing.
- Weak phosphate-sector economics are restraining demand across key import markets. Brazilian producers are curbing output, Chinese buyers are purchasing hand-to-mouth amid rising inventories, and Indonesian nickel-sector weakness is limiting consumption.
- Middle East export disruption offers a potential price-supporting risk, with substantial cargo volumes delayed around the Strait of Hormuz. However, subdued import demand is currently preventing this from translating into broad price gains.
- Any near-term upside is likely to depend on demand catalysts, notably China's seasonal phosphate buying. However, the market outlook may be soft if there is an increase in supply from Kazakhstan, easing recent tightness.
- The market is likely to remain under downward pressure in the near term. Supply remains difficult to move and prompt alternatives are limited, but buyers are reducing consumption and delaying purchases rather than paying current prices.

SULPHURIC ACID

- The short-term outlook is for continued softness, though the rapid price erosion of recent weeks is likely to moderate. All eyes will be on the Chilean market heading into Q4 to see how much demand is left to be booked.
- Adding to the bearish sentiment, Argentina's Bunge tender was awarded in the mid-$300/t CFR range for its October requirement. Availability for September loading from Europe is understood to be more limited, which is providing some support for prompt prices. Despite this, the market consensus is that the trend is firmly downwards, with buyers now using the forward indications and the Bunge result to push for lower prices on any new business.
- China's sulphuric acid export ban has sharply reduced acid availability. Importing markets have cut purchases in response to the limited supply. A resumption of sulphur trade flows in 2026 Q4 could provide some acid importers with an alternative source of raw material and further reduce support to prices. However, this remains uncertain amid renewed conflict in the Middle East.
- The US market remains stable and focused on contract supply, with imports down only 3% year on year in January-July. However, spot activity remains limited, while OCP's continued absence from the acid market has removed a key potential source of demand for export tonnes.
- Increased sulphur availability in 2026 Q4 may provide some acid buyers with more options, but longer term, sulphur prices are expected to remain higher, which will maintain acid prices at elevated levels.

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UNITED ARAB EMIRATES

FID on Umm Shaif gas development

TotalEnergies says that, along with partners ADNOC, CNPC and Eni, it has reached a final investment decision (FID) for the $6.2 billion Umm Shaif Gas Cap development in the Umm Shaif and Nasr offshore concession. ADNOC Offshore is the field operator.

Umm Shaif is Abu Dhabi's oldest offshore field, producing since 1962. By 2030 the project will unlock more than 600 million scf/d of gas production while maximising condensate recovery, through the development of the gas cap resources located above the field's oil reservoirs. By leveraging synergies with existing offshore facilities and clean power from the UAE grid, Umm Shaif Gas Cap is designed to minimise costs and limit emissions. The project also has the potential to increase gas production to up to 1.5 billion scf/d in the future, further supporting the UAE's long-term gas growth strategy. Australian engineer-contractor Worley has been involved in front-end engineering design for the project, according to ADNOC. The investment includes three engineering, procurement and construction packages totalling $5.1 billion for large-scale offshore infrastructure, awarded to consortia comprising major UAE and international contractors.

While not as sour as some of Abu Dhabi's onshore gas fields, Umm Shaif still contains an estimated 1-3% hydrogen sulphide, representing a potential extra 230-690 t/d of sulphur output at maximum production.

"We are delighted to reach this important milestone together with ADNOC and our partners. Following the recent award of the Bab Gas Cap concession, this FID marks another important step in developing Abu Dhabi's significant gas resources. This development will contribute to TotalEnergies' Upstream production beyond 2030 with low-cost and low-emissions resources," said Patrick Pouyanné, Chairman and Chief Executive Officer of TotalEnergies.

WORLD

Mosaic, Ma'aden and Nutrien face feedstock squeeze

Three of the world's major phosphate producers used their second-quarter 2026 results to lay out how far a global sulphur and sulphuric acid squeeze is now cutting into their phosphate businesses. Phosphate fertilizer producers need sulphuric acid as their essential feedstock. Some make it on site from raw sulphur; others import it. Both sulphur and sulphuric acid are now in short supply, following the effective closure of the Strait of Hormuz to commercial shipping in late February and a Chinese sulphuric acid export ban from May.

Mosaic reported a $104 million operating loss in its phosphate segment, Saudi Arabia's Ma'aden cut its 2026 DAP guidance to 6.0–6.5 million tonnes on a 28% Q2 drop in DAP output, and Canada's Nutrien saw its phosphate manufactured product gross margin turn negative at $31 per tonne.

Mosaic swung to a second-quarter net loss of $273 million, on revenue of $2.8 billion, down 6% year on year. Adjusted EBITDA fell to $407 million, from $566 million. Results included $351 million of pre-tax notable items, including a $162 million loss on Mosaic's equity stake in Ma'aden.

Phosphate net sales rose to $1.25 billion, from $1.17 billion, as the DAP realised price jumped 28% to $773 per tonne. But the segment swung to an operating loss of $104 million, and adjusted EBITDA halved to $128 million. Mosaic Fertilizantes in Brazil posted a $41 million operating loss on sales of $1.03 billion. Potash was the bright spot, with adjusted EBITDA flat at $278 million.

Mosaic settled its third-quarter sulphur contracts at $705 per long ton, still historically elevated, and cut 2026 capital expenditure guidance to $1.2 billion. "Mosaic is working through a difficult market by successfully managing what is under our control and positioning ourselves for an eventual recovery," chief executive Bruce Bodine told analysts on the 5 August call. If sulphur availability normalised, he said, Mosaic could restore production "within weeks, rather than months". The company also took a non-cash write-down on a battery cathode purified phosphoric acid project first flagged around 2023–2024, and confirmed it will not proceed.

Mosaic is cutting the workforce at its Uncle Sam and Faustina sites in Louisiana as production remains idled due to the sulphur supply crisis. The company said August 27 that employees were furloughed with notice of dismissal, with only an idle crew remaining in addition to River Sulfur and Ammonia Plant staff. Mosaic implemented a partial production curtailment in May, with additional production cuts announced in early July, which resulted in reduced second-quarter sales and production of phosphates. The production cuts affect sites in both the US and Brazil, though no reduction in workforce has yet been reported for Brazil.

Ma'aden delivered record second-quarter group revenue of SAR 10.9 billion ($2.9 billion), up 16% year on year, and EBITDA of $1 billion. Aluminium and gold carried the group. Phosphate segment revenue slipped 1% to SAR 5.1 billion ($1.37 billion). Aluminium jumped 49% to SAR 3.7 billion ($1.01 billion), and Gold and Growth Minerals rose 34% to SAR 1.9 billion ($523 million).

Phosphate EBITDA more than halved to $328 million, down 49%. DAP production was 28% lower at 1.23 million tonnes, and ammonia output slumped 64% to 0.27 million tonnes, which Ma'aden attributed to challenges in feedstock logistics. The effective closure of the Strait of Hormuz to commercial shipping following US and Israeli attacks on Iran in late February cut off Ma'aden's usual sulphuric acid imports into its Arabian Gulf terminals. CRU's Fertilizer Week reported that the company has been redirecting acid purchases to Yanbu on the Red Sea coast, with cargoes transferred to railcars for inland delivery, and has been moving finished DAP and MAP overland from Ras Al-Khair to Yanbu for export. In April, Ma'aden scrapped an 80,000 tonne acid tender covering June and July delivery, after traders indicated they would avoid doing business in the region. Ma'aden said in its Q2 results that the DAP realised price rose 28% to $863 per tonne. The company withdrew its 2026 ammonia production guidance, previously set at 3.0–3.2 million tonnes, and cut DAP guidance to 6.0–6.5 million tonnes, from the earlier 6.5–7.1 million tonnes range. However, Ma'aden's Phosphate 3 expansion remains on schedule to start commissioning by the end of 2026, and is 82% complete as of July. It will add 1.5 million tonnes a year of production capacity.

Nutrien reported Q2 net earnings of $1.22 billion on sales of $10.81 billion, up 4% year on year. Group adjusted EBITDA edged down 2% to $2.43 billion, as record potash volumes and higher benchmarks were offset by lower fertilizer volumes elsewhere and rising sulphur costs.

The Saskatoon-based producer's phosphate segment took the hardest hit. Phosphate net sales rose 18% to $468 million, but adjusted EBITDA collapsed 75% to $23 million, and the manufactured product gross margin turned negative at $31 per tonne, from a positive $68 per tonne in Q2 2025. Potash net sales rose 6% to $1.05 billion, and adjusted EBITDA rose 4% to $658 million on higher benchmarks and stronger execution. Nitrogen net sales slipped 3% to $1.15 billion, and adjusted EBITDA fell 5% to $635 million, though unit margins gained from lower natural gas costs of $2.10 per MMBtu, from $3.31. "Global phosphate market fundamentals continue to be affected by trade flow disruptions, constrained sulphur feedstock availability and elevated costs, which have placed unsustainable pressure on phosphate producer margins and have resulted in reduced global operating rates," Nutrien said.

BRAZIL

Brazil's ANDA seeks R$2bn subsidy to offset sulphur price spike

Brazil's National Association for the Diffusion of Fertilizers (ANDA) has proposed an emergency R$2 billion ($375 million) subsidy to shield farmers from soaring sulphur prices. The proposal was presented to the government during the International Brazil Congress in São Paulo on 25 August.

ANDA argues the measure is critical to prevent a significant drop in fertilizer appli-



PHOTO: CLUI

Sulphur piles at Mosaic's Faustina site, Louisiana.



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ISSUE 426
SEPTEMBER-OCTOBER 2026

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cation, which could lead to agricultural losses of up to R$30 billion. The call for support comes as the cost of sulphur, a key raw material for phosphate fertilizers, has skyrocketed.

CRU data shows that sulphur prices in Brazil have surged dramatically over the last 18 months. After holding steady at around $182/t CFR in early 2025, prices began to climb, ending the year at over $530/t CFR. The ascent steepened significantly in 2026, breaking the $1,000/t CFR mark in April and hitting a peak of $1,200/t CFR through June and early July – an increase of over 550% from the start of 2025. While the market has since softened from its peak, the latest price for the week ending 27 August was assessed at $1,075/t CFR.

The government has not yet responded to the subsidy proposal but has recently focused on providing credit lines to fertilizer producers and advancing its long-term domestic production plan, Profert.



PHOTO: LIFOSA

Lifosa's Kėdainiai fertilizer complex, Lithuania.

LITHUANIA

Lifosa halts as Kazakh sulphur cut off

EuroChem has reportedly suspended operations at its Lifosa phosphate fertilizer plant in Kėdainiai, Lithuania, on the back of high raw material sulphur costs, CRU reported on 10 August. The producer has not directly confirmed the shutdown, but according to market sources and reports all product lines are said to be offline. Lifosa's problem is understood to be a supply-origin shift, not a supply-volume shortage. Trade data via Global Trade Tracker (GTT) show Lithuania's sulphur import volume held roughly stable year on year at 142,507 tonnes. What changed is where it came from.

"Effectively all sulphur imports previously came from Kazakhstan, but export restrictions have meant that no sulphur has moved from Kazakhstan to Lithuania this year, with supply instead coming from Saudi Arabia, the US, Poland, and other origins," CRU said. "This has likely left Lifosa more exposed to spot price volatility as opposed to the relative stability of sulphur contract prices."

Kazakhstan formally suspended all sulphur exports on 27 June 2026 under Order No. 1363, signed by its Ministry of Energy, with an exemption only for shipments to Russian railway stations. That move followed Russia's own 24 May decision to halt rail transit of Kazakh sulphur through Russian territory to seaports and border checkpoints — the primary logistical route by which Kazakh sulphur from the Tengiz and Kashagan fields reaches European buyers. Russia lifted its rail-transit restriction on 24 July 2026, but Kazakhstan's export ban remains in force until further notice, blocking Lithuania from returning to its main historical supplier. Russia's own sulphur export ban, in place since November 2025, has been extended to 31 December 2026.

Lifosa's Kėdainiai complex, in central Lithuania, is one of the European Union's largest phosphate fertilizer sites. Annual production capacity, according to CRU data, stands at 989,000 tonnes DAP, 430,000 tonnes NP, 469,000 tonnes P2O5/year of phosphoric acid and 1.35 million tonnes/year of sulphuric acid. The plant also produces around 200,000 tonnes/year of monocalcium phosphate (MCP) feed phosphate and 35,000 tonnes/year of technical MAP (tMAP). EuroChem acquired the plant in 2002.

If confirmed, the halt would mark another disruption for a producer that has spent most of the post-2022 period offline or running below capacity. Lifosa resumed operations in June 2024 after a hiatus of more than a year, and output reached 440,925 tonnes in 2024 — more than three times its 2023 volume.

RUSSIA

Russia's sulphur market hit by antitrust probe and plant strike

Russia's sulphur supply is under renewed pressure after another Ukrainian strike hit the Astrakhan gas processing plant, a facility vital to the country's fertilizer industry and responsible for over 60% of its sulphur output. The strike on the night of 24 August was confirmed by the Ukrainian General Staff via Interfax-Ukraine. The natural gas plant has a sulphur production capacity of around 5 million t/a.

This latest supply shock coincides with new regulatory scrutiny of the domestic market. Russia's antitrust body (FAS) has opened a case against four major sulphuric acid producers, Mednogorsk, Sredneuralsk, Svyatogor, and Karabashmed, for allegedly maintaining monopolistically high prices through 2024 and 2025, according to a 27 August report from Kommersant.

This ongoing conflict in the region prompted Moscow to ban sulphur exports to ensure domestic supply; the ban initially came into force on 1 November 2025 and has since been extended until the end of 2026. On 21 August, the government amended this ban, creating a specific allowance for producers to export up to 300,000 tonnes of low-grade material with a permit, in a move to help clear stocks of less desirable product.

Sulphuric Acid News

ALGERIA

Sonatrach hires Saipem and CHEC for Algerian phosphate build

Algeria's Sonatrach and the Algerian Fertilizers Company (AFC) on 12 August signed engineering, procurement and construction contracts with Italy's Saipem and China Harbour Engineering Company (CHEC) for the first phase of the country's Integrated Phosphate Project (PPI). The ceremony at Sonatrach's Algiers headquarters was chaired by Hydrocarbons Minister Mohamed Arkab and attended by the Chinese and Italian ambassadors.

Saipem's Limited Notice to Proceed is worth approximately €500 million ($580 million) and covers EPC of the phosphate processing and fertilizer production facilities at Bled El Hadba (Tébessa province) and Oued El-Kebrit (Souk Ahras province). CHEC will build the associated port facilities at Annaba. The full EPC contract with Saipem is still being finalised.

Once operational, the complex is designed to mine 5.5 million tonnes/year of run-of-mine phosphate rock and to produce 3.2 million tonnes/year of phosphate concentrate, 2.4 million tonnes/year of phosphate fertilizers and 570,000 tonnes/year of urea, along with by-product sulphuric acid, phosphoric acid and ammonia.

Sonatrach said the project would allow Algeria to transform its phosphate and natural gas resources domestically before selling the output "on the national market and for export".

UNITED STATES

Worley to provide engineering services for cobalt refinery project

Worley says that it has been awarded an engineering services contract by United States Strategic Metals to support the development of a multi-metallic processing hub in Missouri, United States. This will include the development of a cobalt refinery and a black mass recycling process line. Under the contract, Worley will provide engineering services and procurement support within an integrated project management team to oversee the construction of the project. The work will be led from Worley's Louisiana operations, with support from teams in Phoenix, United States, the United Kingdom, and the Global Integrated Delivery (GID) team.

"The cobalt refinery project supports the development of critical mineral supply chains in the United States," said Chris Ashton, Chief Executive Officer of Worley. "We are pleased to apply our expertise in minerals and metals to support the delivery of this important project advancing United States Strategic Metal's objectives."

United States Strategic Metals operates a mining and hydrometallurgical processing facility at the historic Madison Mine site near Fredericktown, Missouri. The plant uses sulphuric acid-based hydrometallurgical processing and proprietary technology to extract and recycle battery-grade cobalt, nickel, copper, and lithium.

Ecovyst completes Calabrian acquisition

Ecovyst reported 2Q 2026 sales of $250.0 million, up 42% from $176.1 million in 2025, driven by higher volumes and pricing, including about $55 million of sulphur cost pass-through. Net income rose to $10.7 million (a margin of 4.3%), while adjusted net income was $23.4 million. Adjusted EBITDA increased 27% to $53.1 million.

During the period, Ecovyst completed the June 30, 2026 acquisition of Calabrian, a sulphur dioxide and derivatives business from INEOS Enterprises, financed in part by a $100 million term loan increase. As of June 30, 2026, the company held $87.8 million in cash, total gross debt of $497.1 million, and total available liquidity of $176.3 million. Reflecting 1H 2026 performance and expected contributions from Calabrian in the second half, Ecovyst raised its 2026 guidance to sales of $1.02 – 1.06 billion. Capital expenditures are now expected at $85–$95 million.

INDIA

India plans sulphur and acid subsidies for phosphates production

The Indian government is considering a new financial relief package for its domestic fertilizer industry aimed at protecting its agricultural sector from volatile global markets, according to a Department of Fertilizers (DoF) document dated 14 August. The proposal directly addresses the impact of the "West Asia crisis" on key raw material costs.

The core of the proposed scheme, which now awaits Cabinet endorsement, is a targeted subsidy to support the production of P&K fertilizers (DAP and NPKs including phosphoric acid, though excluding SSP and urea-SSP). The document outlines a 20% subsidy on the procurement of sulphur and sulphuric acid, tied to floor prices of $800/t and $266.67/t, respectively. Indian sulphur prices were assessed at $1,000-1,100/t CFR as of 13 August, with sulphuric acid at $370-390/t c.fr.

If approved, the measures will enter into effect from June 2026 through March 2027, the DoF said. The initiative is framed as part of the government's wider Atmanirbhar Bharat (self-reliant India) strategy, designed to enhance domestic manufacturing capabilities and reduce vulnerability to international price swings. While the proposal is under review, the DoF has directed manufacturers to maintain current production levels to ensure an uninterrupted supply for the nation's farmers during the Kharif 2026 and Rabi 2026-27 seasons.

SOUTH KOREA

LS MnM targets battery-materials growth with smelter-derived sulphuric acid

South Korean metals producer LS MnM plans to use sulphuric acid recovered from copper-smelting operations to process nickel and cobalt for battery materials, linking its existing metals business with its expansion into the electric-vehicle supply chain. The company captures sulphur dioxide generated at its Onsan Smelter and converts it into sulphuric acid. LS MnM's sulphuric-acid facilities have annual capacity of 1.925 million t/a, according to the company, providing a potential internal reagent source for hydrometallurgical processing.

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The acid is intended for nickel and cobalt leaching at EVBM Saemangeum, LS MnM's battery-materials project. The development will combine mixed hydroxide precipitate refining with black-mass recycling, producing nickel, cobalt and manganese sulphates, while recovered lithium will be converted into lithium hydroxide. The project is scheduled for completion by end-2026; earlier plans indicated nickel sulphate capacity equivalent to 22,000 t/a of contained nickel, with full-scale production originally expected in early 2027.

Use of smelter-derived acid would avoid the need to purchase elemental sulphur as a feedstock for acid manufacture and reduce the project's direct exposure to sulphur and sulphuric-acid prices. LS MnM already produces nickel sulphate at its smaller Asan facility and has stated an ambition to build an integrated chain spanning sulphate metals, cathode precursors and recycling. Its longer-term target is to expand nickel sulphate capacity to 270,000 t/y by 2030.

Rising acid prices are also encouraging greater focus on sulphuric acid among South Korean smelters. Korea Zinc plans to raise semiconductor-grade acid capacity at its Onsan smelter from 280,000 t/a to 320,000 t/a in the second half of 2026, with a longer-term goal of 500,000 t/a. This material is principally intended for semiconductor-wafer cleaning rather than battery-material production.

MOROCCO

Koch to acquire half share in JFC 1

Koch Ag & Energy Solutions (Koch) has signed an agreement with OCP Nutricrops (OCP) to acquire a 50% stake in Jorf Fertilizers Company I (JFC I). JFC I owns a 1.2 million t/a phosphate fertilizer plant at Jorf Lasfar, Morocco, the world's largest phosphate fertilizer production complex. This plant will be operated as a 50:50 joint venture by Koch and OCP, on closure of the transaction, and serve customers around the globe, including those in North America. The agreement is the second joint venture between the Moroccan phosphate giant and the US nitrogen fertilizer producer. Koch previously acquired a 50% interest in Jorf Fertilizers Company III (JFC III) — renamed Kofert — from OCP in 2022 (Fertilizer International 507, p11). Combined, the two joint ventures will have a phosphate fertilizer production capacity of approximately 2.5 million t/a.



PHOTO: CAPSTONE COPPER

The Mantoverde pyrite plant site.

"We welcome the signing of this agreement, which marks an important milestone in our long-standing partnership with Koch, a key North American player," said Faris Derrij, the chairman and CEO of OCP Nutricrops. "The joint venture strengthens our ability to deliver reliable, high-quality soil nutrition solutions to farmers and customers, including across North America, while contributing to more resilient agricultural value chains and long-term food security."

CHILE

Capstone approves Mantoverde pyrite plant

Canada's Capstone Copper has approved a $45 million pyrite recovery project at its Mantoverde copper operation in Chile that will cut the mine's sulphuric acid consumption by around 90,000 t/y, the company said in its second-quarter results on 30 July. The Board of Directors approved the Mantoverde Pyrite Augmentation (MVPA) project in July, with formal sanctioning expected in the third quarter of 2026 subject to approval from Mantoverde's joint venture partner. The project is expected to be completed in early 2028.

MVPA will incorporate a pyrite recovery circuit into the existing Mantoverde concentrator plant. Pyrite (iron sulphide) will be recovered and concentrated from the tailings stream, then conditioned and transferred to the existing heap leach process. Based on 10 million t/y of oxide ore leaching at Mantoverde's heap leach facility, the project is expected to reduce sulphuric acid requirements by approximately 20% – an average of 90,000 t/y of sulphuric acid – while also increasing cathode copper production by an average of about 3,500 t/y. At an assumed c.fr Chile sulphuric acid price of $200 to $450 per tonne, Capstone estimates the acid cost savings at $18 million to $40 million per year. Capital cost of $45 million is expected to be incurred in 2027, with the incremental processing operating cost estimated at $0.22 per tonne of sulphide ore processed.

MVPA is also the first step in Capstone's plan to unlock cobalt production in Chile's Mantoverde–Santo Domingo (MV-SD) district. Cobalt solubilised from the pyrite could subsequently be recovered via an ion exchange plant. As currently envisioned, a smaller-capacity cobalt plant would initially treat by-product streams from Mantoverde only, producing up to 1,500 t/y of cobalt. Following sanctioning of Capstone's Santo Domingo project, the facility would be expanded to handle by-product streams from Santo Domingo as well, with a combined MV-SD target of 4,500 to 6,000 t/y of cobalt. The cobalt recovery opportunity is currently at feasibility stage.

The pyrite decision came alongside a broader acid-management push at Mantoverde. Capstone said it had implemented a cash flow optimisation strategy at the mine in 2026 that reduces acid exposure by approximately 200,000 t/y and eliminates the need for spot market sulphuric acid purchases for the remainder of the year. Contracted volumes cover 100% of planned Mantoverde consumption of approximately 243,000 tonnes over the balance of 2026, with 80% locked in under fixed-price contracts at an average of $190/t CFR Chile and 20% on variable pricing. Supply is expected from domestic Chilean sources, Peru, Europe and Asian countries excluding China.

"Capstone's Board approved the Mantoverde Pyrite Augmentation project, an EIA permit application was submitted for Mantos Blancos, and detailed engineering progressed at our transformational Santo Domingo project," Capstone said in the results statement.

Codelco partners up to develop mine, and reuse waste

Chile's state-owned Codelco has formed a 40:60 joint venture with privately owned compatriot Pucobre to work on a copper project in the country's north. Codelco has also agreed with the government to find ways of making more use of waste materials. The Pucobre-Codelco JV plans to develop the Tovaku project, 70 km east of Tocopilla in Antofagasta region. The first stage of work will include detailed engineering, obtaining permits, execution of early works and tendering for major equipment. The goal is to begin production by 2030, at an outlay of around $870 million. Output is expected to be 46,000 t/a of copper cathodes over 21 years. To reach that stage, Codelco will give mining concessions to the JV while Pucobre will contribute existing studies and be responsible for financing and constructing an open-pit mine at Tovaku.

Separately Codelco has signed a technical collaboration agreement with the government's public works ministry to evaluate, validate and document the technical, regulatory, operational and environmental requirements for reuse of mining's by-products in public infrastructure projects. The intention is that the otherwise waste materials can be used provided they show technical performance and regulatory compliance, and are competitive against currently available alternatives, local media reported.

The main areas of interest at this early stage are Codelco's Ventanas copper refinery in central Chile which is a collection point for iron silicate (copper slag), tailings and mining debris, and the spoil heaps from the El Teniente underground mine, also in central Chile.

CHINA

Additional zinc-lead capacity

The Phase I development of the Zhugongtang lead-zinc mine in Hezhang County, Guizhou Province, is entering its final construction stretch. Full-line wet commissioning is scheduled to commence on 30 September, marking the official start of the trial production phase. Formal operational acceptance and commercial production are targeted by the end of 2026, following successful completion of performance testing and all necessary rectification work.

The deposit ranks among the top ten in China by resource size, with cumulative lead-zinc metal reserves of 5.17 Mt. In addition to lead and zinc, the ore body also contains copper and a range of rare metals including germanium, gallium, cadmium, and selenium.

The overall mining project is being advanced in two phases: Phase I is scheduled to achieve integrated feed commissioning on 30 September 2026, with formal operational acceptance targeted by the end of the year. This phase concentrates on bringing the first mining district and the flotation concentrator into operation, targeting an initial processing capacity of 2,000 t/d of ore, producing lead, zinc, and sulphur concentrates while enabling preliminary recovery of associated minerals. Construction of the main processing building and thickener tanks has been completed, equipment installation is over 90% complete, and the semi-autogenous grinding and ball mill circuit successfully passed no-load commissioning on 15 May 2026.

Phase II is scheduled for commissioning by the end of 2027. Upon completion, the mine will reach a total production capacity of 6,000 t/d of ores, with a strategic focus on the high-value extraction of germanium, indium, and other rare metals. At full capacity, the project is expected to produce over 200,000 t/a of zinc concentrate and more than 60,000 t/a of lead concentrate.



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People

Ecovyst Inc, a leading provider of regenerated sulphuric acid, virgin sulphuric acid, and sulphur dioxide and related derivatives, says that it has appointed **Laurie Bergman** as Chief Financial Officer effective August 24, 2026. Ms. Bergman replaces **Michael Feehan**, who will be departing the company.

"We are excited to bring Laurie onto the Ecovyst team. Laurie is an accomplished and seasoned finance and accounting professional, and we are confident that she will bring high-calibre skills and proven experience in implementing growth strategies to her new role with the Company. The rest of the management team and I look forward to working with Laurie to further advance the Company's strategic and operational goals and to drive the creation of stockholder value," said Kurt J. Bitting, Ecovyst's Chief Executive Officer. "On behalf of our Board of Directors and the management team, I also want to thank Mike for his hard work and dedication on behalf of the Company and for his many contributions to Ecovyst's success. We wish Mike all the best in the future," Mr. Bitting said.

Ms. Bergman, 49, joins Ecovyst after having previously served as the Chief Financial Officer of Legacy Food Group since July 2024. From June 2021 to June 2024, she served as the Chief Financial Officer of Liquid Environmental Solutions. Before that, she served as Chief Accounting Officer, Corporate Controller and VP Accounting of UGI Corporation from February 2019 until June 2021. Ms. Bergman has served as a member of the board of directors and chair of the audit committee of Arq, Inc. since June 2023 and also has served as a member of the board of directors and member of the audit committee of QNB Corp since May 2020. It is expected that Mr. Feehan will continue as an employee of the Company until September 30, 2026 in order to provide for a smooth transition of his prior duties to Ms. Bergman.

In Colombia, Ecopetrol SA has made the following changes to its Board of Directors, at a meeting held on August 27, 2026: **Sandra Lucía Rodríguez Rojas**, Corporate Vice President of Territorial Transformation and HSE, will perform her duties through August 30, 2026. **Miguel Ángel Cortés Angarita**, currently Senior Environmental Management Professional within the same area, will assume the role of acting Vice President effective August 31, 2026.

Jaime Andrés García Cuello, Vice President of Administration and Services, will perform his duties through August 30, 2026. **Álvaro Iván Saavedra Barón**, currently Hydrocarbons Supply Manager within the same area, will assume the role of acting Vice President effective August 31, 2026.

Diana Marcela Jiménez Rodríguez, Corporate Director of Institutional Relations and Communications, will perform her duties through August 30, 2026. **Juliana Perdomo Valencia**, currently Senior Communications Specialist within the same area, will assume the role of acting Director effective August 31, 2026.

Julián Fernando Lemos Valero, Corporate Vice President of Strategy and New Business, will perform his duties through August 30, 2026. **Adrian Santiago Coral Pantoja**, currently Hydrocarbons New Business Manager within the same area, will assume the role of acting Vice President effective August 31, 2026.

Felipe Trujillo López, Vice President of Refining and Industrial Processes, will perform his duties through August 30, 2026. **Ana Carolina Ríos Junco**, currently Senior Process Engineer within the same area, will assume the role of acting Vice President effective August 31, 2026.

Ecopetrol says that it will announce the corresponding permanent appointments "in due course".

Idaho Copper Corporation has announced the appointment of four independent directors to its board – **Gil Atzmon**, **David Herskovits**, **Dr. John Moeller** and **Corey Redfield** – and the formation of Audit, Compensation, and Nominating and Corporate Governance committees.

Gil Atzmon has more than 40 years of experience in the energy and mineral sector, spanning roles as a field engineer in oil services, an investment fund manager, an investment banker and a mining executive. He founded Zazu Metals in 2006 and served as its Chairman, CEO and a director until its acquisition by Solitario Resources Corporation in 2017; he has been a director of Solitario since 2017 and was recently named Chairman. Earlier in his career he was VP, Corporate Development of Ivanhoe Mines Ltd., a global energy and mining specialist at BNP Paribas, and Chief Investment Strategist and Portfolio Manager for US Global Investors, Inc.

Calendar 2026/7

OCTOBER

12-16
SGS Sulphur Experts' Sulphur Recovery Technical Training Course, NOORDWIJK, Netherlands
Contact: Alicia Engbers, SGS
Email: Alicia.Engbers@sgs.com

NOVEMBER

3-5
CRU Sulphur & Sulphuric Acid Expoconference 2026, BERLIN, Germany
Contact: CRU Events
Tel: +44 (0) 20 7903 2444
Email: conferences@crugroup.com

30-DECEMBER 4
SGS Sulphur Experts' Sulphur Recovery Technical Training Course, KUALA LUMPUR, Malaysia
Contact: Alicia Engbers, SGS
Email: Alicia.Engbers@sgs.com

FEBRUARY 2027

4-5
SulGas Conference, MUMBAI, India
Contact: Three Ten Initiative Technologies LLP
Tel: +91 96766 11950
Email: admin@sulgasconference.com
Web: sulgasconference.com

16-19
77th Laurance Reid Gas Conditioning Conference, OKLAHOMA CITY, USA
Contact: Juliana Jimenez, Program Director, University of Oklahoma.
Email: jules.jimenez@ou.edu

MARCH

16-18
CRU Phosphates+Potash Expoconference, ROME, Italy
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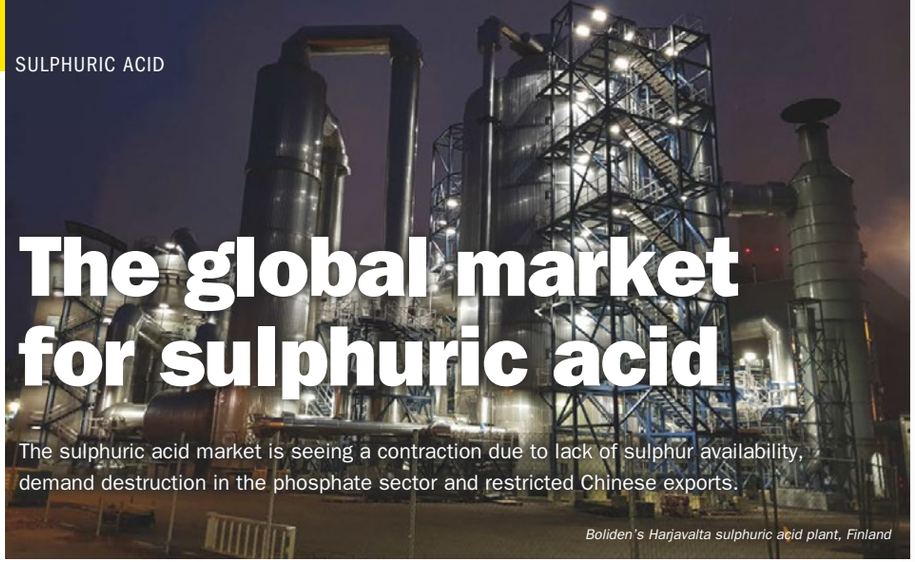

PHOTO: BOLIDEN

The global market for sulphuric acid

The sulphuric acid market is seeing a contraction due to lack of sulphur availability, demand destruction in the phosphate sector and restricted Chinese exports.

Boliden's Harjavalta sulphuric acid plant, Finland

The exceptional circumstances created by the Iranian conflict have had a major impact on sulphur availability, affecting two thirds of global sulphuric acid production. As a result, the industry is seeing a major contraction for the first time in years.

Suppliers

Global sulphuric acid supply is forecast to fall from 319 million t/a in 2025 to 299.0 million t/a in 2026. This represents a 6.4% contraction, and it is the first annual decline since 2022. The main reason for this is a 24.4 million t/a reduction in sulphur-burning acid production, itself arising from restricted sulphur availability, logistical disruption and elevated sulphur costs. This decline is partly offset by greater smelter-acid availability. Smelter acid output is forecast to increase by 4.1 million t/a in 2026, while pyrite-based production declines by 1.1 million t/a. Supply is projected to recover over the medium term, however, as shown in Table 1.

China

China is the largest source of the 2026 global supply contraction. Total domestic acid production is forecast to fall from 127 million t/a in 2025 to approximately 113 million t/a in 2026, a decline of around 10.8%. Output is expected to recover next year, but will likely remain below the 2025 level. As noted above, most of this reduction is led by sulphur-burning acid production – the most flexible source of acid supply. Smelter acid is a by-product of non-ferrous metals production and its availability depends on concentrate supply, smelter throughput and maintenance rather than on acid market conditions alone.

Drivers of the reduction include restricted sulphur availability and logistical constraints due to the closure of the Strait of Hormuz, coupled with high sulphur costs that undermine sulphur-burning economics. This in turn has had an impact on phosphate-sector operating rate, leading to lower acid consumption associated with weaker fertiliser production. Outside of fertilizers, there is also lower demand from the caprolactam and ammonium sulphate sectors, which are similarly impacted by sulphur prices.

Chinese smelter acid output is expected to be broadly stable rather than expanding. Copper-concentrate constraints are limiting smelter throughput, while lower acid values and negative treatment and refining charges are increasing pressure on smelter economics.

China has also started to develop gypsum-to-acid projects, which use phosphogypsum or other waste gypsum materials to produce acid, together with a cement-related co-product. GPCG commissioned a 650,000 t/a gypsum-to-acid plant in mid-2026, using 1.4 million t/a of waste gypsum and producing around 0.8 Mt/y of cement feedstock. This is expected to be expanded to 800,000 t/a by 2028. Other projects over the next few years include Guizhou Wengfu (650,000 t/a of acid), Hubei Dongsheng (300,000 t/a) and Yunnan Xiangfeng (600,000 t/a). On top of this 2.4 million t/a of supply that it already under construction, another 7.1 million t/a of gypsum-based capacity is planned, and could become accelerated if sulphur economics continue to be constrained.

Europe

Europe remains the largest exporting region for sulphuric acid. Regional acid supply is forecast to rise from 17.5 million t/a in 2025 to 18.2 million t/a in 2026, and 19.6 million t/a in 2030. Smelter acid production has recovered from the low point of 2022 and is forecast to reach 8.9 million t/a this year after a number of maintenance-related disruptions. Northern European availability is supported by additional production at Boliden's Odda smelter, while the outages at Pirdop and Huelva seen last year seem to be easing. All of this should see European exports increase from 5.9 million t/a in 2025 to 6.6 million t/a in 2026, leading to a net trade surplus rising from 2.9 million t/a to 3.8 million t/a, a level which is expected to remain largely consistent out to the end of the decade. However, Europe's ability to act as a swing supplier is constrained by regional consumption. Despite production gains in 2024 and 2025, European exports in 2025 were lower than in 2023 because additional output was absorbed by domestic demand.

Table 1: **Global acid supply by production route, million t/a**

Route	2025	2026 forecast	2027 forecast	2030 forecast
Sulphur-burning acid	195.2	170.8	194.5	227.3
Smelter acid	91	95.1	100.4	104.2
Pyrite-based acid	23.3	22.1	22.1	21.8
Other/recycled production	9.9	11	11.8	13
Total	319.4	299	328.8	366.3

Source: CRU

Japan and South Korea

Japan is expected to increase exports in response to stronger international pricing and the market share vacated by China, rising from 3.07 million t/a in 2025 to 3.24 million t/a in 2026. South Korea has less capacity to increase exports. Volumes are expected to remain near 2.4 million t/a, declining slightly year on year from 2025 to 2026 due to a shortage of copper concentrates, which limits smelter throughput and by-product acid availability. Together, Japan and South Korea contribute useful incremental supply to the international market, but the combined increase is modest relative to China's export loss.

Peru

Peru is an important supplier to the Pacific acid market, particularly Chile. Smelter-based acid availability is expected to improve in the short term as PetroPeru ramps up, adding an estimated 100-200,000 t/a of supply by 2026. Exports are forecast to increase from around 1.0 million t/a in 2025 to 1.24–1.3 million t/a in 2026. However, the longer-term outlook is less supportive of exports. From 2028, the start-up of Tia Maria is expected to increase domestic acid demand, reducing export availability to approximately 700,000 t/a. This decline is strategically relevant to Chile, which remains structurally reliant on imports.

Consumers

Global acid demand is forecast to fall by 20.4 million t/a this year, with fertiliser demand accounts for most (80%) of the contraction, and metals-related demand dropping by an additional 2.2 million t/a.

Morocco

Morocco remains one of the world's largest acid consumers and importers because of its phosphate fertiliser industry. However, demand is forecast to decline from 23.8 million t/a in 2025 to 21.4 million t/a in 2026, before recovering to 25.5 million t/a in 2027 and 30.6 million t/a by 2030. This year's reduction is mainly based around restricted sulphur availability and lower phosphate operating rates, together with a shift towards triple superphosphate (TSP) production rather than mono- and diammonium phosphate (MAP/DAP). TSP has lower acid intensity than DAP and MAP, reducing acid consumption per tonne of phosphate fertiliser produced. TSP accounted for around 50% of Moroccan phosphate-fertiliser exports in 2025.

Moroccan sulphur-burning operating rates are expected to average around 70% in 2026. The country is forecast to add 3.0 million t/a of sulphur-burning capacity by 2030, while acid demand is forecast to grow by 5.0 million t/a over the same period. This implies that the country is likely to remain exposed to supply constraints and import requirements during periods of high phosphate operating rates.

Middle East

Saudi Arabia's acid market is shaped by the geographic separation of its phosphate operations. Despite national acid capacity, facilities at Ras Al Khair and MWSPC cannot fully balance local production and consumption because they are located in different areas. Acid imports reached 1.19 million t/a in 2025, but this year the closure of the Strait of Hormuz is expected to constrain purchasing and reduce imports to around 600,000 t/a. Import dependence is expected to ease from 2027 as Ma'aden III is commissioned, including associated coastal acid capacity. The location of this capacity should improve the ability to serve phosphate operations and reduce the need for imported acid.

Indonesia

Indonesian demand is affected by the economics of nickel high-pressure acid leach projects. In 2026, lower nickel prices, weaker HPAL economics and sulphur availability constraints have limited acid consumption growth. However, acid imports have increased because imported acid can substitute for sulphur where local sulphur-burning capacity cannot obtain feedstock. Imports rose 91% year on year to 800,000 tonnes for the year to August.

Longer term, nickel-related consumption is forecast to expand strongly. Integrated nickel-leaching demand is projected to increase from 9.2 million t/a in 2026 to 27.1 million t/a by 2030, with non-integrated consumption adding an additional 900,000 tonnes, rising to 1.6 million t/a. Import requirements should diminish after 2027 as domestic smelter-acid output recovers and is consumed within Indonesian industrial clusters, but this year sulphur-burning output is forecast to decline by 16% because of sulphur shortages and high input costs. Smelter acid supply is recovering. Freeport Indonesia's Manyar smelter is returning to production, while PT Smelting is expected to ramp up in the second half of 2026. Both are expected to attain full capacity by late 2027. Total Indonesian acid production is forecast to rise sharply from around 13 million t/a in 2026 to 32 million t/a by 2030, mainly based on sulphur-burning supply. Most new smelter acid is expected to be absorbed domestically, particularly by non-integrated nickel operations and battery-material supply chains. As a result, additional Indonesian smelter output is not expected to become a major export source.

India

Indian acid consumption was 14.3 million t/a in 2025 and is projected to rise eventually to 18 million t/a by 2030. Most of this acid goes to support the phosphate fertilizer sector. Domestic supply is expected to increase from 13.0 million t/a in 2025 to 14.3 million t/a in 2026, supported by new sulphur-burning capacity and the ramp-up of Adani's copper smelter, which is expected to produce 1.4 million t/a of acid at capacity. In spite of this, India remains structurally short of sulphur-burning acid supply. Imports are forecast at 1.6 million t/a in 2026, lower than previous years as domestic supply rises and global availability tightens.

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Brazil

Brazilian demand is expected to decline by around 1.7 million t/a in 2026 as high sulphur prices force cuts to phosphate production. Mosaic has curtailed single superphosphate operations, reducing acid consumption. SSP output is forecast to decline by around 30%. Brazilian imports have nevertheless risen sharply. Imports through July 2026 were already above total 2025 volumes, increasing 81% year on year.

Chile

Chile is structurally the largest long-distance acid import market due to the requirements of copper leaching operations. Copper-sector acid demand is forecast to remain broadly stable at 7.6 million t/a in 2026, before increasing to 8.47 million t/a by 2030. Near-term demand weakness at Chuquicamata and Mantoverde has been partially offset by recovery at Radomiro Tomic. Longer-term growth is linked to mine extensions at Spence, El Abra and Lomas Bayas, along with Marimaca, from 2028, and Collahuasi and Gaby later in the decade. The acid intensity of Chilean copper production has also increased, with the number of tonnes of acid required to produce a tonne of copper rising from 4.5 in 2015 to 7.1 in 2025, as SX-EW copper output declines and processing conditions become more acid intensive.

Chile's acid-import requirement is forecast at about 3.3 million t/a in 2026, compared with 4.0 million t/a in 2025. The reduction reflects high prices, revised mine plans and alternative supply arrangements rather than the disappearance of structural import dependence.

United States

US demand is forecast to decline from 29.9 million t/a in 2025 to 27.4 million t/a in 2026, before recovering to 30.7 million t/a by 2030. The immediate decline is concentrated in phosphate fertilisers, reflecting affordability constraints and further temporary production curtailments by Mosaic. Imports are forecast to decline by around 200,000 t/a in 2026, but the United States retains a structural deficit in sulphur-burning capacity and continues to require approximately 3.0 million t/a of imports through the forecast period. The medium-term outlook includes new demand from lithium processing. Lithium Americas is expected to add around 1.0 million t/a of acid demand by 2030.

Southern Africa

Acid demand in the Democratic Republic of the Congo has expanded with copper production, rising from to an estimated 5.8 million t/a in 2026. On-site sulphur-burning facilities provide much of the market's supply, but confirmed additions remain limited. Smelter-acid availability is expected to improve from 2026, including around 700,000 t/a from the Kamoa project. Imports were approximately 1 million t/a in 2025, principally sourced from Zambia. Zambia's removal of acid export restrictions has reduced a potential supply risk for the Congolese market.

Namibian acid demand is principally associated with uranium production. Demand is forecast to rise from 630,000 t/a in 2020 to 780,000 t/a in 2026. Domestic availability weakened after the Tsumeb smelter entered care and maintenance in June 2025, removing approximately 200,000 t/a of acid production. Supply is expected to improve from 2026 as the Skorpion Zinc smelter resumes production. A further improvement could occur from 2027 if Tsumeb restarts. Europe remains the principal import source.

Trade

Global sulphuric acid trade is forecast to decline from 23.1 million t/a in 2025 to 20.1 million t/a in 2026, remaining near 20 million t/a through 2030. Seaborne trade is expected to decline more sharply, down 3 million t/a to 14.2 million t/a this year, before recovering modestly to 15 million t/a in 2027. As well as the demand destruction and lower sulphur burning acid production mentioned above, China's effective withdrawal from acid exports weighs heavily upon the market, and is the primary cause of the contraction in seaborne trade. China imposed an export quota of 700,000 tonnes for January–April 2026, after which exports were reportedly suspended for May–December. Exports in the first four months of the year were 50% lower year on year, and are expected to decline from 4.64 million t/a in 2025 to 950,000 t/a for full year 2026.

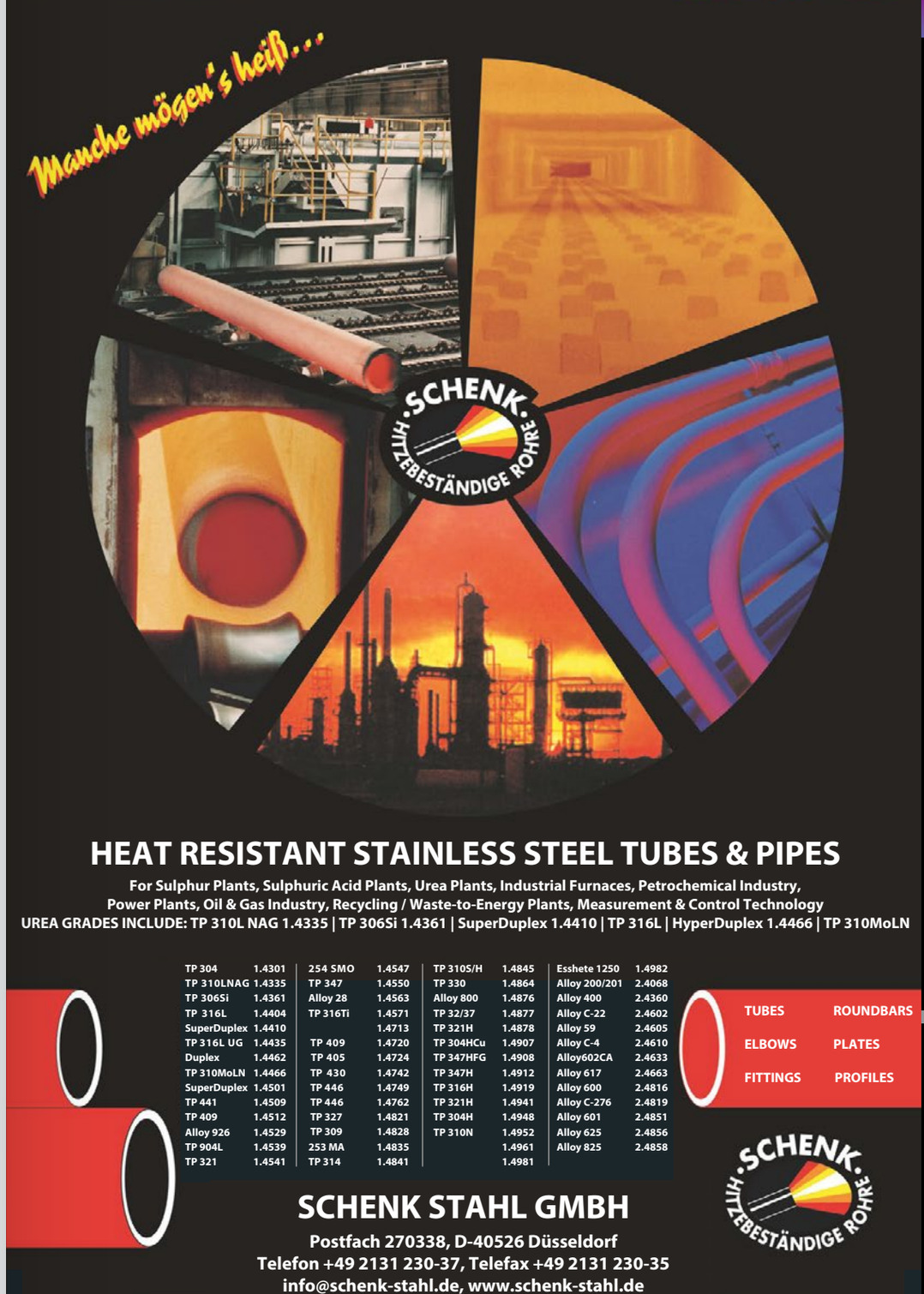
Set against this, Europe, Japan, South Korea and Peru are increasing or maintaining exports, but cannot fully replace Chinese cargoes. This has increased the importance of regional sourcing, especially European supply into Atlantic and Pacific deficit markets. The trade response varies by region. Chile has seen lower imports, increased reliance on European sources and reduced Chinese participation, while Morocco has seen a sharp import reduction as domestic operations run at lower rates and sulphur is prioritised.

Pricing

Acid prices reached historically high levels in 2026 following China's export restrictions and reduced availability of sulphur-burning supply. However, demand cuts, buyer resistance and improved expectations for smelter supply have caused delivered prices to decline from their mid-year peak. Delivered prices have softened more sharply than FOB prices. This reflects demand destruction in key destination markets, shifts in cargo availability and changes in freight and supply-chain conditions. FOB values in Europe and Northeast Asia remain relatively firm because these regions have become essential sources of export supply. Chinese domestic prices remained high despite easing during July and August. The national average declined from approximately $310/t in early July to around $292/t in early August.

The relationship between sulphur prices and acid prices is central to sulphur-burning economics. Acid premiums are measured as the acid price minus sulphur cost divided by approximately 3.06, reflecting the relative sulphur requirement for acid production. In China, the domestic acid premium was negative through 2026 and reached around negative $85/t. In practical terms, it was cheaper to purchase acid than to produce it from sulphur at prevailing feedstock costs.

Overall, prices are expected to peak in Q3 2026 and decline in the fourth quarter, assuming demand curtailment and improved sulphur availability. An easing of China's export restrictions, reopening of the Strait of Hormuz and a release of constrained sulphur supply could all bring prices down, but the principal upside risk remains a worsening copper-concentrate shortage. This could reduce smelter throughput and hence smelter-acid supply, increasing reliance on more expensive sulphur-burning output.



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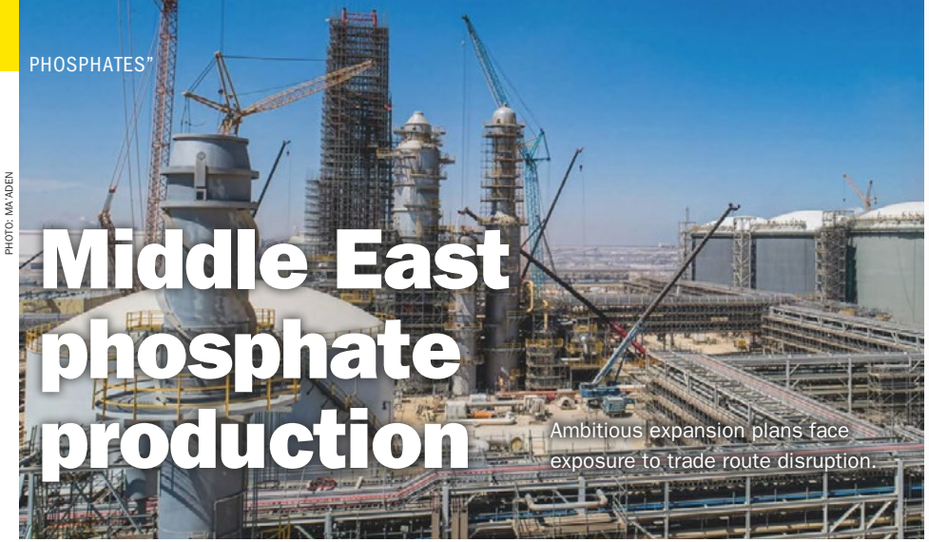

PHOTO: MA'ADEN

Middle East phosphate production

Ambitious expansion plans face exposure to trade route disruption.

Construction at Ma'aden Phosphates

The Middle East is one of the world's major phosphate exporting regions and hence a significant consumer of sulphur and sulphuric acid. However, for some countries in the region, ambitious expansion plans face unusually acute exposure to trade-route disruption. Saudi Arabia remains the principal regional force in export-oriented phosphate fertilizers, while Jordan retains an established role in phosphoric acid and finished fertilizers. Egypt is advancing projects intended to extend downstream processing around domestic phosphate resources, and the United Arab Emirates has a number of prospective, but still speculative, projects associated with Ruwais.

However, the disruption of shipping through the Strait of Hormuz has demonstrated that physical production capacity and deliverable supply are not the same thing. It has constrained the ability of Saudi producers to reach export markets, while also interrupting sulphur availability – a critical input into phosphoric acid and phosphate fertilizer manufacture.

Saudi Arabia

Saudi Arabia is the Middle East's most important integrated phosphate fertilizer producer. Its industrial system combines phosphate resources, processing capacity, ammonia availability and export infrastructure, with Ma'aden and its partner SABIC central to the sector. The country's established phosphate supply chain is orientated towards the Arabian Gulf, notably around Ras Al-Khair and Jubail. At Ras Al-Khair, Ma'aden has approximately 3.3 million t/a of DAP and MAP capacity, together with around 1.5 million t/a of phosphoric-acid capacity (tonnes P_2O_5). A further facility at Jubail has approximately 500,000 t/a of DAP capacity.

But much of Saudi Arabia's phosphate export system has been designed around Gulf access, leaving exports heavily dependent on passage through the Strait of Hormuz. Since the closure of the Strait at the end of February 2026, moving phosphate fertilizers from Saudi plants to customers has become substantially more difficult. Alternative arrangements have included trucking material to Red Sea ports, particularly Yanbu and Neom. Some volumes have also moved through Duqm in Oman. These options preserve some export capability, but they impose additional transport, handling and scheduling costs, and are not direct substitutes for a fully functioning export system. Furthermore, exports east via the Red Sea must still run the gauntlet of Houthi rebel attacks around the Bab al-Mandab Strait.

The immediate consequence has been a sharp reduction in exports and the accumulation of inventory. Up to 600,000 tonnes of Saudi phosphate fertilizer was reported to have been stranded in the Gulf at one point. Although a significant portion of this material reportedly moved during the June and July ceasefire period, the episode showed the significance of maritime access in converting nominal capacity into market supply.

At present Ma'aden may be able to export approximately 300–400,000 t/month while the Strait remains unavailable. This is meaningful volume, but below the level that a fully operational export network could support. Saudi DAP and MAP exports are forecast at 4.6 million t/a in 2026, despite the disruption. On a broader DAP, MAP and TSP basis, Saudi exports are projected to fall from approximately 6.5 million t/a in 2025 to 4.7 million t/a in 2026 – a decline of around 25%.

Ma'aden III

The most important addition to Saudi Arabia's phosphate sector is Ma'aden Phosphate III at Wa'ad Al-Shamal. The project is expected to provide 3 million t/a of DAP and MAP capacity in two phases. The project was previously expected to commission by the end of 2026, although regional tensions and export disruption create a risk to ramp-up and the timing of commercial operation. The project includes 760,000 t/a of wet-process phosphoric acid capacity, (tonnes P_2O_5), together with forecast finished-product capacity equivalent to around 583,000 t/a P_2O_5 as DAP and 208,000 t/a P_2O_5 as MAP. It also includes capacity for NPK products. The project would add a new large-scale export-oriented production platform to Saudi Arabia's existing facilities, extending the country's ability to serve markets in South Asia, Africa and elsewhere. It also reinforces a broader pattern in phosphate markets: new capacity is increasingly concentrated in integrated, resource-backed systems. Saudi Arabia has an advantage in this regard because its phosphate operations sit within a wider industrial base capable of supplying ammonia, power, infrastructure and export logistics. However, 2026 has also shown that integration at the plant level does not eliminate exposure to external maritime routes.

Jordan

Jordan remains a significant Middle Eastern phosphate producer, centred on Jordan Phosphate Mines Company (JPMC) and its facilities at Aqaba. JPMC operates DAP capacity at Aqaba equivalent to approximately 110,000 t/a P_2O_5, alongside MAP capacity of around 40,000 t/a P_2O_5. The Aqaba location gives Jordan access to the Red Sea. Capacity additions include the proposed joint venture with Turkey's Transpet, developing 300,000 t/a of phosphoric acid capacity, and associated sulphuric acid capacity. Tendering concluded in June with construction to start soon. Jordan has an established export-oriented phosphate industry, but the picture is one of continued activity around phosphoric acid and phosphate conversion, with the timing and realisation of individual proposals remaining uncertain.

Egypt

Egypt's phosphate developments are focused on building or expanding downstream conversion capacity at Abu Tartour and Ain Sokhna. At Abu Tartour, activity is based around the El Wady for Phosphate Industries and Fertilizers (WAPHCO). The project involves the construction of a phosphoric acid plant with a production capacity of 500,000 t/a of phosphoric acid and 1.6 million t/a of sulphuric acid, supporting the downstream processing of locally mined phosphate rock. Phase 1 of the development represents an investment of approximately US$658 million and will produce 250,000 t/a of phosphoric acid.

Misr Phosphates, a 25% stakeholder in WAPHCO, also has a plan to develop a DAP/MAP/NPK plant at Ain Sokhna in northeast Egypt, including 518,000 t/a of wet-process phosphoric acid capacity, plus finished-product capacities equivalent to 230,000 t/a P_2O_5 for DAP, 156,000 t/a P_2O_5 for MAP and 276,000 t/a P_2O_5 for TSP.

A separate project by El-Nasr Company for Intermediate Chemicals (NCIC) at Ain Sokhna is expected to add approximately 392,000 t/a P_2O_5 of wet-process phosphoric acid capacity from 2028, as well as DAP and MAP capacity equivalent to approximately 83,000 t/a and 94,000 t/a P_2O_5 respectively. The location in the Suez Industrial Zone is notable because it links processing potential with access to Egyptian ports and the Suez trade corridor.

Egypt's prospective projects point to a strategic direction of moving beyond phosphate rock extraction and toward higher-value acid and fertilizer production.

UAE

The United Arab Emirates is also a potential site for phosphate fertilizer production in the region, courtesy of ADNOC's strategic tie-up with Morocco's OCP. OCP has the world's largest phosphate rock reserves and some of the lowest cost production, while the Emirate of Abu Dhabi has become the world's leading exporter of sulphur. A strategic plan launched in 2018 intended that ADNOC would supply sulphur to OCP under a long-term contract, but also provided for the potential development of a phosphate hub at Ruwais in Abu Dhabi using imported Moroccan phosphate rock. The project proposes phosphoric acid capacity of around 450,000 t/a P_2O_5, plus DAP and MAP capacities equivalent to around 225,000 t/a and 180,000 t/a. The development remains highly speculative. Nevertheless, Ruwais is a logical location for a potential integrated phosphate project. It is already a major industrial and energy hub, with established ammonia production and ample gas reserves for expansion. A partnership involving ADNOC and OCP could potentially combine industrial infrastructure and energy capability with phosphate-sector expertise and acid supply.

Sulphur supply

Phosphate production depends fundamentally on sulphur. Sulphuric acid is required to convert phosphate rock into phosphoric acid, which can then be used in DAP, MAP, TSP and compound fertilizers. This means disruptions in sulphur availability have a direct effect on the phosphate industry, even where mines and fertilizer plants themselves remain operational.

The 2026 Middle East conflict and closure of the Strait of Hormuz have tightened sulphur availability sharply. Middle Eastern sulphur suppliers have been described as operating at approximately half their normal capacity. Sulphur prices have consequently risen to levels that make it the largest component of phosphate production costs for many producers.

Forecast sulphur FOB Vancouver prices average around $912/t in 2026 and $928/t in 2027, compared with $302/t in 2025. While Saudi and Moroccan producers are indicated to retain comparatively strong phosphate margins, the price increase changes the operating environment across the industry. It can weaken the economics of less integrated producers and constrain output where sulphur cannot be sourced reliably.

The relationship between sulphur and phosphate supply also magnifies the implications of maritime disruption. The Strait of Hormuz is not only an export route for Saudi finished fertilizer; it is part of the logistics chain affecting regional sulphur movement. A protracted closure would therefore restrict both the movement of finished products and the availability of a vital production input.

Outlook

The Middle East phosphate industry has a substantial expansion agenda. Saudi Arabia's Ma'aden Phosphate III is the foremost project and would materially increase regional DAP and MAP capacity once fully operational. Jordan continues to develop its acid and fertilizer position, while Egypt is pursuing new downstream processing capacity. However, the near-term supply picture remains more constrained. Saudi Arabia's existing production base has been affected primarily by export logistics, while regional sulphur tightness has raised costs and complicated operations across phosphate value chains. The global traded volume of DAP, MAP and TSP is forecast to fall from 33.8 million t/a in 2025 to 27.8 million t/a in 2026, reflecting the magnitude of the supply disruption.

For Middle Eastern producers, the defining operational question is not simply how much capacity can be built, but how reliable the whole production chain is, from phosphate rock, sulphur, ammonia, and production plants, to ports and shipping corridors. The projects now under development could strengthen the region's share of global phosphate supply over the latter part of the decade, but this year's lesson has been that production capability, input availability and export access must all be considered together. ■

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PHOTO: TSI

The impetus for sulphur forming



While some sulphur is transported as a liquid, especially in Europe and North America, recent events have highlighted the increased flexibility of solid sulphur supply chains.

Sulphur piles at Galveston, Texas.

For a sulphur producer, the question of whether to sell molten material or convert it into a solid form is often framed too narrowly. Liquid sulphur remains an efficient choice where supply and consumption are closely integrated: a nearby sulphuric-acid plant, a stable high-volume offtake agreement, and dedicated heated storage and transport can provide an effective route from recovery unit to consumer.

However, while heated storage and transport adds cost and complexity, the central benefit of forming is logistics optionality. A solid product can be stockpiled, loaded through dry bulk systems, redirected between customers and held while transport availability changes. That contrasts with molten sulphur, which must remain within a temperature-controlled handling chain and be received at facilities equipped to store, pump and use it. The commercial value of solid sulphur is therefore strongest for remote producers, exporters and suppliers with diverse or uncertain outlets.

Recent disruption to shipping through the Strait of Hormuz brings this distinction into sharper focus. It does not mean solid sulphur can avoid the Strait, and it does not make forming an alternative to secure maritime access. However, it increases the value of product that can wait safely, be marketed through a wider range of vessels and terminals, and be redirected when the timing or destination of a shipment changes. In that sense, sulphur forming can be viewed as resilience infrastructure as well as a product-handling choice.

Decoupling transport

Granules and pastilles allow a producer to turn recovered sulphur into a material that can be held at ambient conditions and shipped through conventional solid-bulk logistics. This does not eliminate handling requirements - sulphur dust needs appropriate controls and dry-bulk operations require sound storage and loading practice - but it removes the need to preserve a continuous hot-liquid chain from producer to customer.

This decoupling is particularly valuable because sulphur recovery is usually tied to the operation of a refinery or gas-processing complex. A producer may be unable or unwilling to reduce recovery output simply because a vessel is late, a customer is on maintenance or a rail route is disrupted. Forming capacity gives the operation somewhere to place material until the logistics chain is available again. It also lets the supplier separate the timing of production from the timing of sale and shipment.

Iran war

This year's disruption to Strait of Hormuz traffic has severely constrained Middle Eastern sulphur exports while some production continued. The report estimates that Middle Eastern producers accumulated more than one million tonnes of inventory by June. The region's heavy exposure to the Strait means that only a small share of Middle Eastern sulphur availability lies outside the affected route. The immediate constraint was therefore maritime access, not the physical form of the sulphur itself. Solid cargo remains subject to vessel availability, port access, insurance conditions, congestion and the same transit risk. But the disruption raises the value of inventory buffering. If shipping windows are uncertain, solid sulphur can be accumulated in stockpiles or silos until a vessel can be secured. A molten system can also store material, but it needs heated capacity and continued temperature management. The longer the interruption, the more significant this difference can become.

Second, disruption increases the value of vessel and berth optionality. When suitable ships are scarce or when security and insurance considerations limit nominations, a supplier benefits from having the broadest possible range of loading and transport options. Formed sulphur can generally be placed into dry-bulk cargo systems, whereas a molten shipment requires specialised equipment throughout loading, transport and discharge. This does not guarantee ship availability, but it reduces one layer of operational constraint.

Third, uncertainty makes destination flexibility more valuable. A dry solid cargo can generally be held, sold to another customer, moved through intermediate storage or re-routed with fewer infrastructure dependencies than a hot liquid cargo. For molten sulphur, an alternative buyer must have appropriate heated tanks, pumps and receiving arrangements, and the transport asset must remain compatible with the revised route. Those requirements are most difficult to manage precisely when port calls, sailing times and discharge windows are volatile.

Market developments

Flexibility can cut both ways, of course. Two examples have come from different locations around the world this year. Ukrainian strikes on Russian gas processing infrastructure has affected sulphur output from the Astrakhan plant. While in theory Kazakhstan could supply the Russian market, one of the key constraints on sulphur from Kashagan has been that it cannot be loaded as molten. This is a useful reminder that the issue is not solely whether sulphur is solid or liquid at the point of production. Loading infrastructure, terminal configuration and customer reception capability determine the practical routes available to a supplier. Forming capacity only delivers its full value when storage, handling and export facilities are designed to use it.

A similar investment in flexibility has come from Heartland Sulphur in Alberta, which has developed a supply model that combines remelting and forming: it can receive both solid and molten sulphur, supply molten material to North American customers and form solid material for offshore export. Heartland Sulphur increased re-melting capacity at its sulphur terminal near Edmonton, Alberta in 2025 from 500 t/d to 700 t/d, and aims to increase this to 1,500 t/d by the end of 2026. Heartland Sulphur is a partnership between sulphur marketer Lion Sulphur and distribution company InterChem. Coupled with the existing 4,500 t/d of forming capacity, the re-melt expansion shows that these systems can be complementary rather than mutually exclusive. The company has the option to produce molten sulphur for the US market, or granules which can be shipped via Vancouver to global consumers.

Elsewhere, Saudi Arabia is investing in a new sulphur handling facility at Ras Al-Khair Port on the country's Eastern Province coast under a build-own-operate-transfer (BOOT) model. The facility is expected to have the capacity to receive, process, form and export up to 9,500 metric t/d of molten sulphur per day.

A resilience decision

Obviously producers will not be abandoning molten sulphur. A supplier with a reliable local acid customer, a short dedicated route and established heated infrastructure may have little reason to add forming solely for export optionality. Likewise, a formed product supply chain incurs its own capital, operating, storage and handling costs, while end users must remelt the material before it can be consumed.

The stronger conclusion is that forming becomes more attractive where a producer needs to manage uncertainty. That may include remote location, international sales, multiple customers, variable offtake, limited local acid demand, intermittent shipping access or a need to build inventory without compromising upstream operations. Under those conditions, the value lies in the ability to separate recovery from immediate transport and sale.

For Gulf-linked exporters, the current Strait of Hormuz situation provides an additional illustration of this value. Formed sulphur cannot remove the fundamental exposure to maritime disruption. It can, however, give a producer more choices before and after the transit: more capacity to hold product, more potential shipping and terminal options, and more scope to alter the timing or destination of a cargo. Those are the characteristics that make solid sulphur a logistics tool – and, in a disrupted market, a potential source of operational resilience.



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SULPHUR + SULPHURIC ACID
ISSUE 426
SEPTEMBER-OCTOBER 2026

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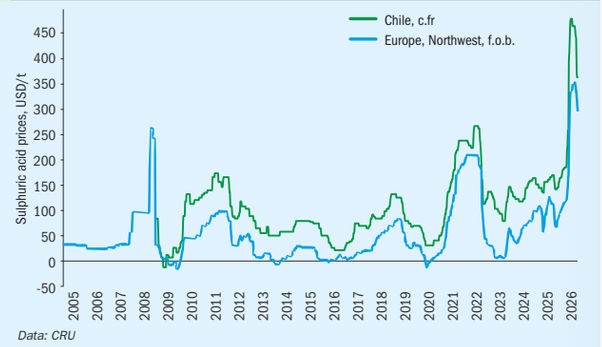
China export halt reshapes acid trade in 2026

In this insight, **Viviana Alavardo**, CRU Sulphur and Sulphuric Acid Analyst, examines the impact of China's suspension of sulphuric acid exports, which has removed an estimated 2.8 million tonnes from the traded market in 2026 and compounded an already acute shortage of sulphur. While prices have eased from their record highs in May as importers reduce requirements and reallocate supply, they remain historically elevated amid limited scope for replacement volumes.

To preserve domestic acid supply amid the acute global sulphur shortage, Chinese authorities unofficially announced the suspension of all sulphuric acid exports from May until year-end. China's withdrawal from the market added substantial pressure to an already tight global market, driving prices to unprecedented levels in May. As no alternative origin can fill the gap left by these volumes, importers have had to adjust by cutting back on requirements, thereby easing pressure on prices.

Fig. 1: **Sulphuric acid prices have fallen but remain at historical highs**



Data: CRU

Sulphuric acid prices reach new records in 2026

The acute sulphur shortage, caused by the ongoing Middle East conflict and the closure of the Strait of Hormuz, has led Chinese authorities to suspend all sulphuric acid exports to protect domestic supply. The market was already tight, as China had initially implemented a quota system for January–April, capping exports at 700,000 t – just over half the volume shipped during the same period last year.

Sulphuric acid prices had been on an upward trend since 2025 Q4, supported by constrained availability from key exporting regions, renewed demand from major consumers and elevated sulphur prices. China's unofficial announcement further accelerated acid price increases, pushing prices to all-time highs. As a result, delivered prices in Chile rose from $190/t c.fr. at the start of the year to $500/t in May (see Fig. 1). Prices in exporting regions mirrored this upward trend, with f.o.b. prices in Northwest Europe and Japan/South Korea reaching $350/t in May.

Chinese exports have boomed over the past decade

The announcement of China's withdrawal proved highly disruptive. China increased its annual acid exports to 4.6 million tonnes in 2025 in response to global supply disruptions, raising its share of the traded market to 27% (see Fig. 2). Chinese cargoes have consistently filled a structural gap in the traded market over the past several years, with limited scope for other origins to compensate.

On the demand side, China's role in supplying acid has been significant. Chile, the largest sulphuric acid importer, sourced almost 40% of its requirements from China in 2025. India, Morocco, Saudi Arabia and Indonesia imported smaller volumes, but their reliance on Chinese supply was even higher.

With limited scope for alternative exporters to increase supply, the market has had to adjust to tight availability through demand reductions and the reallocation of import flows. Consumers have already responded by curbing their acid

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requirements, discouraged by high prices and limited availability. The resulting demand reduction has removed support for acid values over the past two months. Delivered prices into Chile declined to $380/t c.fr. in late August, down $120/t from their peak in May. This downward pressure has also been mirrored in exporting regions, with average f.o.b. prices in Northwest Europe and Japan/South Korea declining to $310/t from $350/t over the same period.

Consumers have already adjusted to tight availability

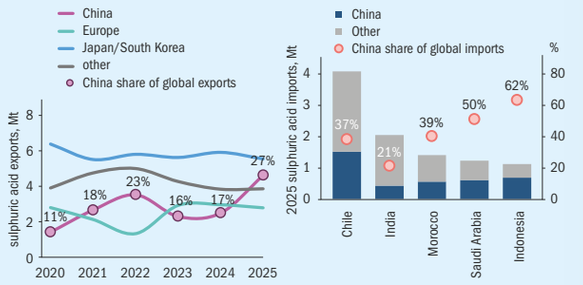
Buying activity among major consumers has shown mixed signals throughout 2026 (see Fig. 3). Chilean buyers reduced their import requirements by 14% y/y through August, as mining consumers, including Capstone, adjusted production plans to reduce acid consumption. In early August, following a revision to its Mantoverde mine plan, the company announced that it would halt all spot purchases for the remainder of 2026, with its remaining acid requirements for the year fully covered by existing contracts. As a result, total annual imports are expected to decline to 3.3 million tonnes in 2026.

In addition, a copper producer and a Chinese smelter finalised an acid-for-concentrate swap in July, widely understood to involve the supply of 100,000 t of acid. The conclusion of this deal has significantly reduced spot-market pressure from one of Chile's major consumers ahead of Q4 procurement.

By contrast, buying activity in Brazil remained surprisingly strong through August, despite affordability constraints in the phosphate sector. Acid purchases increased by 85% y/y and have already surpassed the total volume sourced in 2025. This frenzied buying has resulted in a temporary glut, which has also supported the downward price trend in the region. Buyers have paused acid purchases, but total annual imports are expected to increase to almost 1 million tonne in 2026.

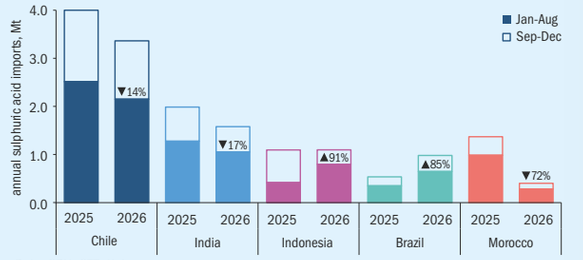
Other phosphate-consuming countries, including Morocco and India, have curtailed their acid requirements. Import demand in the two destinations declined by 17% and 72% y/y through August, respectively. The prevailing global sulphur shortage, rising cost pressures and limited acid availability have discouraged buyers from securing acid as an alternative feedstock. Annual import demand from both countries is expected to be lower than in 2025.

Fig. 2: **China has become a key sulphuric acid supplier**



Data: CRU, GTT

Fig. 3: **Buying activity has shown mixed signals across key consumers**



Data: CRU, GTT, Kpler

Conversely, Indonesian buyers have remained active in the market, as the acute sulphur shortage has prompted them to secure acid as an alternative feedstock for nickel operations. As domestic sulphuric acid supply from smelter operations has not ramped up as initially expected, buyers have temporarily shifted towards imported acid, with purchases through August increasing by 91% y/y. As a result, total annual imports in 2026 are expected to remain broadly stable compared with 2025, at around 1 million tonne.

China's decision to halt acid exports is expected to remove around 2.8 million tonnes of supply from the traded acid market in 2026. As no alternative source of supply can compensate for a loss of this scale, market tightness will persist for the remainder of 2026. In response, the market has adjusted through lower import demand, which has in turn entrenched bearish sentiment and pushed prices lower. Although prices have fallen considerably over the past two months, they remain at historical highs, as the ongoing shortage is preventing a sharper decline.

Under typical market conditions, tight acid availability would be addressed through increased sulphur burning. However, given the current geopolitical environment and the ongoing closure of the Strait of Hormuz, this route has not been a feasible option. Improved sulphur availability would provide some acid buyers with greater flexibility, removing further support for prices. However, a resolution to the Middle East conflict would not necessarily ease the persistent supply tightness in the acid market.



About the author

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PHOTO: IHG HOTELS



2026 Sulphur+ Sulphuric Acid Expoconference

CRU welcomes you to the 2026 Sulphur+Sulphuric Acid 2026 Conference and Exhibition at the Estrel in Berlin 3-5 November. Join us for a truly global gathering of the sulphur and sulphuric acid community, where leading market and technology experts and producers will gather to connect, share knowledge, exchange ideas and learn about market trends and the latest developments in operations, technology, processes and equipment.

The Estrel, Berlin.

What to expect in Berlin

For 42 years, CRU's Sulphur+Sulphuric Acid Expoconference has brought together the global sulphur and sulphuric acid community to exchange market intelligence, technical expertise and operational experience.

This November, more than 400 professionals from over 40 countries are expected to meet in Berlin, including producers, processors, traders, technology providers and end-users from across the value chain. The event combines commercial perspectives with practical technical discussions, providing an ideal platform to build connections and address the issues shaping the sector.

A market in transition

Supply volatility, constrained sulphuric acid availability from copper smelters, evolving trade flows and rising carbon costs are changing the operating environment for the sulphur and acid industries.

The 2026 programme will examine these developments through expanded market outlooks, trade-flow analysis and supply-and-demand insights from CRU analysts and industry participants. Delegates will gain context on current market conditions and the factors likely to influence sourcing, production and competitiveness in the years ahead.

Commercial insight and technical expertise

The conference's dual-streamed agenda is designed to connect commercial and technical priorities. You can expect:

- Market outlooks covering global sulphur and sulphuric acid supply, demTechnical presentations on production, processing, plant reliability and operational improvement
- Innovation showcases spanning process technology, materials and equipment
- Practical case studies sharing real-world operational experience and lessons learned
- Troubleshooting clinics focused on solutions-led discussions of key plant challenges
- Emissions and decarbonisation discussions addressing compliance requirements and evolving carbon costs

Meet the global industry

Alongside the conference programme, a dedicated exhibition will feature solution providers serving the sulphur and sulphuric acid industries. It offers an opportunity to discover technologies, discuss operational requirements and connect directly with specialists supporting the sector.

Whether the priority is understanding market risks, strengthening supply relationships, improving plant performance or identifying new technical solutions, CRU's Sulphur+Sulphuric Acid Expoconference remains an essential annual forum for the global industry to connect and do business.

Register today for your place at the 2026 Sulphur+Sulphuric Acid Expoconference in Berlin. For more information visit: sulphur.events.crugroup.com.

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Conference Agenda

MONDAY, 2 NOVEMBER

(Correct at time of going to press)

SIGHTSEEING – Classic Berlin Tour – 13:00

TUESDAY, 3 NOVEMBER – CONFERENCE DAY 1

08:00 REGISTRATION AND EXHIBITION OPEN

OPENING PLENARY SESSION

09:00 **Welcome address**
Lisa Connock, Managing Editor, *CRU*

09:10 **Industry keynote address. Sulphur: the fourth element of life – from refinery to resource in a decarbonising world**
Andreas Krobjilowski, Technical Managing Director, *MiRO Mineraloelraffinerie Oberrhein GmbH & Co. KG*

09:30 **Global sulphur markets outlook**
Dr. Peter Harrisson, Principal Analyst, *Sulphur and Sulphuric Acid, CRU & Co. KG*

10:00 **Industry keynote – Panel discussion: Reshaping the global sulphur and sulphuric acid industry**
Craig W. Jorgenson, President and CEO, *TSI*
Marco Brunsendorf, Head of Sales Smelter Products, *Aurubis*
Maud Bergsjø, Sector Group Manager, *Cefic*

10:50 NETWORKING COFFEE BREAK

COMMERCIAL AND MARKETS SESSION

11:20 **Sulphuric acid market at unprecedented levels amid tight availability**
Viviana Alvarado, Analyst, Sulphuric Acid, *CRU*

11:50 **The role of specialised sulphur hubs: A necessity for the market and an 'insurance' for its user at the same time**
Michael Schöber, Managing Director, *Duval NV*

12:20 **From reagent to active material: The role of sulphur and acid in battery materials**
Willis Thomas, Head of CRU+, *CRU*

12:45 NETWORKING LUNCH

SULPHUR TRACK

14:00 **Sulphur troubleshooting clinic**

15:30 NETWORKING COFFEE BREAK

SULPHUR TECHNICAL SHOWCASE SESSION

16:00 **TBC**
TBC

16:15 **Two-stage sour water stripping: A parametric study**
Simon Weiland, Product Manager, *OPTIMIZED GAS TREATING, INC*

16:30 **Sulphur run-down war stories**
Stefaan Gouhie, Sales Director Europe, *AMETEK CSI*

16:45 **Protecting your investment by detecting refractory problems before they cause real problems**
Bob Poteet, Director of Business Development, *WIKA Instrument LP*

17:00 **Sulphur valorisation via the development and commercialisation of artificial soil**
Awais Zaka, *Khalifa University of Science and Technology*

17:15 **TBC**
TBC

SULPHURIC ACID TRACK

14:00 **Sulphuric acid troubleshooting clinic**

15:30 NETWORKING COFFEE BREAK

SULPHURIC ACID TECHNICAL SHOWCASE SESSION

16:00 **Acid purification and concentration with ultrastable graphene oxide membranes**
Christopher Thompson, *Via Separations*

16:15 **Optimising wear life and performance in sulphuric acid production**
Carsten Düchting, Chief Executive Officer, *Düchting Pumpen Maschinenfabrik GmbH & Co. KG*

16:30 **Beyond acid: Exploring the range of applications that Chemetics CORE-SO2 can drive, including SO_3 for high purity acid production and gaseous or liquid SO_2, while minimising forced byproduct production**
Worley Chemetics

16:45 **Transforming sulphuric acid plants into renewable energy assets for large-scale hydrogen production and low-carbon manufacturing**
Paul Zorn, Senior Vice President – Process Engineering, *P & P Industries AG*

17:00 **Technical discussions on major maintenance of conversion system at sulphuric acid plant**
Enze Jin, Overseas Business Manager, *Wylton*

17:15 **Surface protection and reliability strategies for sulphuric acid assets: Safer and longer-lasting operation of production lines through engineered design and high-performance materials**
Patrick Pfeil, Head of International Sales & Projects, *Rema Tip Top AG*

17:30 **(Live) Demo: SensoTech LiquiSonic measurement for reliable sulphuric acid and oleum process control**
Duc Tien Le, Application Engineer, *SensoTech GmbH*

17:45 NETWORKING WELCOME RECEPTION

WEDNESDAY, 4 NOVEMBER

(Correct at time of going to press)

COMMERCIAL AND MARKETS TRACK

08:00 REGISTRATION & EXHIBITION OPEN

09:00 **ECONOMICS OF SULPHUR AND SULPHURIC ACID INDUSTRY**

Industry keynote address: Economics of smelter operations – how rising sulphuric acid prices are turning a by-product into a profit centre
Daniel Peltonen, President, *Boliden Smelters*

Economics of global energy outlook. Margins under pressure. Energy transition meets sulphur supply realities
Ilona Khachirova, Analyst, *CRU*

10:30 NETWORKING COFFEE BREAK

11:00 **MARKETS, TRADE AND LOGISTICS**

Decoding sulphur: Tracing the journey from by-product to strategic commodity
Ilya Motorygin, Managing Partner, *GG Trading DMCC*

The role of Türkiye in the European and Mediterranean sulphur market. The need for greater transparency, standards and trust in sulphur trading
Nurettin Bayraktar, Chief Executive Officer, *Bayminerals*

Regional market overview. South Asia sulphur demand at the crossroads: Fertilizer pressures, supply-side transition risk, and what comes next
Muhammad Idrees, Executive Vice President – Engineering & Business Development, *Ultron FZE*

12:30 NETWORKING LUNCH

14:00 **MARKETS, TRADE AND PROJECTS**

Phosphate shock: Supply constraints multiply and intensify in 2026
Maria Gamboa, Analyst, Phosphate Raw Materials, *CRU*

Pre-purchase evaluation of sulphur quality: A buyer's guide
Jan Hermans, Consultant, *Elessent Clean Technologies*

Energy and sustainability: SULPHURREAL project
Dimitrios Dimitrakis, Group Leader, *Deutsches Zentrum für Luft- und Raumfahrt (DLR)*

15:30 NETWORKING COFFEE BREAK

16:00 **CRU INTERNATIONAL BRIEFING**

SULPHUR TRACK

08:00 REGISTRATION & EXHIBITION OPEN

09:00 **SULPHUR PROCESSING, STORAGE & SAFETY**

Step by step to tailor-made sulphur processing solutions: Digital configuration for faster, smarter project delivery
Alexander Wolf, Global Segment Manager Chemicals, *IPCO Germany GmbH*

Sulphur tank venting design considerations
Brandon Forbes, Quality and Technical Manager, *AMETEK CSI*

Eliminating the sulphur pit: A self funding reliability upgrade for SRUs
Richard Spires, Vice President Technology and Products, *Wood*

10:30 NETWORKING COFFEE BREAK

11:00 **SULPHUR RECOVERY UNIT: SPOTLIGHT ON CATALYTIC REACTORS**

Simulation-based thermohydrodynamic analysis of a Claus process catalytic reactor
Elmo Nasato, President, *Nasato Consulting Ltd*

Restoring Claus reactor performance through online sulphur washing: a case study in downtime avoidance
Sunil Umare, Chief Manager Operation, *Hindustan Petroleum Corporation Limited – HPCL*

Expanding evaluations of heterogeneous catalysis in Claus tail gas treatment using a bespoke adiabatic laboratory reactor
Robert Marriott, Director of Research, *Alberta Sulphur Research Ltd*

12:30 NETWORKING LUNCH

14:00 **CLAUS TAIL GAS TREATING: BEST OPERATING PRACTICES**

Managing mercaptan in tail gas units
Michael Huffmaster, Consultant (Professional Engineer), *Michael A. Huffmaster, PE, LLC*

The ten commandments of tail gas treating
Gerrit Bloemendal, SME Gas Treating and Sulphur Recovery, *Worley Comprimo*

Beyond MDEA: cutting costs and boosting sulphur recovery in tail gas treating with selective removal technology
Yifan Zhu, Technical Director, *Fluor*
Sergey Vorobyev, Head of Technology – OASE Gas Treatment, *BASF SE*

15:30 NETWORKING COFFEE BREAK

16:00 **OPERATOR SPOTLIGHT. SULPHUR PLANT PERFORMANCE: TROUBLESHOOTING CASE STUDIES**

Reduced sulphur species control in AGRP-II: Case studies on high RSH in TGT reactor and high H_2S in treated water
Saad Almutairi, Panel Operations, *KNPC*

Sour water stripper (SWS) Corrosion failures: Mechanisms and solutions
Khalid Ghazal, Technical Staff Process Engineer (Sulphur & Amine Specialist), *Saudi Aramco Mobil Refinery Company Ltd.*

Pushing the limits of SRU revamps high-level oxygen enrichment enabling 50% capacity increase and ultra-lean acid gas operation
Debopam Chaudhuri, Principal Process Specialist, *Fluor*

SULPHURIC ACID TRACK

08:00 REGISTRATION & EXHIBITION OPEN

09:00 **SULPHURIC ACID INDUSTRY: PROJECTS AND INNOVATION**

Small modular plants in a megaplant-dominated world
Gabriel Murakami, Marketing Coordinator, *Clark Solutions*

Anhui Jinxuan's 1800 MTPD project – HP steam replaces MP steam in sulphuric acid plant, reducing steam consumption and increasing net power output
Shuang Yan, ENGINEER, *CERE China Technical Engineering Jiangsu Co., Ltd. SHANGHAI BRANCH*

"I love it when a plan comes together" A Lithium Americas update
Steven Puricelli, VP of Process and Technology, *EXP*

10:30 NETWORKING COFFEE BREAK

11:00 **OPERATOR SPOTLIGHT: METALURGICAL ACID PLANTS**

Managing a sulphuric acid plant in rural Navada
Jacob Carpenter, Senior Mechanical Engineer, *Nevada Gold Mines*

Benchmarking small-scale acid plants against world-scale facilities: closing the per-tonne gap
Andres Restero Gutierrez, *PQP Columbia*

Plant operations, reliability, and debottlenecking. case study from Minas Buenaventura – Peru
Jose Lama, Operations Superintendent, *Cia. de Minas Buenaventura, Peru*

12:30 NETWORKING LUNCH

14:00 **OPERATOR SPOTLIGHT: METALURGICAL ACID PLANTS**

A new gas cleaning plant upstream of the sulphuric acid plants for secondary copper smelter offgas
Hanno Hintze, Director Engineering Technology, *Aurubis AG*

Evaluation and reduction of SO_2 emissions in Acid Plant No.1 at the Ilo Copper Smelter
Alvaro Jara, Metallurgist, *Southern Peru*

Operational Insights from DeNO$_x$ Measurement Campaign and Development of Inline UV–Vis NOx Monitoring
Kumar Rajan, Senior Product Engineer, *Metso*

15:30 NETWORKING COFFEE BREAK

16:00 **SULPHURIC ACID PLANT PERFORMANCE: CATALYSTS AND EMISSIONS**

Unlocking new levels of converter performance with cutting-edge catalyst additive manufacturing technologies
Jochen Willersinn, Technology Manager – Sulphuric Acid Catalysts, *BASF SE*

Performance optimisation on Wylton's cesium-promoted catalyst – VCs
Jae Shi, *Wylton*

A new catalyst approach for lean gas conditions
Martin Alvarez, Solution Specialist, VK Catalyst, *Topsoe A/S*

Beyond the cesium ceiling: SulfoMax EV and the next frontier in SO_2 conversion
Shanmuga Sundaram, Business Segment Head – BU Catalyst – Sulphuric Acid, *Süd Chemie India Pvt Ltd.*
Hirsh Shah, Manager – Sales & Technical Services, *Süd Chemie India Pvt Ltd.*

19:00 SULPHUR+SULPHURIC ACID PARTY (19:00-23:00)

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THURSDAY, 5 NOVEMBER

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SULPHUR TRACK

08:00 REGISTRATION & EXHIBITION OPEN

09:00 SULPHUR RECOVERY PROCESSES: ALTERNATIVES TO CONVENTIONAL CLAUS

Recovering sulphur from phosphogypsum
Tim Cotton, Chief Executive Officer, *Novaphos*

From sulphur liability to strategic resource: Capturing full value from sulphur-containing off-gases
Jenny Hedenblad, Senior Licensing Manager, *Topsoe A/S*

OXYSULF Technology – an alternative to the conventional SRU process. Low-emission processing of sulphur and sulphur-containing feed streams including ammonia-rich gases
Mathias Innerkofler, Business Development Manager, *kvt.technology*

10:30 NETWORKING COFFEE BREAK

11:00 DECARBONISATION OF SULPHUR AND SULPHURIC ACID INDUSTRIES

From trials to routine operation: Field data review of renewable co-processing impact on amine, SWS and SRU Performance at VAROPreem Lysekil
Kaiyr Tekebayev, *SGS Sulphur Experts*

NX SulphuRec™ New innovative solution to reduce CO_2 emissions
Daniela Boni, Sulphur Technology Manager, *NextChem Tech S.p.A.*

Integrated AGEU & TGTU design at greenfield gas processing facility: A unified solvent strategy for sulphur recovery and future-ready carbon capture
Mujahid S. Alturais, Senior Project Engineer, *Aramco Overseas*
Saleh A Aldhowayan, Process Engineer, *Saudi Aramco*
Ibrahim J. Alzahrani, Lead Process Engineer, *Aramco Overseas*

Developments in decarbonisation of the sulphuric acid industry
Dimitrios Dimitrakis, *Deutsches Zentrum für Luft- und Raumfahrt (DLR)*

12:55 NETWORKING LUNCH

14:00 INSIDE THE SULPHUR PLANT: OPERATIONS AND BEST PRACTICES

An improved refractory concept supports a safe and long-lasting operation of claus reaction and sulphur furnaces
Xiaowei Huang, Business Development Expert EEC, *RHI Magnesita*

Sulphur plant control innovations – facts and basics
Jochen Geiger, Instrumentation Expert, *Jg-consultant (AMETEK Process Instruments)*

Improving performance and reliability of the SRU reaction furnace and incinerator
Uday Parekh, Senior Global Director – Energy & Chemicals, *Blasch Precision Ceramics*

SULPHURIC ACID TRACK

08:00 REGISTRATION & EXHIBITION OPEN

09:00 SULPHURIC ACID PLANT: ASSET INTEGRITY, MATERIALS OF CONSTRUCTION AND MAINTENANCE

Creep based service life assessment for converter components using FEA
Robert Crane, Mechanical Engineer, *NORAM Engineering and Constructors*

SAF 3006 (UNS S83071) - A new super duplex stainless steel for low and high concentration sulphuric acid heat exchangers
Jonas Höwing, Technical Marketing Specialist, *Alleima*

Performing complex acid-resistant repairs on brick-lined units, preferably externally with only partial internal access
Roland Günther, Project Manager – Export Sales, *STEULER-KCH GmbH*

10:30 NETWORKING COFFEE BREAK

11:00 SULPHURIC ACID REGENERATION AND PLANT EQUIPMENT

Energy efficiency optimisation of main blowers in sulphuric acid plants: Considerations for greenfield and brownfield plants
Wolfhard Kiefer, Sales & Proposal Manager, *Howden, a Chart Industries Company*

Oxy-SAR: Examining the impact of oxygen enrichment and pure oxygen operation for sulphuric acid regeneration plants
Worley Chemetics

Energy efficiency and enhancing productivity at Petrokimia Gresik's sulphuric acid plant through innovative redesign of jug damper, economiser and the application of dry ice cleaning methods
Galih Yudhaprawira, Operation Engineer, *PT Petrokimia Gresik*
Jawad Farisi, Operation Manager, *PT Petrokimia Gresik*

Project highlights of the replacement of a spent acid furnace
Florian Kistl, Head of Sales, *CS Combustion Solutions*
Martin Kürten, Head of Project Management, *Grillo*
Irina Pfeifer, Managing Director, *HUGO PETERSEN*

12:55 NETWORKING LUNCH

14:00 SULPHURIC ACID PLANT DESIGN: INNOVATIVE EQUIPMENT, PLANT PERFORMANCE AND WASTE HEAT RECOVERY

The LUREC® journey – Innovation driven by an industry challenge
Metso

Optimising atomisation for sulphur and decomposition furnace injector lances in a field test
Ellen Stotz, Process Technology Distribution, *Lechler GmbH*

From emissions monitoring to asset reliability: Enhancing sulphuric acid plant performance through operational insight
Edmundo Bardales, SO_2 Business Developer and Engineer, *SENSIA*

15:30 END OF CONFERENCE



Exhibition Floorplan

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2 SensoTech
3 Fluor
4 STEULER-KCH Plastic Linings
5 WIKA
6 Shandong Junfei Environmental Protection Technology Co., Ltd
7 HEC International INC
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9 Gouda Refractories
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13 Aecometric Corporation
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22 European Filter Corporation
23 OPTIMIZED GAS TREATING, INC.
24 PegasusTSI
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30 Clark Solutions
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37 MECS / Elessent Clean Technologies
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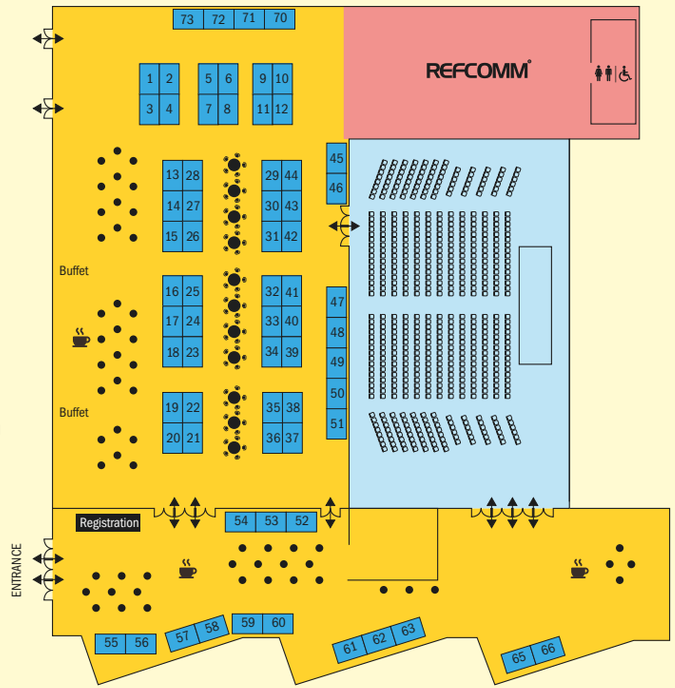

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Exhibitor Spotlights

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Contact: Helene Mbangu
Email: Helene.Mbangu@bluefil.com
Web: www.bluefil.com

CS Combustion Solutions — Stand 1

CS Combustion Solutions, part of the Unitherm-Cemcon Group, draws on UNITHERM's burner, kiln and furnace-construction experience dating to 1946. Its specialist team engineers, supplies and commissions vertical and horizontal burners and combustors. Applications include sulphur, spent acid and acid gas; waste gas, air and water; hazardous, special, liquid and pasty wastes; and burners and reaction furnaces for sulphur recovery units.

Contact: Florian Kistl
Email: sales@comb-sol.com
Web: www.comb-sol.com

Duiker Clean Technologies — Stand 12

Duiker is a specialised combustion engineering and contracting company based in the Netherlands, providing advanced thermal process solutions, related equipment, and after-sales services for applications such as sulphur recovery, ammonia-to-hydrogen, and ammonia-to-heat conversion. With extensive experience in designing, supplying, and servicing sulphur recovery burners and associated equipment, Duiker integrates proven engineering with innovative features that enhance plant performance, safety, reliability, and overall operation.

Contact: Ernst Van Koert
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Web: www.duiker.com

FIMA Maschinenbau GmbH — Stand 54

For more than 80 years, FIMA Maschinenbau GmbH has delivered high-performance single- and multistage radial blowers and turbo compressors to the world's most demanding industries. In sulphuric acid production and sulphur recovery units, where reliability and efficiency are critical, FIMA blowers and compressors set the benchmark. Every blower is engineered, manufactured, and tested at our German headquarters, ensuring the highest quality before it reaches your plant.

Contact: Lars Altmann
Email: leads@fima.de
Web: www.fima.de/en



Fluor — Stand 3

Fluor Corporation is a global engineering, procurement, construction, maintenance and project management company. With more than a century of experience delivering complex projects worldwide, Fluor provides proven and innovative solutions for sulphur recovery plants, tail gas treating units and proprietary process technologies. Its technical expertise, dependable project delivery and strong safety record have established it as a respected leader in sulphur recovery.

Contact: Marcus Weber
Email: marcus.weber@fluor.com
Web: www.fluor.com

HUGO PETERSEN — Stand 21

HUGO PETERSEN offers a comprehensive technology portfolio for the production of high-quality sulphuric acid and oleum from elemental sulphur, metallurgical off-gases and spent acid gases. The company also has established expertise in hydrochloric acid production and gas cleaning, applying wet, dry and catalytic process technologies. Its services include:

- Consulting, design and construction of new plants and plant units
- Revamping, modernisation and refurbishment of existing facilities.

Contact: Patricia Tucci
Email: patricia.tucci@hugo-petersen.de
Web: www.hugo-petersen.de/en

CONFERENCE + EXHIBITION PREVIEW

IPCO — Stand 59

IPCO, a world leader in sulphur processing and handling solutions, has supplied sulphur processing and handling systems globally since 1951. Its portfolio covers all capacity requirements: Rotoform® pastillation systems for small-to-medium output, producing uniform, free-flowing sulphur pastilles, and automated drum granulation systems for medium-to-high throughput. Together, these technologies provide reliable, high-quality sulphur forming solutions for storage, transport and downstream handling.

Contact: Alexander Wolf
Email: alexander.wolf@ipco.com
Web: www.ipco.com/

KALFRISA — Stand 43

KALFRISA is a Spanish engineering company with more than 60 years' experience in energy-efficiency and environmental technologies. For sulphuric acid plants, it designs and manufactures start-up preheaters that heat converters to catalytic operating temperature, supporting reliable start-up and performance. Combining robust engineering, advanced burner management and automated controls, KALFRISA provides global support across design, manufacture, installation, commissioning, maintenance and technical assistance.

Contact: Caterina Favaro
Email: caterina.favaro@kalfrisa.com
Web: www.kalfrisa.com/

P&P Industries AG — Stand 34

P&P specialises in sulphur and sulphuric acid processing, waste-gas cleaning and precious-metal catalyst technologies. A global leader in spent sulphuric acid regeneration plants, P&P converts sulphur-bearing waste gases and liquids into high-quality sulphuric acid and clean, sulphur dioxide-free air. Its proprietary solutions reduce raw-material use, energy demand and disposal costs while supporting reliable operation, high plant availability and improved environmental performance.

Contact: Paul Piantino
Email: paul.piantino@pp-industries.at
Web: www.pp-industries.at

Recalibrate — Stand 56

Recalibrate is transforming sulphuric acid production through patented technology designed to eliminate SOx and NOx emissions – pollutants linked to smog, acid rain, and ocean degradation. As demand for food, energy, and infrastructure grows, its scalable, economically competitive solution makes cleaner manufacturing integral rather than an add-on. Recalibrate's mission is to protect air and water without compromising human progress.

Contact: Kenny Erdoes
Email: kenny.erdoes@recalibrateco.com
Web: www.recalibrateco.com

REMA TIP TOP — Stand 39

REMA TIP TOP is a global provider of conveyor and processing technology, tire repair, rubber products and coatings. With nearly a century of expertise in material development and services, it operates through REMA Conveying, REMA Surface Protection, and REMA Motion. Its service network supports mining customers with conveyor technology, wear and corrosion protection, maintenance services, and analysis tools designed to improve conveyor availability and reduce maintenance costs.

Contact: Patrick Pfeil
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Web: www.rematiptop.com

SBS Steel Belt Systems — Stand 27

SBS Steel Belt Systems designs, manufactures, installs and commissions continuous machinery and plants using stainless steel belts. Its solutions serve the chemical, petrochemical, fertiliser, sulphur, food, rubber and powder-coating industries. SBS delivers end-to-end packages, from engineering and construction through installation, commissioning and after-sales support. The company serves international industrial and engineering clients and is part of Austria-based BERNDORF BAND GmbH, a stainless steel belt provider.

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Schenk Stahl GmbH — Stand 61

Schenk Stahl has specialised for over 38 years in supplying tube and piping materials for corrosive environments particularly in applications involving sulphur resistance and nitric and sulphuric acid. Its 6,500 m² stock covers 1,800 dimensions, with tube sizes ranging from 1.00 to 813.00 mm OD. Services include plasma, laser and waterjet cutting, band sawing, 3D pipe bending and welding. Grades include superduplex, superaustenitic, nickel alloys and stainless steels for urea, nitric and sulphuric service.

Contact: Frederic Schenk
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Smart SCOPE GmbH — Stand 31

Smart SCOPE designs and delivers technology solutions for sulphuric acid and industrial gas-cleaning plants, from targeted revamps to new-build projects. Combining deep plant-design expertise, proven technologies and practical operational experience, Smart SCOPE helps customers enhance plant performance and strengthen plant reliability.

Contact: Torsten Weber
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Web: www.smart-scope.de

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SOCEMO designs and manufactures gas-solid and gas-liquid separation equipment, pressure vessels and acid distribution systems for process industries. It supplies cyclone separators, mist eliminators and demisters, alongside proprietary sulphuric acid plant technologies and catalysts. Certified to ASME and GB150 standards and operating ISO 9001, 14001 and 45001-based systems, it has delivered more than 350 sulphuric acid projects worldwide, providing end-to-end process, equipment and catalyst solutions.

Contact: info@socemo.com
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Web: www.socemo.com

STEULER-KCH GmbH — Stand 48

Steuler Linings is a complete service provider for surface protection providing acid proof and refractory linings for sulphuric acid and gas cleaning plants. Its Plastic Linings division also supplies bundled solutions for wet electrostatic precipitators, apparatus and piping construction. The company supports projects throughout their lifecycle, offering engineering, material supply, installation, repair and maintenance services.

Contact: Oliver Schmidt
Email: oliver.schmidt@steuler-kch.de
Web: www.steuler.de

Topsoe — Stand 20

Topsoe is a global provider of technologies and solutions supporting the energy transition. Built on decades of scientific research and innovation, Topsoe helps customers strengthen energy resilience and meet sustainability goals. Topsoe's portfolio includes solutions to transform renewable resources into fuels and chemicals, technologies for low-carbon and conventional fuels chemicals as well as ensuring clean air. Founded in 1940 and headquartered in Denmark, Topsoe employs more than 2,800 people globally.

Contact: www.topsoe.com/contact
Web: www.topsoe.com

Worley Chemetics — Stand 32

Worley Chemetics is a provider of technology, solutions and equipment fabrication for sulphuric acid, chlorine chemicals and specialty chemical facilities. Since 1964, it has served chemical, oil and gas, fertiliser, pulp and paper customers worldwide with engineered equipment, systems and plants. Its CORE-SO2™ technology supports green fertiliser goals by reducing environmental footprint and greenhouse gas emissions, recovering CO_2-free power, and enabling compact, modular plant design.

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Web: www.worley.com

Wylton — Stand 25

Wylton, founded in 1990, leverages operating experience from its sulphuric acid plants and manufacturing expertise in catalysts, sulphuric acid and process equipment. Supported by research, development and engineering capabilities, it supplies high-performance catalysts and tailored solutions to customers in more than 20 countries. Wylton provides lifecycle services, including site planning, operations and maintenance, catalyst selection, bottleneck diagnosis and troubleshooting, supporting plant performance from initial design through operation.

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Celebrating 120 years of industry leadership

HUGO PETERSEN celebrates its rich history in process plant engineering and construction. Since its foundation in 1906 it has established itself as a technology leader in sulphuric acid and gas purification, consistently setting industry benchmarks, combining technological excellence with the highest standards of quality, safety, and regulatory compliance. **Axel Schulze** and **Mahmoud Salehi** of HUGO PETERSEN look back on some of the key milestones and highlight recent innovations.

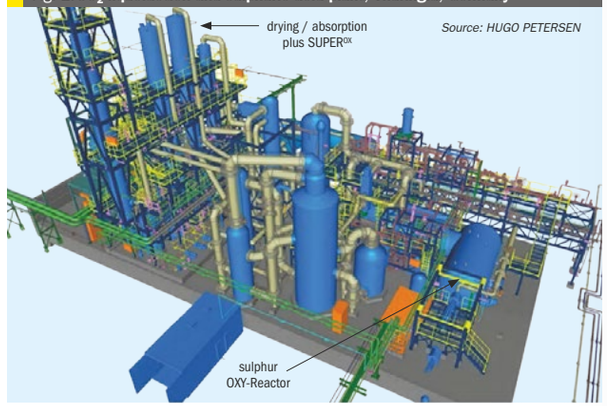
For more than 120 years, HUGO PETERSEN has developed process plant technologies for sulphuric acid production and gas purification. Its integrated approach combines flexible product configurations, high heat recovery and low-emission performance to deliver solutions tailored to each customer's operating requirements.

Drawing on extensive expertise in metallurgical and chemical processes, HUGO PETERSEN has contributed to the development of sulphuric acid production technology over several generations. Its proprietary Tower process, for example, represented an important step beyond the formerly prevalent Lead Chamber process. Today, the company continues to develop processes and equipment in line with Best Available Technology (BAT) standards.

HUGO PETERSEN offers a broad in-house portfolio of sulphuric acid technologies, including Dry Catalysis, Wet Catalysis and Petersen Tower Technology, alongside advanced developments such as SUPER^{OX} and SUPER^{CO}. These technologies address a range of feedstocks and applications, from metallurgical off-gases and elemental sulphur to split-acid processes.

At the centre of the company's approach is Process Integration Network Consulting (PINC^{HP}), which is applied from the initial client consultation. This methodology is used to identify opportunities to integrate new process solutions with existing plant infrastructure and maximise operational value. It is complemented by ENER^{REC}, HUGO PETERSEN's proprietary technology for energy recovery and utilisation in process plants.

Fig. 1: **SO_2 liquefaction and sulphuric acid plant, Thuringia, Germany**



Source: HUGO PETERSEN

Examples of PINC^{HP} applications include the use of absorption energy in energy-intensive operations such as solution pre-heating for titanium dioxide production, seawater desalination and district heating. By recovering and integrating energy that might otherwise remain underutilised, these concepts can support lower overall energy consumption and operating costs.

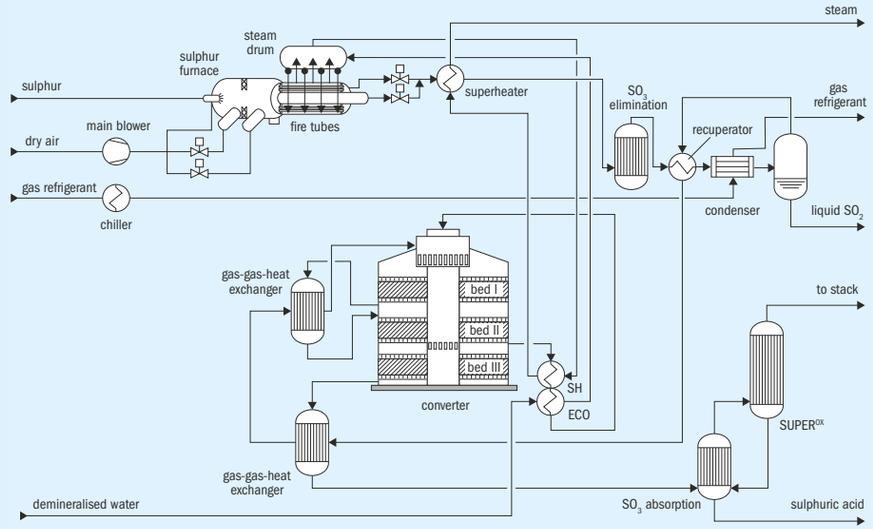
Guided by the objective of working alongside customers to optimise and develop processes over time, HUGO PETERSEN continues to develop sulphuric acid technologies tailored to individual plant requirements.

Case study 1: SO_2 liquefaction and sulphuric acid production

HUGO PETERSEN was commissioned to develop an integrated and energy-efficient process for sulphur dioxide liquefaction and sulphuric acid production. The concept was designed to meet the requirements of Germany's Technical Instructions on Air Quality Control (TA Luft), while accommodating variable feed compositions and capacity requirements.

The process configuration prioritises flexible operation, energy recovery and low emissions. Integrated heat-recovery measures minimise energy consumption, while the plant design supports emissions performance below applicable TA Luft limits.

Fig. 2: **SO_2 liquefaction and sulphuric acid production**



Source: HUGO PETERSEN

Process principle

Partial condensation occurs when a gas is cooled below its dew point, causing part of the vapour to form a liquid. The dew point is the temperature at which a gas reaches its saturation pressure.

For sulphur dioxide, this behaviour differs substantially from water. Water boils at atmospheric pressure at 100°C, whereas SO_2 boils at approximately –10°C. At room temperature, SO_2 has a saturation pressure of around 3.3 bar. Condensing SO_2 therefore requires the removal of energy from the gas, generally through cooling. The energy associated with this phase change is known as the enthalpy of vaporisation.

The HUGO PETERSEN process concept selected uses a high SO_2 concentration in the gas leaving the sulphur furnace, known as the HP-OXY Reactor.

Plant flexibility and energy integration

The plant is designed to produce both liquid sulphur dioxide and sulphuric acid at 96 wt-% H_2SO_4 concentration. It can operate across a sulphur throughput range of 25% to 100%.

Within this operating range liquid SO_2 production can vary from 0% to 100% and sulphuric acid production can vary from 40% to 100%.

The production ratio between the two products can be adjusted according to operational requirements.

Process heat is recovered for steam generation. The generated steam is used for sulphur heating, operation of key equipment, powering the absorption chiller and electricity generation. Deep-temperature cooling for liquid SO_2 condensation is achieved through recuperators and steam-driven absorption chillers.

SO_2 conversion to SO_3 is achieved using a high-efficiency, specially shaped V_2O_5 catalyst in a three-bed converter. Combined with tail-gas scrubbing, this arrangement supports heat recovery and further energy utilisation.

Detailed process description

Ambient air first passes through a drying tower upstream of the main blower (see Fig.1). The dried air is subsequently supplied to the HP-OXY Reactor, where high-temperature sulphur combustion takes place with low NOx formation.

Combustion of liquid sulphur produces a process gas containing approximately 17.5 vol-% SO_2 at around 1,450°C. Directly downstream of the reactor, the gas passes through a waste-heat boiler and then a combined superheater/economiser, reducing its temperature to approximately 180°C.

An absorption tower removes SO_3 formed through auto-oxidation during sulphur combustion, as SO_3 is undesirable in the condensed SO_3 product. The gas is then cooled in a recuperator before entering a chilling stage, where its temperature is reduced to below –55°C. This condenses part of the SO_3, which is recovered as liquid product and pumped to storage.

The remaining gas is reheated in the recuperator, with additional heat supplied from the first and third catalyst beds. This raises the gas temperature to 420°C or higher before conversion. Dry air is injected upstream of the converter to enrich the gas with oxygen.

The gas then passes through three catalyst beds. Heat generated in the first and third beds is recovered through the gas-to-gas heat-exchange system, while an additional superheater cools the gas before it enters the third catalyst bed. The SO_2 conversion rate is typically in the range of 96% to 98%.

Finally, the gas enters the SO_3 absorption tower, where sulphuric acid is produced. Remaining SO_2 is treated

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in HUGO PETERSEN's SUPER^{OX} process, in which SO_2 reacts with H_2O_2 to form sulphuric acid. Resulting emissions are below 50 mg/Nm³.

- Despite furnace temperatures of approximately 1,450°C, NOx formation was minimised through use of the HUGO PETERSEN OXY Reactor. The project was commissioned in 2022, demonstrating the combined energy efficiency and low-emission potential of HUGO PETERSEN's technology.

Case study 2: Sulphuric acid plant with more than 97% heat recovery

A further HUGO PETERSEN project involved the installation of a 1,800 t/d sulphur-burning sulphuric acid plant for Crimea Titan. The plant was designed to achieve more than 97% heat recovery and utilisation while supplying the full sulphuric acid demand of a three-line titanium dioxide plant.

The client required an integrated utility solution, including:

- high-, medium- and low-pressure steam supply to the plant network;
- multiple process hot-water streams;
- back-pressure and condensing steam turbines; and
- high-pressure steam generation optimised for the site's energy requirements.

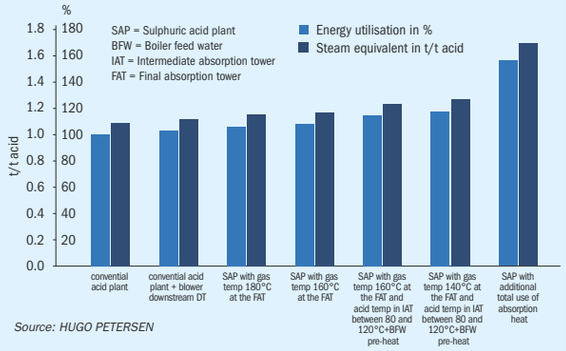
The key design parameters were:

- Acid production: 1,800 t/d, based on 100% H_2SO_4
- Steam conditions: 440°C at 40 barg
- Measures to maximise steam generation

The plant design incorporated several measures to increase steam generation and improve energy recovery:

- positioning the main blower downstream of the drying tower to recover compression heat;
- operating the drying tower with 98% acid to support effective drying;
- maintaining an inlet temperature of 140°C at the intermediate absorption tower/final absorption tower system, reducing energy transferred to the acid;
- reducing the intermediate absorption tower outlet temperature to 80°C;
- preheating boiler feedwater from 120°C using absorption heat; and
- recovering heat from the drying and absorption sections for boiler-feedwater preheating, injection coolers and technical hot-water supply.

Fig. 3: **Energy yield for plant optimised to maximise HP steam generation**



Source: HUGO PETERSEN

Fig. 4: **Distribution of energy across the sulphuric acid plant**

Source: HUGO PETERSEN

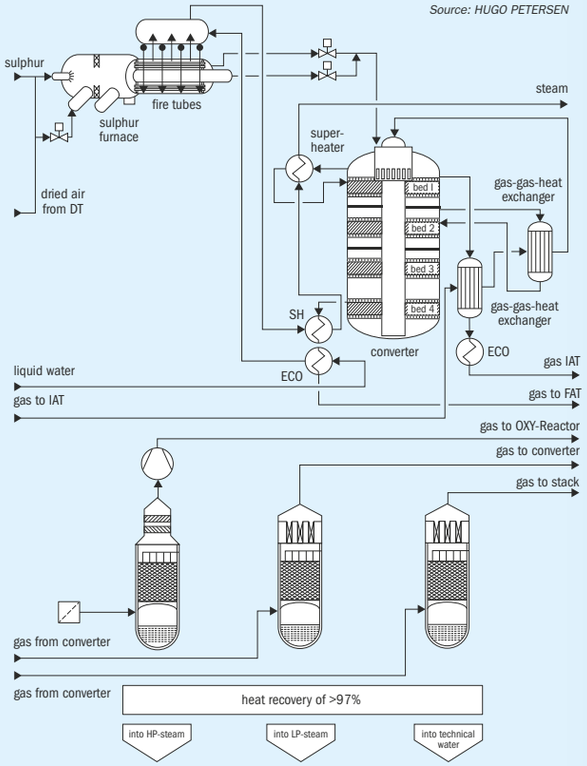
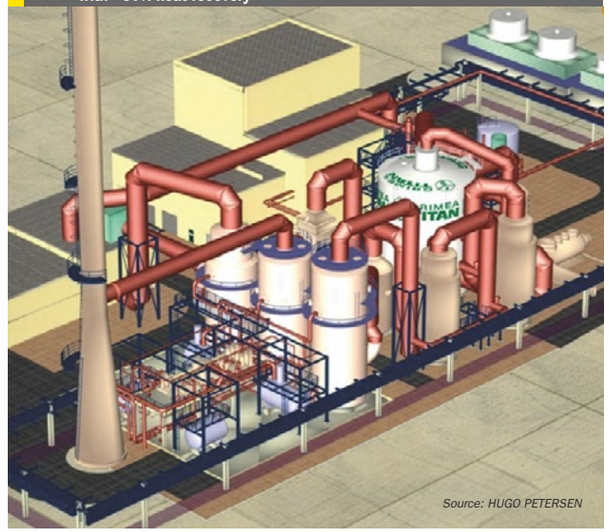


Fig. 5: **Crimea Titan 1,800 t/d sulphur-burning sulphuric acid plant with >97% heat recovery**



Source: HUGO PETERSEN

The resulting energy yield is shown in Fig. 3.

Energy utilisation

The recovered energy was used across the wider plant network:

- 22 MWe generated by a condensing turbine;
- steam-driven equipment, principally the main blower, powered by back-pressure turbines;
- extraction steam from back-pressure turbines supplied to meet plant-network steam demand;
- low-pressure steam used for sulphur melting; and
- technical hot water supplied to meet wider site demand.

Fig. 4 illustrates the distribution of energy across the process.

The plant (Fig. 5) was commissioned in 2012 and enabled the client to place its central thermal units into emergency idling mode. The project illustrates how ENER^{REC} can be configured around site-specific energy requirements, integrating sulphuric acid production with steam, power and hot-water demand.



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Modernising sulphur combustion

Improved atomisation, air-side mixing and modular burner inserts can increase the reliability, flexibility and capacity of sulphur furnaces, while minimising modifications to existing equipment. **Florian Kistl** of CS Combustion Solutions discusses practical retrofit routes to modernise sulphur combustion in existing sulphur furnaces.

Sulphur furnaces are long-life assets. In many plants the furnace shell, refractory lining and combustion-air infrastructure remain serviceable long after the original burner technology has become an operational constraint. For operators using conventional sulphur guns with pressure atomisers or rotary-cup burners, a targeted retrofit can therefore offer a more attractive alternative to a major furnace rebuild.

The objective is straightforward: improve sulphur atomisation and combustion-air mixing while retaining as much of the existing installation as possible.

When the burner becomes the bottleneck

Sulphuric acid producers are often under simultaneous pressure to increase plant availability and capacity while controlling maintenance expenditure. This is particularly relevant in older sulphur-burning plants, where the furnace may have substantial remaining life but the burner system creates recurring operating problems.

Poor atomisation can contribute to:

- unburnt sulphur carry-through;
- refractory hot spots;
- unstable combustion;
- high sulphur pressure;
- frequent repair and adjustment of nozzles and spray guns.

The retrofit question is therefore not necessarily whether to replace the furnace, but how to remove the limitations of the burner system without creating an extensive brownfield investment.

Depending on the existing design and the underlying constraint, options can range from replacing atomiser tips and sulphur lances to installing a complete new burner assembly. For multi-gun furnaces, a newer approach introduces project-specific burner inserts within the existing windbox, retaining much of the original air-side infrastructure.

The appropriate route should be determined by the actual operating limitation. Where droplet formation is the principal issue, an atomiser and lance upgrade may be sufficient. Where air distribution, flame shape or mechanical reliability are also limiting performance, the burner and windbox arrangement should be assessed as an integrated system.

For plants seeking additional capacity, the review must extend beyond the furnace to include the combustion-air blower, waste heat boiler and downstream conversion and downstream absorption sections. This staged approach avoids unnecessary scope while ensuring that a limited retrofit is expected to resolve a plant-wide constraint.

Why conventional sulphur guns can become restrictive

Conventional sulphur guns commonly use pressure atomisation, forcing liquid sulphur through relatively small passages at high pressure to create a spray cone. In practice, atomisation quality is closely linked to sulphur pressure and flow rate. Lower operating loads can therefore reduce spray quality, while contamination or changes in sulphur condition can increase plugging risk and shorten nozzle life.

Typical pressure-atomiser systems may require sulphur pressures of approximately 8 to 20 barg. By comparison, CS ultrasonic atomisers typically operate at 2 to 5 barg. The lower pressure requirement reduces energy consumption of the sulphur supply system and provides more flexibility when integrating a retrofit into an existing plant.



Combined sulphur/fuel gas lance for start-up without mechanical changes

More important, the technology changes how droplets are formed. Smaller droplets provide substantially greater surface area for a given sulphur mass, reducing the time required for heating, evaporation and reaction.

At one sulphuric acid plant in the African Copperbelt, replacement of conventional pressure atomisers with ultrasonic nozzles and optimised swirl bodies reduced measured droplet size from approximately 400 micrometres to 110 micrometres. Following the revamp, the plant is expecting elimination of sulphur droplet carry-through to the waste heat boiler and catalyst beds.

The nozzle architecture also changes the plugging mechanism. With ultrasonic atomisation, sulphur and the atomising medium are mixed externally. The nozzle does not rely on the fine internal sulphur passages typically associated with pressure atomisers, making plugging technically unlikely and enabling a wider operating range. A single CS nozzle can normally be controlled from approximately 20% to 100% of nominal capacity, with continuous operation possible up to 110%.

Case evidence: pressure-atomiser retrofit

At an African Copperbelt sulphuric acid plant, conventional sulphur guns with pressure atomisers were replaced with ultrasonic nozzles and revised air-side mixing elements.

The project delivered:

- an increase in production from 2,200 t/d to 3,000 t/d;
- a reduction in droplet size from about 400 to 110 micrometres;
- elimination of sulphur carry-through to downstream equipment; and
- a more uniform furnace temperature distribution.

Before the revamp, the plant had experienced frequent nozzle plugging, high spare-part consumption and significant unplanned downtime.

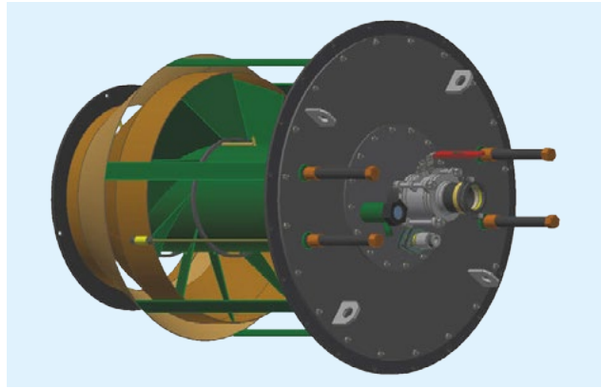
Rotary-cup burners: a different retrofit case

Rotary-cup burners present a different set of operational challenges. Rotating components and drive systems introduce mechanical maintenance requirements in a hot, sulphur-bearing environment. Flame geometry can also be difficult to adapt when furnace conditions or production requirements change.

Where two rotary-cup burners are installed, the arrangement can occupy significant space without necessarily providing practical online redundancy.

A Belgian sulphur dioxide plant illustrates an alternative approach. Two rotary-cup burners were replaced by a single burner equipped with two Ultrasonic Atomizers. Sulphur throughput increased from 16 t/h to 20 t/h.

The new configuration removed rotating burner components and enables the individual sulphur guns to be isolated and removed while the furnace continued operating at reduced capacity. The spray angle could also be matched to the existing furnace and checker-wall geometry.



Newly developed modular windbox insert with swirl body

Upgrading atomisation is only half the battle

A finer spray alone does not guarantee a successful retrofit. Sulphur droplets must meet the combustion air with the appropriate velocity, momentum and distribution. The interaction between droplet size, spray angle, swirl, residence time and furnace geometry determines whether sulphur is converted rapidly and whether heat release is distributed evenly throughout the combustion chamber.

This is why air-side modifications can be as important as the atomiser itself.

In previous CS revamps, swirl bodies and CFD-supported changes to furnace mixing have been used to improve sulphur and combustion-air distribution. At one reference site, the combustion system was combined with revised mixing elements and a new vector wall. The objective was to improve mixing while reducing the pressure loss associated with the original baffle arrangement.

The result was a more uniform temperature field and lower air-side pressure drop.

For operators, poor mixing can manifest in several ways:

- localised refractory overheating;
- sulphur carry-through to the waste heat boiler;
- deposits;
- elevated downstream pressure drop; and
- restricted plant load.

Improving the burner should therefore be approached as a combustion-system retrofit, rather than simply as a nozzle replacement.

A modular insert approach for multi-gun furnaces

Many existing sulphur furnaces use several guns arranged through a shared windbox. Historically, upgrading these systems could require substantial modifications to the windbox, furnace front and combustion-air distribution.

To reduce this scope, CS Combustion Solutions has developed a modular burner-insert concept specifically for multi-gun installations.

The principle is to introduce modern atomisation and controlled swirl within the existing mechanical circumstances, rather than redesigning a functioning furnace around a new burner. Each insert is engineered for the specific project. The existing air duct can normally remain in place, while the windbox casing requires only limited modification, principally to enlarge the opening for the swirl insert.

The furnace opening is assessed on a case-by-case basis and may also be retained where geometry permits.

The existing refractory lining can generally remain in service. Its condition is assessed during the retrofit engineering phase, and local defects can be repaired during the same shutdown if required. This is especially important for older furnaces: a burner upgrade should not automatically lead to full refractory replacement where the existing lining remains suitable.

Within the insert, combustion-air swirl can be adapted to the actual furnace geometry. During commissioning, the

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swirl setting is mechanically adjusted to achieve the most suitable flame shape and mixing behaviour for the existing chamber, then fixed for normal operation.

This avoids unnecessary moving components while still allowing the retrofit to be tuned to the individual furnace.

The insert architecture is a new development, but it is founded on ultrasonic atomisation and swirl principles already proven in operating retrofit references. The design objective is consistent across projects: minimise modifications to the existing plant while introducing the atomisation and air-management performance required for modern operation.

Plant availability can be more valuable than efficiency alone

For many operators, the strongest economic driver is not a modest gain in energy efficiency, but the avoidance of unplanned shutdowns. A sulphur burner problem can force the entire acid plant out of service, and lost production can rapidly outweigh the cost of replacement parts.

At the Copperbelt plant, the operator reported approximately 30 days of unplanned furnace shutdown per year before the revamp and more than $200,000 spent on nozzle tips and guns in less than two years.

A more robust atomisation system can address several sources of intervention at once:

- lower susceptibility to plugging can reduce nozzle-related stoppages;
- finer droplets and improved mixing can reduce the risk of unburnt sulphur reaching the waste heat boiler;
- more uniform heat release can help protect refractory; and
- wider turndown capability can give operators greater flexibility to match plant load without compromising atomisation quality.

These improvements can also lead to higher production output. Where sufficient margin exists in the furnace volume, waste heat boiler, blower, converter and downstream acid plant, increases of approximately 20–30% may be achievable without changing the combustion chamber itself.

Such opportunities must always be assessed on a plant-specific basis, but they can turn a reliability-focused retrofit into a capacity project.



CS nozzles – ceramic material possible to prevent sulphidation in H_2S atmosphere

When avoided downtime, reduced maintenance expenditure and additional production are considered together, relatively short payback periods may be possible. Depending on plant condition, lost-production value and retrofit scope, payback periods in the range of 12 to 24 months can be achievable.

Case evidence: rotary-cup replacement

At a Belgian sulphur dioxide plant, two rotary-cup burners were replaced by one burner fitted with two ultrasonic atomisers.

The retrofit delivered:

- an increase in sulphur throughput from 16 t/h to 20 t/h;
- elimination of burner-side rotating components;
- improved maintenance flexibility; and
- flame geometry matched to the existing furnace and checker wall.

Planning the retrofit around the shutdown

The commercial attractiveness of a retrofit depends heavily on execution. A typical assessment begins review of:

- furnace drawings and refractory details;
- sulphur and combustion-air process data;
- piping and instrumentation information; and
- the geometry of the existing windbox and furnace openings.

Computational fluid dynamcis (CFD) can be used where furnace geometry or operating history indicates that mixing, hot spots or residence time require closer assessment.

Once the concept is defined, detailed engineering and fabrication can proceed before the plant is taken offline. For the modular insert concept, project lead times are intended to remain within a few months, depending on scope.

With mechanical preparation completed in advance, installation can normally be scheduled within a regular major maintenance shutdown, avoiding the need for a separate extended outage.

Commissioning then becomes an optimisation exercise rather than a reconstruction project. Sulphur and atomising-medium flows are established, air-side swirl is mechanically adjusted to suit the furnace, flame behaviour and temperatures are verified, and the final setting is fixed for operation.

Modern performance without rebuilding the furnace

The most effective sulphur-combustion retrofit is not necessarily the one that replaces the most equipment. In many plants, the better solution is to retain a sound furnace and modernise the components that determine atomisation, mixing and operational flexibility.

For conventional sulphur-gun installations, ultrasonic atomisation can provide lower sulphur pressure, significantly finer droplets, wide operating range and low tendency to plugging. For rotary-cup systems, the same technology can remove rotating burner components and simplify redundancy arrangements.

The modular burner-insert approach extends these benefits to multi-gun furnaces while deliberately minimising changes to the existing windbox, air duct and refractory.

For operators facing recurring burner maintenance, sulphur carry-through, limited turndown or a need for additional capacity, this provides a practical alternative to a major furnace rebuild: improve the combustion system where it matters, integrate the solution around the existing asset, and use the next planned turnaround to bring an older furnace closer to modern operating performance.



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125 years of innovation: The IPCO story

In 1901, the world's first steel belt conveyor rolled off a production line in Sweden. Designed to transport waste at a timber mill, it was a modest beginning for a technology that would later underpin solidification processes across the chemical, oil and gas industries.



PHOTO: IPCO

World's first steel belt, Sweden, in 1901.

This year marks 125 years of steel belt production for process solutions manufacturer IPCO. The distinctive properties of steel belts remain central to many of the company's solutions today.

Initially, steel belts were used primarily for conveying, where their exceptional wear resistance and fatigue strength – the ability to withstand the repeated bending stresses created by pulleys and drums – made them a reliable, durable choice. By the early 1920s, however, new applications were emerging. Baking and drying systems began to take advantage of steel's excellent thermal properties, transforming the belt from a passive transport medium into an active processing tool.

For the chemical industry, a key milestone came in 1931 with the production of the world's first chrome-nickel stainless-steel belt. This development opened the door to cooling and solidification applications. Four years later, the company produced and installed the world's first continuous steel belt cooler for chemical products: a solidification line for resin and wax products.

Just over a decade later, in 1951, the company supplied its first system for the oil and gas sector – a continuous sulphur slating line installed at a refinery in Mexico. As the global oil and gas industry expanded, so did demand for reliable and efficient sulphur solidification. Steel belt technology evolved accordingly, culminating in the introduction of the system that would come to define sulphur solidification worldwide: Rotoform.

While systems had advanced considerably between the first chemical cooler and the arrival of the drop-forming process, the fundamental principle remained unchanged. Rather than producing a continuous sheet or flake, however, the product left the belt as individual, uniform pastilles.

A chemical melt was deposited onto a continuously running steel belt, which then passed through a cooling zone. Chilled water was sprayed onto the underside of the belt, drawing heat from the melt through the steel. As the product solidified, it was discharged from the belt, ready for downstream storage, transport and reprocessing.

Today, 125 years on, that spirit of innovation continues. Sulphur processing, in particular, has seen some of its most significant impact. More than 2,500 Rotoform systems have been installed worldwide since launch, with more than 750 designed specifically for sulphur solidification at refineries and gas plants.

Among the earliest adopters was Shell, which installed Rotoform technology at its Jumping Pound facility west of Calgary, Canada, in the mid-1980s. The relationship expanded from there: Shell Canada's Shantz plant installed 46 Rotoform lines, which remain the largest installation of their kind anywhere in the world. That scale reflects the trust the technology earned early on – and has continued to earn ever since.

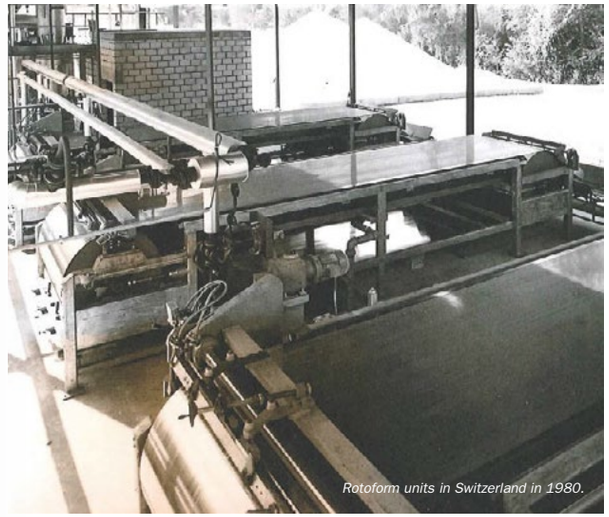

PHOTO: IPCO

Rotoform units in Switzerland in 1980.

The enduring reliability and performance of Rotoform

What established Rotoform as the industry standard was its combination of consistency and simplicity. Molten sulphur is deposited through a rotating perforated shell directly onto a moving steel belt. It is then rapidly cooled from beneath, solidifying into uniform hemispherical pastilles without ever coming into contact with the cooling water.

The result, across a range of throughputs, is:

- consistent pastille size and shape;
- high-bulk-density, free-flowing product;
- a clean, dry process with minimal handling loss;
- efficient, direct solidification from the melt.

This single-step, liquid-to-solid process delivers product quality classified as premium under Sulphur Development Institute of Canada (SUDIC) specifications. The uniform size and shape of Rotoform pastilles make them free-flowing for easy handling, while their predictably high bulk density offers significant benefits for storage and transportation.

Innovation at increasing scale

As sulphur producers sought higher throughput, the technology continued to evolve. The Rotoform S8 is now the world's most widely used sulphur solidification system, producing 2–5 mm pastilles at rates of up to 130 t/d, with an on-stream factor of 96%.

For operations requiring greater capacity, the Rotoform HS, introduced in 2005, represented a substantial scale-up. Its extra-large depositing shell, featuring more than 30,000 holes, increases throughput to 260 t/d while maintaining pastille quality.

Most recently, in 2020, IPCO introduced a high-capacity solution that moved beyond steel belt-based processing while continuing to deliver a SUDIC-quality end product. The SG range of rotating drum granulators takes a different mechanical approach: the SG20 handles up to 800 t/d, while the SG30 – the highest-capacity sulphur solidification solution on the market – handles up to 2,000 t/d.

Both systems operate on a single-pass principle. Sulphur nuclei are generated externally and progressively built up to the required size as they travel through a slowly rotating drum. A bank of nozzles applies molten sulphur, while controlled water evaporation within the drum provides cooling.

The successful development of the SG range is a reminder that the company's defining constant over 125 years has been its willingness to engineer the solidification solution best suited to the product and the industry's requirements.

Global demand for sulphur continues to be driven by agriculture, energy, chemicals and healthcare. Whether the market requires high-precision pastilles or bulk-ready granules, solidification remains the critical final step in turning molten sulphur into a stable, transportable product.

This is a 125-year story that begins with the first steel belt, continues through a single steel belt cooler installed in 1935, and includes the refinery in Mexico that first applied steel belt technology to sulphur in 1951. It encompasses the launch of Rotoform in Switzerland in 1980 and, more recently, the decision to look beyond the steel belt where a different principle was needed to achieve the required throughputs.

As the sulphur industry enters its next chapter, IPCO's continued focus on innovation will help it meet the evolving needs of sulphur processors around the world for many years to come. ■

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Engineered heat tracing for sulphur safety

Molten sulphur systems demand precise temperature control to prevent solidification, rising viscosity and the build-up of hazardous vapours. Carefully engineered heat tracing for pipework, storage tanks and vapour spaces is therefore critical to maintaining safe, reliable operations. It helps mitigate the risks of blockages, overpressure, toxic exposure and ignition. **Kent Snelson** of QMax Industries sets out the safety case for correctly heated sulphur systems.

Molten sulphur is among the most demanding services in the refining industry. Although the objective appears straightforward – keep sulphur above its melting point and maintain flow – the acceptable operating range is narrow. Missing it can create serious safety risks, from blocked and pressurised lines to the release of toxic and flammable hydrogen sulphide (H_2S) vapour.

Heat tracing on sulphur piping and vessels is therefore not simply a maintenance consideration. It is an engineered safety system.

A narrow operating window

Sulphur freezes just below 240°F (116°C), with crystallisation beginning at around 246°F (119°C). As temperatures approach this threshold, viscosity rises, flow slows and a cooled section of pipe can solidify within hours.

A frozen sulphur line is not a simple restart issue. Uneven thawing, for example, using a torch or heating a single localised point, can trap expanding liquid sulphur behind a solid plug. The resulting pressure may exceed the design limits of fittings and associated equipment.

The upper end of the temperature range brings a different risk. Sulphur experiences a significant viscosity increase at roughly 320–360°F (160–182°C), becoming much thicker while still molten. A line or pump cavity in this range may lose flow much as it would during freezing, but at temperatures where off-gassing can create an explosion hazard.

Sulphur off-gas can contain sulphur dioxide and H_2S, which is both toxic and flammable at low concentrations. Vessel vapour spaces, vent lines and low points where vapour can accumulate require particular attention. Effective tracing of these areas helps prevent liquid or solid sulphur accumulation and mitigates associated safety risks.

Sulphur service requires a heating system that maintains a defined temperature range consistently across the full length of piping and vessels. This is a design requirement, not an afterthought.

Why point-source heating is insufficient

Installing bare tubing alongside a pipe is a common heat tracing approach, but it is not well suited to sulphur service. Bare-tube tracers transfer much of their heat convectively into the air inside the insulation, while conductive transfer to the pipe occurs only at a narrow contact point.

This creates an uneven temperature profile: high temperatures near the tracer and colder areas on the opposite side of the pipe. In sulphur service, these cold zones can become the starting point for solidification and plugging.



PHOTO: QMAX INDUSTRIES

QMax FTS fluid tracing system

Conductive, bolt-on systems such as QMax's Fluid Tracing System (FTS) address this issue by pairing bare tubing with an extruded aluminium channel. The channel acts as a thermal bridge between the heating medium (steam or hot oil) and the pipe wall, improving heat distribution and reducing the gap between heating-medium temperature and the sulphur's bulk temperature.

A heat-transfer compound at the tube, channel and pipe interfaces is also essential. Although less conductive than metal, it is substantially more conductive than air. The objective is to achieve the thinnest reliable layer, typically around 0.015 inches (0.381 mm). Excess compound increases thermal resistance, making installation quality as important as the equipment selection.

Engineering determines tracer requirements

Tracer sizing is not a simple look-up exercise. Two pipes of the same diameter may require different tracer configurations depending on:

- pipe and insulation specifications;
- heating-medium temperature and pressure;
- process-fluid properties;
- ambient conditions;
- target operating temperature; and
- line geometry and heat-loss profile.

A proper thermal analysis should precede system selection. Without it, sections of a system may operate outside the required temperature range until an upset exposes the weakness.

This principle applies even to large installations. For example, a documented triple-train sulphur tail-gas tracing installation on 28-inch piping, operating at 262°F and 51 psig, used a bolt-on approach because thermal performance and installation flexibility, not pipe diameter alone, drove the design.

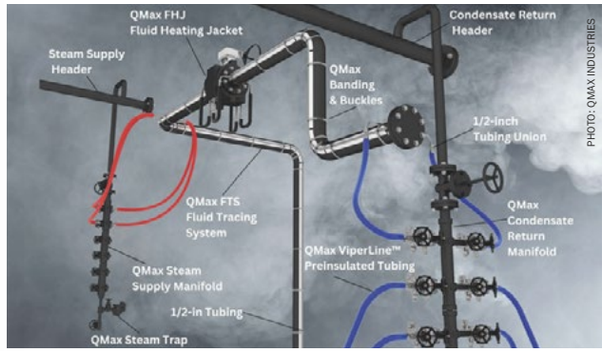

PHOTO: QMAX INDUSTRIES

Header to header system

Tank heating requires the same discipline

Molten sulphur storage tanks and pits present similar risks in a different geometry. Internal finned-coil banks, external bolt-on tracing and plate-coil systems can all be appropriate, provided the design delivers calculated, distributed heat rather than isolated hot spots.

The relationship between tank fill level, diameter and heat input is particularly important. A poorly designed system may first show its shortcomings as an underheated area (cold spot) near the tank floor, rather than through an obvious alarm or operating failure.

Tank-heating designs should therefore be supported by installation-specific thermal data rather than generic assumptions.



PHOTO: QMAX INDUSTRIES

Sulphur tank with heat tracing

Vapour spaces create a separate failure mode

Sulphur vapour spaces behave differently from liquid sulphur systems. A liquid-line problem is usually visible: flow slows, pumps strain or level readings stop changing. In contrast, a vapour space that cools below its dew point may allow sulphur vapour and entrained mist to condense quietly onto cold surfaces.

This is especially hazardous in vent and relief lines. A blocked liquid line interrupts flow and is likely to be noticed. A vent line blocked by condensed sulphur can remain undetected while removing a critical pressure-relief path.

As long as the tank remains warm, sulphur may continue to off-gas H_2S and sulphur dioxide. A plugged vent does not create the hazard; it removes a safeguard against it. Since these lines can extend for hundreds of feet, maintaining sufficient and uniform heat transfer throughout their length is a key engineering challenge.

Ignition risks in sulphur vapour spaces

Vapour spaces in sulphur storage equipment can present both toxicity and flammability hazards. Hydrogen sulphide–air mixtures can become flammable at relatively low concentrations, so combustible-gas monitoring, inerting and sweep-air dilution may be required to maintain safe conditions.

These areas can also develop pyrophoric iron sulphide scale. This material forms when sulphur vapours react with steel over time and may ignite spontaneously when exposed to oxygen—for example, during tank entry, inspection or after a blocked vent clears.

This risk affects how heating equipment is specified. Equipment in these zones should be appropriate for hazardous locations, with surface temperatures controlled by design.

On the liquid side, the central requirement is to provide enough heat to maintain sulphur in a molten state. In vapour spaces, the requirement is to maintain surfaces above the vapour dew point, limiting condensation, corrosion and potential ignition sites.

The bottom line

Sulphur's narrow thermal operating range, and the serious consequences of operating outside it, mean that heat tracing must be treated as an engineered safety system.

Effective designs require:

- heat-transfer calculations to support tracer selection;
- technology that delivers even heat distribution;
- documented, high-quality installation practices;
- tank and vapour-space designs that account for H_2S accumulation and condensation risks.

QMax's bolt-on FTS and its internal and external tank-heating solutions can each support this design approach. However, the critical factor is not the product alone, but whether the underlying engineering has been completed thoroughly. In sulphur service, that engineering provides the safety margin.

SULPHUR SAFETY

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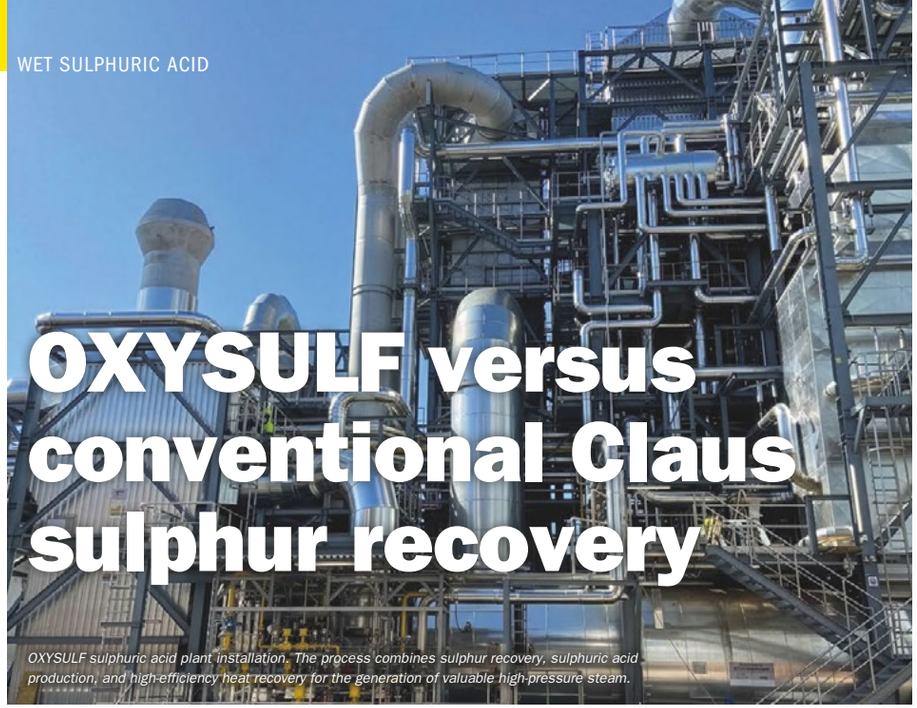


PHOTO: KVT TECHNOLOGY

OXYSULF versus conventional Claus sulphur recovery

OXYSULF sulphuric acid plant installation. The process combines sulphur recovery, sulphuric acid production, and high-efficiency heat recovery for the generation of valuable high-pressure steam.

KVT's OXYSULF process converts elemental sulphur and sulphur-containing streams into high-grade sulphuric acid while achieving ultra-low SO_2 emissions. Its process characteristics make it an alternative for refineries and industrial facilities seeking to improve sustainability, reduce operating costs and meet increasingly demanding environmental requirements. **Robert Kahr**, **Sabine Kopfberger** and **Mathias Innerkofler** of KVT Technology compare an OXYSULF plant with an equivalent-capacity conventional SRU across emissions, energy efficiency and overall performance.

Refineries face growing pressure to upgrade facilities in response to increasingly stringent regulations governing SO_2 and CO_2 emissions. At the same time, there is a growing need to improve the energy efficiency of refinery operations and processes.

Although the Claus process remains widely used for sulphur recovery, it has feed-related limitations, particularly with respect to H_2S concentration and the presence of NH_3. Ammonia is commonly present in refinery sour water stripper (SWS) off-gas and can adversely affect process performance and operating flexibility.

Conventional Claus units are also less suited to dilute sulphur-bearing gas streams or feeds with fluctuating sulphur loads, as efficiency tends to decline under these conditions. However, the ability to process variable feed compositions is becoming increasingly important as modern refineries manage a broader range of off-gas streams and operating scenarios.

The OXYSULF process, developed by Kanzler Verfahrenstechnik (KVT), provides an alternative route to sulphur recovery. It can process elemental sulphur and a wide range of sulphur-bearing feed streams from multiple industries, producing high-grade sulphuric acid.

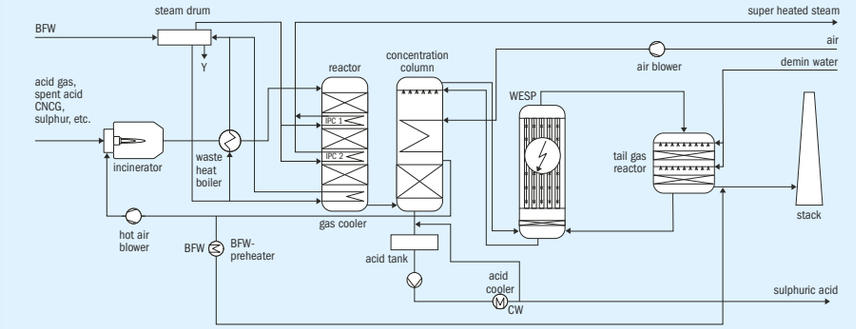
The process combines high sulphur recovery with lower emissions, a smaller carbon footprint and improved energy recovery. Its relatively simple design can reduce operating expenditure (opex) and maintenance requirements, while supporting high operational reliability. A two-stage combustion system further enables the effective treatment of ammonia-containing feeds, ensuring reliable ammonia destruction and stable plant operation.

The following sections describe the OXYSULF process and compare its performance with that of a conventional Claus-based configuration.

The OXYSULF process

Based on wet sulphuric acid technology, OXYSULF converts a broad range of sulphur-bearing feed streams into a valuable commercial product, namely commercial-grade sulphuric acid exceeding 98 wt-%. The process consists of a multi-stage catalytic oxidation system with integrated heat recovery. Unlike conventional dry sulphuric acid plants, OXYSULF eliminates the costly and energy-intensive gas drying step by directly processing wet feed gases.

Fig. 1: **OXYSULF sulphuric acid plant installation. The process combines sulphur recovery, sulphuric acid production and high-efficiency heat recovery to generate valuable high-pressure steam**



Source: KVT Technology

The closed-loop process design avoids the need for consumable chemicals and eliminates waste streams. Process side streams are recycled internally, supporting near-zero-waste operation and maximising resource utilisation.

High sulphur recovery and low emissions are combined with efficient heat recovery, improving overall plant energy efficiency. By producing high-pressure steam, an OXYSULF unit can displace part of a refinery's boiler duty, reducing fossil-fuel consumption, operating costs and associated CO_2 emissions.

The process comprises four principal stages:

Combustion: Feed gases are fully oxidised with excess oxygen, converting sulphur species to SO_2. For feeds with elevated NH_3 concentrations, a dedicated combustion approach minimises NO_2 formation while ensuring effective ammonia destruction.

Catalytic oxidation: SO_2 is converted to SO_3 in a multi-bed catalytic reactor system. This configuration provides high conversion efficiency and temperature control across the catalyst beds. KVT uses established catalyst technologies supplied by internationally recognised manufacturers.

Sulphuric acid condensation: SO_3 reacts with water vapour in the process gas to form sulphuric acid, which is condensed and recovered in a specially designed, high-efficiency condensation column. The system is designed to maximise acid recovery, maintain stable operation over a wide operating range and support efficient heat integration.

Final gas purification: Sulphuric acid aerosols are removed in a wet electrostatic precipitator (WESP). The remaining process gas then passes through a tail-gas reactor, where residual SO_2 is converted into sulphuric acid. This final treatment stage supports sulphur recovery of up to 99.99% and SO_2 emissions typically below 15 mg/Nm³.

Low-concentration sulphuric acid streams generated during final purification are returned directly to the concentration column, where they are reconcentrated to product specification. This closed-loop arrangement eliminates liquid effluents and further improves overall sulphur recovery.

Operational benefits

Key advantages of OXYSULF are shown in Table 1 and summarised below.

OXYSULF operates without additional chemical consumption or liquid effluent generation. Its high energy efficiency reduces fossil-fuel demand and associated CO_2 emissions, while a substantial share of the process heat can be recovered as high-pressure steam.

This steam can be integrated directly into the customer's steam network, displacing conventional boiler capacity and delivering further reductions in fuel consumption and site emissions.

The process also produces a high-value commercial product. Sulphuric acid is widely used in fertilizer production, metals processing, chemical manufacturing and battery production.

Its compact, modular design supports high availability and operational reliability, while broad feed and throughput flexibility enables treatment of a diverse range of sulphur-containing gas streams. The adapted combustion concept also addresses high-NH_3 feeds by ensuring complete ammonia destruction while minimising NO_x formation.

OXYSULF operates at substantially lower pressure than conventional Claus units, reducing feed-gas pressure requirements, simplifying plant integration and lowering energy consumption. Together with high sulphur recovery, low emissions and strong energy integration, these features position OXYSULF as an attractive alternative for modern refinery sulphur recovery applications.

OXYSULF vs. the Claus process

Conventional Claus technology remains the most widely applied sulphur recovery process in refineries. However, stricter emissions requirements and decarbonisation targets are increasing interest in alternative technologies.

OXYSULF converts sulphur-bearing feeds directly into commercial-grade sulphuric acid while maximising energy recovery and minimising emissions. It can treat a broad range of streams, including NH_3-bearing gases, SO_2-rich streams, mercaptans and sulphur-containing hydrocarbons,

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Table 1: **OXYSULF response to key sulphur recovery requirements**

Requirement	KVT OXYSULF advantage
Feed flexibility	Handles a wide range of sulphur-bearing feeds, including H_2S-rich gas, NH_3-bearing SWS gas, SO_2-rich FGD gas, ARU off-gas, elemental sulphur, spent acid, mercaptans, and other sulphur-containing streams
High sulphur recovery	Sulphur recovery up to 99.99%
Sulphuric acid grade	Commercial-grade H_2SO_4, up to 98.2 wt-%
Heat recovery and steam generation	High-pressure superheated steam generation
Operational flexibility	Stable operation over a wide turndown range (30-110% capacity)
Low emissions	Ultra low emissions: SO_2 < 15 ppm
Utility consumption and energy efficiency	Minimal utility demand, zero liquid effluents, and efficient recovery of process heat into the HP steam system
Reliability and safety	Proven glass-tube condenser technology with positive-pressure air protection and redundancy on critical equipment
Environmental compliance	Zero liquid effluents and emissions performance consistent with stringent environmental regulations

Source: KVT Technology

Table 2: **Comparative assessment of OXYSULF and conventional Claus/TGTU technologies**

Parameter	OXYSULF process	Claus process + TGTU
Primary product	Commercial-grade H_2SO_4 (>98 wt-%)	Elemental sulphur
Sulphur-bearing feed streams	H_2S, SO_2-rich streams, mercaptans, sulphur-containing hydrocarbons, NH_3-bearing gases	Predominantly H_2S-rich acid gas
Ammonia in feed	Excellent tolerance, dedicated destruction concept	Limited, requires careful burner design
Sulphur recovery	Up to 99.99%	Typically, 99.5-99.9%
Energy efficiency	Very high	Moderate
Steam generation	High-pressure steam, typically 2-4 × higher than Claus systems	Limited LP/MP steam recovery
SO_2 emissions	<15 ppm (50 mg/Nm³)	Typically, 20-150 mg/Nm³
Additional fuel requirement	No dedicated process fuel required	Fuel often required for incineration/reheating
CO_2 footprint	Reduced through steam export and lower fuel demand	Higher overall footprint
Chemical consumption	Minimal (SCR reagent only)	Potential chemicals for tail-gas treatment
Economic value creation	Sulphuric acid + steam export	Sulphur product only
Industrial applications	Fertilizers, chemicals, metals, battery materials, electronics	General sulphur market
Plant complexity	Moderate	High (Claus + TGTU + incineration)
Capex	Competitive due to reduced equipment count and simplified configuration	Higher overall installed cost due to Claus, TGTU, and incineration sections

Source: KVT Technology

integrating sulphur recovery, emissions control and energy recovery within one process configuration.

Product value and feed flexibility

OXYSULF converts H_2S-rich gases, SO_2-containing streams, mercaptans and NH_3-bearing gases into commercial-grade sulphuric acid. In contrast, Claus units are principally designed for H_2S-rich acid-gas feeds and produce elemental sulphur. The ability to process a wider range of feeds while generating a commercial chemical product provides additional operating flexibility.

Energy efficiency and carbon reduction

Oxidation reactions in the OXYSULF process generate substantial recoverable heat, enabling efficient high-pressure steam generation for refinery utility systems. Compared with conventional Claus units, steam production can be significantly higher, reducing boiler-fuel demand and associated CO_2 emissions which can contribute directly to refinery decarbonisation initiatives.

Environmental performance

OXYSULF achieves sulphur recovery of up to 99.99% while maintaining SO_2 emissions below 15 ppm. The process generates no liquid effluent and has minimal chemical requirements, limited primarily to the SCR reagent used in the tail gas treatment system. Modern Claus systems equipped with tail-gas treatment units can also achieve high sulphur recovery; however, this typically entails greater complexity, higher utility demand and increased maintenance requirements.

Case study: Energy efficiency and decarbonisation

KVT conducted an energy-efficiency and decarbonisation assessment for a refinery operating four sulphur recovery trains, each with a sulphur capacity of 65 t/d. The study evaluated replacement of two existing Claus SRU trains with one OXYSULF unit, quantifying the effects on utility consumption, steam production, fuel use and CO_2 emissions.

Both configurations (Fig. 2) process the same refinery acid-gas and SWS-gas feeds. The reference case comprises two Claus SRU trains producing elemental sulphur, while the OXYSULF configuration converts the same sulphur input into commercial-grade sulphuric acid and produces substantially more high-pressure steam (see Table 3).



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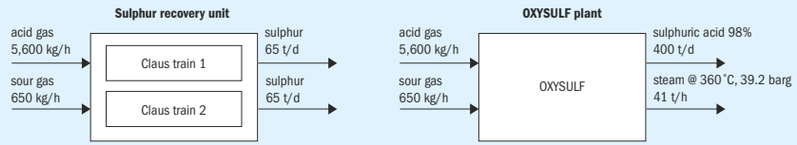
Fig. 2: **Comparison of the sulphur recovery configurations assessed in the refinery case study**



Source: KVT Technology

Baseline SRU configuration

The reference configuration comprised two conventional Claus SRU trains, each rated at 65 t/d of sulphur capacity. Together, these units generated approximately 10 t/h of steam, required 0.1 t/h of fuel gas for incineration and consumed approximately 1.6 MW of electrical power. The refinery Energy Intensity Index (EII) was approximately 110.

OXYSULF configuration

The proposed installation consisted of one OXYSULF sulphuric acid plant with a capacity of 400 t/d on a dry basis. The unit generated approximately 41 t/h of high-pressure steam, required no dedicated process fuel and consumed approximately 1.3 MW of electricity. Improved energy integration reduced the refinery EII to approximately 75–80.

The assessment indicates that the principal benefit of OXYSULF extends beyond sulphur recovery. Higher steam production can displace significant refinery boiler capacity, reducing fuel use and greenhouse-gas emissions. In the evaluated case, the refinery EII improved from approximately 110 to 75–80, while annual CO_2 emissions were reduced by approximately 26,000 tonnes (see Table 4).

Conclusion

Tightening environmental regulations, combined with the need to improve energy efficiency and reduce greenhouse-gas emissions, are increasing demand for alternative sulphur recovery technologies.

OXYSULF converts a broad range of sulphur-bearing feeds into commercial-grade sulphuric acid. The process combines sulphur recovery, acid production, emissions control and high-efficiency heat recovery within a single integrated configuration.

Sulphur recovery of up to 99.99%, ultra-low SO_2 emissions (below 15 ppm), zero liquid effluents and high-pressure steam generation support both environmental performance and operational efficiency. The technology also offers broad feed and throughput flexibility, enabling treatment of diverse refinery and industrial sulphur-bearing streams.

The refinery case study illustrates the potential benefits of integrating OXYSULF into refinery utility systems. In the evaluated case, improved heat recovery and steam generation reduced the refinery EII from approximately 110 to 75–80 and lowered annual CO_2 emissions by around 26,000 tonnes.

Compared with conventional Claus-based systems, OXYSULF provides a simpler and more compact configuration, greater feed flexibility, stronger energy integration and lower environmental impact. These characteristics make it an alternative for refineries and industrial facilities seeking to improve sustainability, reduce operating costs and meet increasingly demanding environmental requirements.

Table 3: **Process comparison**

Parameter	Claus SRU	OXYSULF
Capacity*, t/d	2 × 65 sulphur	1 × 400 H_2SO_4
Steam production, t/h	10	41
Fuel consumption, t/h	0.1	0
Electricity demand, kW	1.6	1.3
Direct CO_2 emissions, t/h	0.438	0.300

Source: KVT Technology

**The sulphuric acid plant capacity corresponds to the sulphur throughput processed by the two Claus trains under the refinery's operating conditions.*

Table 4: **OXYSULF refinery energy efficiency and CO_2 reduction impact**

Parameter	Value
VHP steam demand, t/h	98
Boiler capacity reduction, t/h	88 → 57.3
Fuel gas savings, t/h	2.0
CO_2 savings from process, t/h	0.138
CO_2 savings from electricity, t/h	0.211
CO_2 savings from steam export, t/h	2.87
Total CO_2 savings, t/h	3.22
Annual CO_2 savings, t/a	~26,000

Source: KVT Technology

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Pre-purchase review of sulphur quality: A buyer's guideline

As sulphur markets tighten, higher prices are bringing long-stored, mined and lower-quality material into commercial circulation, increasing the risks associated with contamination, acidity and inconsistent supply. **Jan Hermans** of Elessent Clean Technologies outlines how buyers can assess sulphur quality through robust sampling, careful Certificate of Analysis review and close collaboration between purchasing, laboratory and production teams.

The recent rise in sulphur prices is a clear reminder that commodity markets reward scarcity. Against a backdrop of geopolitical disruption and structural shifts in energy markets, sulphur buyers must understand both the causes of tightening supply and the operational implications of changing product quality.

Historically, customers could obtain bright yellow, refinery-produced sulphur at relatively affordable prices. However, as the energy transition advances and renewable generation increasingly displaces oil and gas consumption, refinery capacity has begun to contract in Europe and the United States. China is also expanding renewable energy capacity, although this is currently adding to, rather than replacing, fossil-fuel supply.

This matters because refinery sulphur production is declining while global demand continues to grow. Sulphur is essential to fertiliser production and the extraction of critical metals, both of which are central to food security and the energy transition. This tightening supply-demand balance was already contributing to higher prices.

More recently, disruption to exports of solid sulphur from the Middle East via the Strait of Hormuz has further constrained availability and disturbed global supply chains. As a result, sulphur prices have surged to peak levels.

Market scarcity and high prices are creating opportunities for alternative suppliers. Although sulphur processing requires substantial capital investment, current economics are making new and previously marginal supply sources more attractive. This may expand supply, but it can also increase the risk of inconsistent product quality and unreliable delivery.

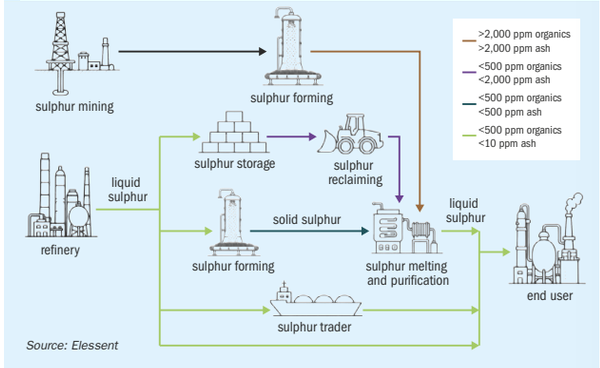
For example, Canada is remelting sulphur blocks that have been stored since the mid-1990s. Prolonged storage can degrade product quality, meaning that recovered sulphur may no longer meet expected specifications. When combined with lower-cost melting facilities, this can result in more variable product entering the market.

In Iraq and parts of Central Asia, substantial stockpiles of waste sulphur are available. These range from so-called black sulphur to dumped sulphur exposed to environmental contamination and acid formation over extended periods. For buyers considering these sources, quality is not the only challenge: limited infrastructure between inland stockpiles and export terminals can materially affect logistics costs and supply reliability.

Exceptionally high prices can therefore make formerly uneconomic stockpiles commercially viable. However, this raises a critical question for sulphur buyers:

How can buyers distinguish between suitable and unsuitable sulphur, while protecting the reliability of their supply?

Fig. 1: **Sulphur supply chain**



Source: Elessent



PHOTO: ELESSENT

Fig. 2: Arrival of sulphur with differing quality characteristics

The sulphur supply chain

A clear understanding of the sulphur supply chain is essential when evaluating product quality (Fig. 1). There are three principal sources of supply:

- High-quality sulphur supplied directly from refineries
- Long-term stored refinery sulphur
- Mined sulphur

High-quality sulphur supplied directly from refineries

The sulphur supply chain begins at the refinery, where sulphur is recovered as a by-product of oil and gas processing. From there, it can take several routes before reaching the end user.

Some refinery-produced sulphur is supplied directly to a consumer, representing the shortest route from production to use. Other volumes are sold through traders, who distribute product according to regional demand and customer requirements. In these routes, sulphur is commonly handled in molten form and generally retains a high level of purity.

Where customers are located further from a refinery, or where storage and transport in solid form are required, molten sulphur is sent to a forming facility. Here, it is converted into granules, pellets or pastilles to improve handling, storage and transport characteristics. Modern forming technologies can produce sulphur with purity of up to 99.9%, creating a premium product stream.

Once formed, solid sulphur moves through the distribution network to end users. During storage, loading, reloading and transport, it may become contaminated by dust, soil, metals and other foreign material. The degree of quality deterioration depends on handling practices, storage conditions and the wider logistics chain.

Elemental sulphur is also subject to natural oxidation. Exposure to oxygen, moisture and environmental conditions can gradually lead to the formation of sulphates and, in some circumstances, small quantities of sulphuric acid. Although these reactions are generally slow, they should be considered when designing storage, handling and distribution systems.

Long-term stored refinery sulphur

Historic sulphur blocks and stockpiles

Historically, surplus refinery sulphur was stored in large blocks and stockpiles, particularly in Canada and the Middle East, when production exceeded demand. With prices rising, many of these reserves are being recovered and reprocessed for commercial use.

The quality of long-term stored sulphur can vary substantially. During storage, excavation, transport and remelting, the material may be contaminated with soil, dust, metals and other impurities. Acidity and contamination levels can be higher than expected, particularly where stockpiles have been exposed to environmental conditions for extended periods.

Degraded sulphur deposits

In some regions, sulphur was historically deposited in large open areas and left undisturbed for many years. These degraded stockpiles may contain significant accumulated contamination, while acidity can increase over time. Despite these quality challenges, elevated prices have renewed interest in recovering and processing such material as an additional supply source.

Mined sulphur

Mined sulphur represents a smaller, but potentially growing, source of supply. Although Frasch sulphur mining is no longer widely practised, active operations remain in Poland. Higher prices have also prompted renewed consideration of historic mining projects that were abandoned during the 1960s and 1970s, when refinery-produced Claus sulphur became widely available. Examples include former sulphur mining areas in Mexico and Eastern Europe.

Frasch-mined sulphur, often referred to as dark sulphur, typically contains

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Table 1: **Physical forms of sulphur**

 Sulphur prills, granules & pastilles	 Sulphur flakes	 Sulphur lumps	 Sulphur powder
• Easiest to work with • Might start rolling back on excessive conveyor belt angles	• Fast melting time • Creates fines and dust	• Long melting time • High chance of damaging equipment (agitator, pumps, etc.)	• Hard to suspend

Source: Elessent

higher levels of organic contaminants than refinery sulphur, making it more challenging to process. Large open sulphur deposits in Iraq can contain even greater concentrations of organic material and are commonly described as black sulphur.

For both Frasch-mined and black sulphur, pre-treatment is often recommended to reduce organic contamination before further processing. In sulphuric acid production, this can improve operational efficiency, reduce maintenance requirements and lower overall operating costs.

Ultimately, all supply routes converge at the sulphur user, where sulphur is used to produce sulphuric acid. Regardless of origin, sulphur is typically remelted and filtered to remove ash, solids and other contaminants, improving consistency before use or onward distribution.

The effectiveness of remelting and filtration is critical. Final sulphur quality directly affects the reliability, efficiency and maintenance requirements of the sulphuric acid plant. The key question is whether the processing facility can reliably manage incoming sulphur (see Fig. 2) while meeting production targets and preserving an acceptable catalyst life.

Sulphur quality and analytical methods

The purchase of solid sulphur involves significant administrative documentation, covering contractual terms, logistics and payment conditions. However, when evaluating the product itself, buyers often rely primarily on one document: the Certificate of Analysis (CoA).

A typical sulphur CoA includes:

- Batch or lot number
- Date of manufacture and date of analysis
- Supplier name
- Sulphur purity, such as 99.5% minimum
- Moisture content
- Ash content
- Carbon or organic content
- Acidity
- Particle-size distribution, for granular sulphur
- Laboratory authorisation or signature
- Test methods used

The reliability of a CoA depends on the representativeness of the sample. For example, was the vessel loaded from one stockpile or from several locations? Does the cargo contain material from multiple suppliers or quality streams? These factors should be considered when assessing the sampling procedure and interpreting reported results.

For the greatest level of assurance, sampling should take place at three stages:

1. Before loading – to issue the CoA used in the sale process. Physical and chemical testing should be completed before loading, and moisture sampling should take place no more than seven days before loading begins.
2. During loading – sampling by the vessel owner can help protect against potential quality claims.
3. On arrival – to verify that delivered the product conforms with the CoA and contractual specification.

The next question is more practical: what do the values on a CoA mean for day-to-day sulphur plant operation?

Physical and mechanical considerations

The physical form of sulphur has a direct effect on handling, storage and melting performance (Table 1).

Mechanical contamination (Fig. 3) must also be considered. Foreign objects, including gloves, peddles, bolts and other materials associated with handling operations, can enter the sulphur stream. Such contaminants may not be captured in the relatively small samples used for routine testing and may therefore be absent from the CoA.

Understanding physical and mechanical properties is therefore as important as understanding chemical composition when seeking safe, reliable and efficient sulphur processing.

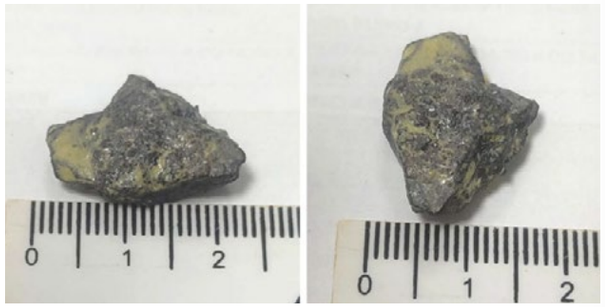

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Fig. 3: Example of mechanical contamination

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Interpreting analytical results

Obtaining a representative sample is only the first step. Buyers must also understand how that sample has been analysed and whether the reported results can be compared meaningfully with other results or specifications.

Official testing standards exist, but some have been withdrawn, superseded or replaced. A CoA may report certain parameters without identifying the test method, while others may reference standards or methods such as ISO, ASTM, IHM, AFPC, IS 6655 or AM-xx.

These references can appear authoritative, but buyers should understand what each method involves and whether results obtained through different methods are directly comparable.

Table 2: **Selected analysis methodologies**

	Acidity	Ash level	Organic content	Moisture
ISO	ISO 2704	ISO 2866	ISO 2866 withdrawn	Oven drying
ASTM	D4569*	D4574*		
AFPC**	AFPC XIV-2	AFPC XIV-3	AFPC XIV-4	AFPC XIV-5
BS 4113	Withdrawn since 1967			
IS 6655	Indian Standard since 1979: wet chemical analyses Validation reaffirmed in 2015			
IHM	In-house method			
AM-xx	Analytical method			

Source: Elessent

** Refers to analysis of sulphur used in rubber compounding materials.*
*** AFPC: Association of Fertilizer and Phosphate Chemists.*

Table 3: **Operational effects of sulphur quality**

Contaminant or issue	Impact during melting and processing	Operational and business consequences
Acidity	Can corrode melting, piping and filtration equipment. Neutralisation may be required, generating additional solids.	Higher maintenance costs, shorter equipment life and potential unplanned shutdowns.
Ash and inorganic solids	Increases solids loading, contributes to filter blockage and raises pressure drop. Carry-over to the sulphur burner or converter can increase pressure drop, particularly in the first catalyst bed.	More frequent filter cleaning, higher maintenance expenditure, lower plant availability and potentially reduced converter performance.
Organic contaminants	Can increase sulphur viscosity and interfere with melting and transfer. May cause plugging and pump or line problems.	Reduced production rate, increased cleaning requirements and a greater risk of blockage or downtime.
Moisture	May cause foaming and unstable melting or handling conditions. It can also increase the risk of hydrogen sulphide release during processing.	Lower melting capacity, production losses, and increased process and fire-safety risks.

Source: Elessent

Typical parameters reported on a CoA

Sulphur purity

Sulphur purity can be determined through direct analytical testing or calculated from the concentrations of identified impurities.

Ash content

Most standardised ash methods use a similar principle: a sample is heated under controlled conditions until combustible material is removed, leaving an inorganic residue. However, results can differ depending on sample mass, furnace temperature, heating time and calculation method.

Organic content

Analytical results for organic content can vary substantially between methods. Traditional wet-chemical techniques may generate different results from modern instrumental methods, each with different detection limits, strengths and limitations.

Acidity

Acidity may be determined through titration-based or instrumental methods. Differences in sample preparation, endpoint selection and calculation procedures can result in different reported values.

Moisture content

Moisture analysis is generally more straightforward and is typically based on measuring mass loss after drying at a specified temperature for a defined period. Nevertheless, drying conditions and the characteristics of the sample can still influence the result.

When reviewing a CoA, the analytical method should always be considered alongside the reported value (see Table 2). Similar specifications do not necessarily produce comparable results where different methods have been used. Understanding the methodology behind each parameter is essential to assessing product quality and supplier performance.

What sulphur quality means for plant performance

The implications of poor-quality sulphur extend beyond a laboratory result. They can affect plant availability, equipment integrity, operating costs and safety (Table 3).

A detailed CoA review can reveal non-conformities related to analytical methods and reporting practices. These issues can undermine confidence in the reported results, create discrepancies with counter-analysis and, more importantly, increase the risk of receiving sulphur that does not meet site requirements.

Potential warning signs include:

- Inconsistencies between the analytical procedure cited and the name of the issuing laboratory or institute.
- No clearly stated analytical procedure.
- Vague or insufficiently described methods, such as IHM or AM-xx, that provide limited information on how testing was performed.
- An unusually short interval between the analysis date and the bill of lading date.

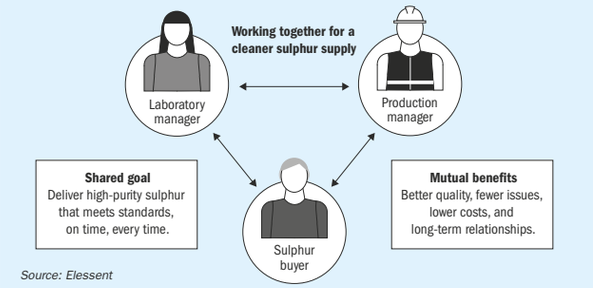
Conclusion and recommendations

Effective sulphur purchasing requires close collaboration among the Laboratory, Production and Purchasing teams (Fig. 4).

Each team has a distinct role:

- Laboratory management should complete a thorough technical review of the CoA and the methods used.
- Plant management should assess the potential operational risks and determine whether preventive measures are needed to handle the expected sulphur quality.
- Purchasing management should retain responsibility for the buying process while incorporating technical quality and supplier-reliability considerations.

Fig. 4: **Collaboration between Laboratory, Production and Purchasing**



Source: Elessent

This collaboration enables the plant to prepare for incoming shipments and take preventive action to minimise quality issues, operational disruption and production losses.

Additional practical measures include:

- Do not base purchasing decisions on price alone; product quality and supplier reliability should be core evaluation criteria.
- Conduct a detailed CoA review before approving a purchase.
- Request photographs of the stockpile or cargo before shipment to obtain an initial visual indication of product condition.
- Where supplier analysis is uncertain, appoint an independent inspector to conduct counter-analysis and verify compliance with contractual specifications.

A CoA should not be treated as automatic confirmation of sulphur quality. A rigorous technical review, supported by coordination between Laboratory, Production and Purchasing, can materially reduce the risk of receiving non-conforming material.

In a changing sulphur market, understanding what is being purchased, how its quality has been determined and what that quality means for plant performance is becoming just as important as the purchase price itself.



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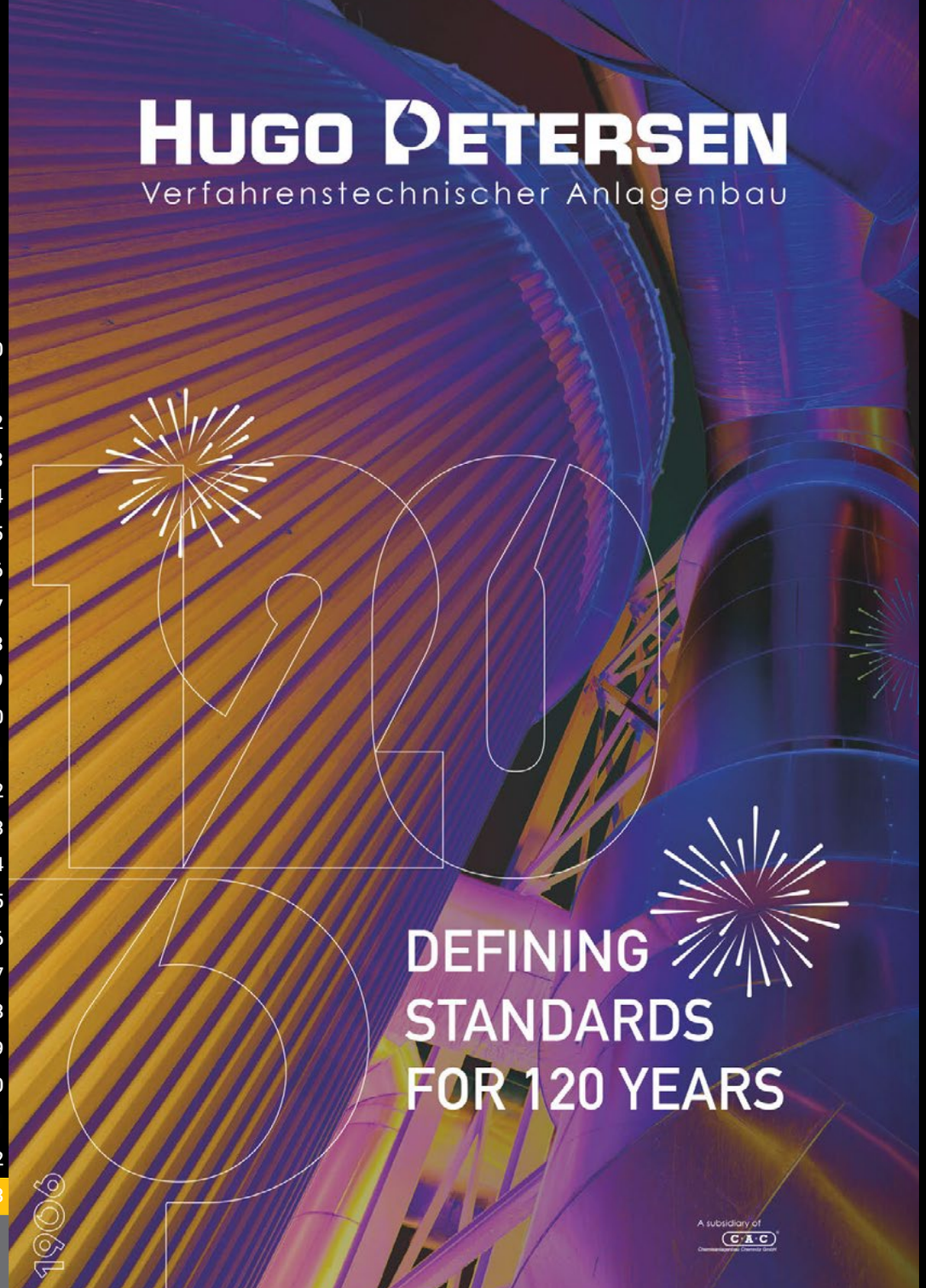

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