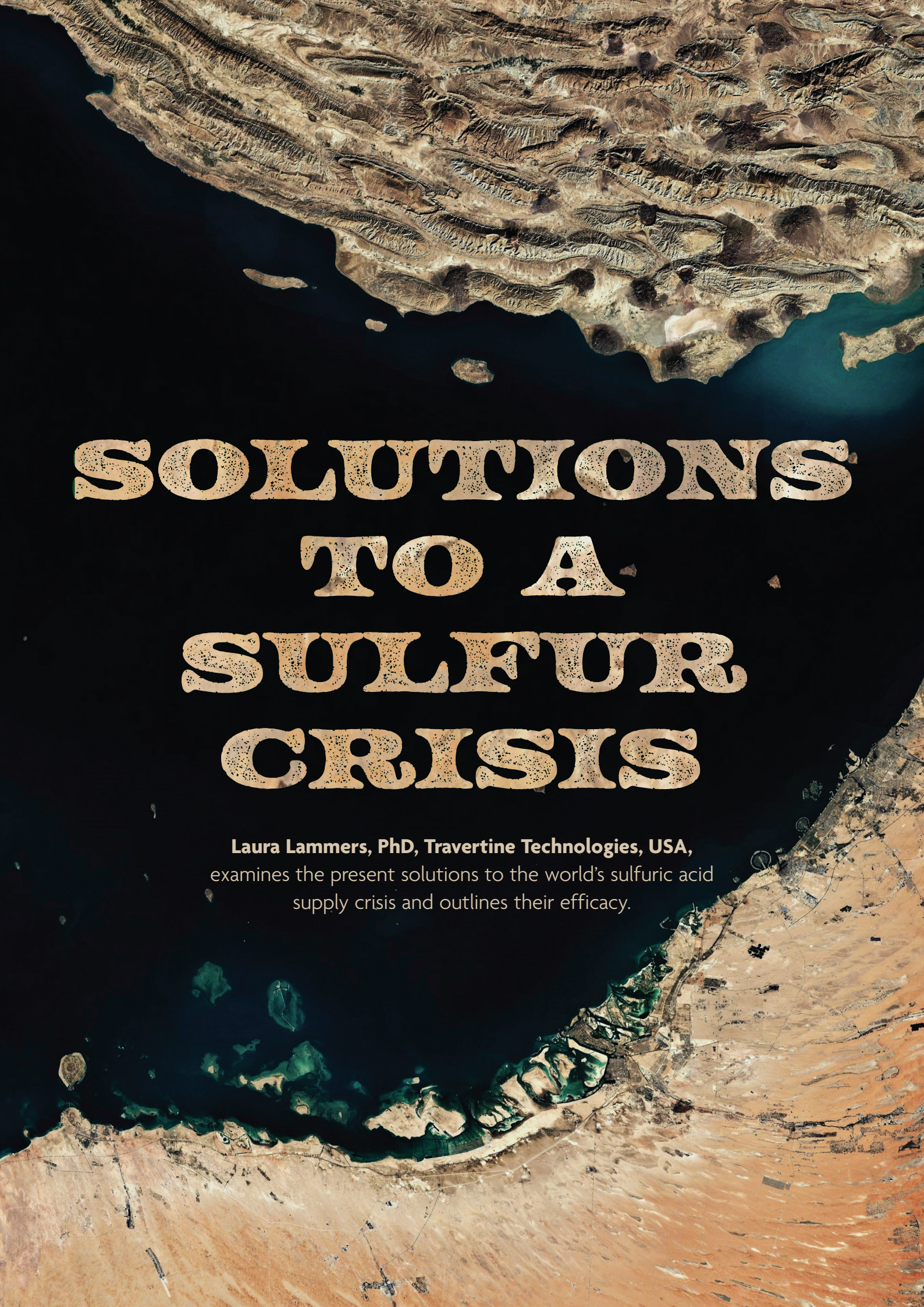


The background of the cover is an aerial photograph. The top half shows a rugged, mountainous landscape with brown and tan hues, suggesting a dry or volcanic environment. Below this, a dark blue body of water stretches across the middle. The bottom right corner shows a coastal area with a mix of brown, tan, and green, indicating a mix of land and vegetation. The title is centered over the dark water area.

SOLUTIONS TO A SULFUR CRISIS

Laura Lammers, PhD, Travertine Technologies, USA,
examines the present solutions to the world's sulfuric acid
supply crisis and outlines their efficacy.



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– facing record-high sulfur prices¹ and a forecasted sulfur² shortage reaching into 2027 – David Delaney, CEO of phosphate-based fertilizer producer Itafos, declared, “we are in a crisis, no doubt about it.” It is a refrain the industry has been hearing too often.

Earlier in 2026, David Miliband, president of the International Rescue Committee, told *The Guardian* the sulfur crisis and its impact on fertilizer production (and thus, agriculture) was a “food security timebomb.”³ The World Trade Organization (WTO) added, “fertilizers are the number one issue of concern today”. In a separate UN press briefing, Máximo Torero, Chief Economist of the Food and Agriculture Organization (FAO), described the current state of affairs as “a systematic shock affecting agrifood systems globally.”⁴ Qu Donyu, FAO’s Director-General, was blunter: “this is not only a geopolitical crisis, but also a disruption at the core of the global agrifood system.”⁵

Indeed, fertilizer producers have been feeling the strain of soaring fertilizer prices.⁶ As margins are squeezed, production has been scaled back. In May, American chemical company Mosaic announced it would be reducing US phosphate production due to high input costs.⁷ Two months later, the company expanded that scale-back across facilities in North America and Brazil, citing the multifaceted fertilizer crisis.⁸

But to strategise how to possibly exit this worsening crisis, it is important to understand how the world ended up here in the first place.

The threefold genesis of today’s global sulfuric acid crisis

Some industry experts have seen this day arriving for some time. In 2022, University College London researchers led by Mark Maslin, PhD, published a landmark study that sounded the alarm around a looming sulfur shortage and resulting crisis.⁹ They foresaw a collision of fundamental supply-and-demand dynamics.

More intensive agriculture to feed the world’s growing population – coupled with the growth of metals and mineral refining for modern and green technologies (ranging from batteries and EVs to the GPUs and other semiconductors found in data centres and smartphones) – would drive a significant increase in demand for sulfuric acid. Yet on the supply side, the global move away from fossil fuels and toward fossil-free energy and technologies would slash traditional supplies (some 80% of global sulfur supply historically has come from the desulfurisation of crude oil and natural gas).

In other words, the world is requiring more sulfuric acid than ever, precisely as the biggest source of supply may

be dwindling. Most analysts agree that sulfur prices will not go back to historical lows.

Indeed, as sulfur demand began to outpace supply, sulfur prices responded just as macroeconomics suggested they would.¹⁰ Between early 2024 and early 2025, sulfur prices doubled as major new acid leaching operations for nickel ore came online. They doubled again by early 2026. And prices would double yet again by mid-2026, ticking over US\$1500/t in some geographies.

But this gross supply-demand imbalance that Maslin and his colleagues warned about has turned out to be just one of three major forces colliding to create the acute crisis of today, on the back half of 2026. The other two forces are Iran and China.

In a chain of events, at the end of February, joint US-Israeli military strikes against Iran began a new wave of Middle Eastern conflict. Iran responded by closing the Strait of Hormuz, in the process cutting off the source of 50% of the world's sulfur.¹¹ The move sent shockwaves through sulfuric acid markets and the global industries and economies that depend upon it.¹²

As the Iran conflict lasted weeks and then months, China – the world's largest single-country producer of sulfur¹³ – announced a ban on sulfur exports, further throttling global supply.¹⁴ At the end of July, India followed suit, similarly banning sulfur exports in order to protect its domestic supplies.¹⁵ Russia imposed a ban of industrial sulfur exports through to the end of the year,¹⁶ while also restricting the transport of Kazakhstan sulfur through its territory.

The combined effect of Middle Eastern disruptions, in addition to China and other countries instituting export bans to stockpile their domestic supply, sent sulfur prices rocketing to record highs.^{17, 18}

Must the sulfur crisis remain on this single-minded trajectory? There are promising pathways through and out of this difficult moment, toward a more stable and economically sustainable sulfuric acid market.

Meeting the moment: new industrial processes and technologies emerge

A path forward up and out of this crisis – a solution to the sulfur straits the world now finds itself in – is possible. It will take concerted effort on four specific fronts.

- First, the industry must decrease its collective heavy dependence on Middle Eastern sulfur and sulfuric acid, to mitigate that sizable geopolitical risk and diversify the global market.
- Second and in tandem, countries will need to bolster domestic supplies, to reduce import dependency.
- Third, industries such as fertilizer production must mitigate demand for virgin sulfur and virgin sulfuric acid, which will otherwise ultimately run up against constraints of either geopolitical dependency, requirements for fossil-derived sulfur inputs amidst the ongoing transition away from fossil fuels, or both.
- Which leads to fourth, worldwide stakeholders must build robust, alternative sulfuric acid supply chains that are not dependent on fossil-derived sulfur.

Implementing such strategies is not a pipe dream. A number of companies have developed and are scaling solutions that address most or even all of these criteria.

Travertine has developed an electrochemical process that upcycles sulfate waste into sulfuric acid. It can use a variety of feedstocks including phosphogypsum, normally an environmentally hazardous waste by-product of fertilizer production.

Utilising a circular process, sulfate waste is transformed into a mineral co-product – either calcium carbonate (limestone) or slaked lime – which are the building blocks of low-carbon cement. Sulfate salts from the mineralisation process are sent to electrochemical salt splitting, producing sulfuric acid and caustic. The caustic feeds the mineralisation reactor and the circular process continues (again leveraging sulfate waste such as phosphogypsum). The result is a process that simultaneously reduces demand for virgin, fossil-derived sulfuric acid while building a supply of alternative, upcycled sulfuric acid for key uses such as fertilizer production.

The Travertine ProcessTM is starting to scale. In 2024, Holcim Maqer Ventures, part of Swiss building materials company Holcim, invested with an eye toward decarbonising its cement production while also recognising the complementary value to fertilizer production.¹⁹ Amrize also entered into a partnership on similar fronts.²⁰ In October 2025 a demo plant was opened outside of Rochester, New York, US.²¹ There, Travertine has partnered with Sabin Metal Corp. to produce sulfuric acid using waste gypsum as the feedstock. Earlier in 2026, a joint venture (JV) framework agreement was announced with Canadian company Arianne Phosphate to deploy Travertine's process at their Lac à Paul phosphate project in Quebec.²² The company is also in the early stages of developing a US-based project producing purified phosphoric acid and carbon-negative calcium carbonate for ready-mix concrete.

Travertine is not alone. Several start-ups are working on complementary technologies and solutions to this global challenge. Aepnus Technology has developed a patented, salt-splitting electrolyser that recycles sodium sulfate waste. Peregrine hydrogen has developed a novel electrolyser that co-produces green hydrogen and sulfuric acid from SO₂.

How to break the shackles of sulfur's geopolitical dependency, instability, and risk

Scaling these solutions is already under way. Travertine has more than a dozen feedstock testing locations spread across every continent but Antarctica. But coordinated action across governments, fertilizer producers, and investors can accelerate progress along the road to recovery from this sulfur crisis.

Governments must prioritise sulfur and sulfuric acid as a critical element and critical chemical, respectively, that is central to national security and their economies. Fertilizer producers can start, sooner rather than later, exploring alternative sources of sulfuric acid that can simultaneously help them address the hazardous waste

storage challenges that phosphogypsum creates. Investors can infuse needed capital to help start-ups and growth-stage companies bridge from pilot project to demo facility to full scale commercial plants that can produce meaningful volumes of sulfuric acid.

If these critical stakeholder groups can align, the world's most used and most important industrial chemical can chart a new course for its future – and the world's.

There are signs these ideas are gaining initial momentum. In the US the Trump Administration announced a suspension of import duties on phosphate fertilizers from Morocco in a bid to support American farmers, acknowledging the need to diversify supply chains and lower costs.²³ Meanwhile, the Payne Institute for Public Policy at the Colorado School of Mines has called for a strategic plan underpinning America's approach to sulfur.²⁴ The Coalition for a Prosperous America – a nonprofit lobbying organisation that advocates on behalf of American manufacturers and producers – in early August declared that “food security is national security” in a similar exhortation.²⁵ Think tanks are issuing parallel proclamations about the EU's domestic sulfur supply and sulfuric acid market.²⁶

It is mid-August as these words are written. There is no telling what the state of conflict in the Middle East or the Strait of Hormuz will be by the time will be this issue goes to press in October. But it can be said with confidence that the same vulnerabilities will remain for the world's sulfur supply and sulfuric acid production. The industry must start taking decisive steps to mitigate this risk now, so that there is a sustainable future tomorrow. That starts with scaling solutions that have already gained a foothold in this industry. Together, it can be done. **WF**

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