The Mosaic Co. acquired the idle property as part of a merger in 2004 and needed help managing historical risks associated with the property, particularly those alongside a transcontinental rail line.

VigIndustries Inc., a Mosaic subsidiary, hired Burns & McDonnell to put its geological and engineering knowledge and experience to work. The relationship opened with evaluations, led to innovative approaches and ultimately resulted in a timely, affordable and environmentally sensitive remediation effort developed with contractor USC Technologies.

“This project demonstrates Mosaic’s commitment to responsible management,” says Jim Brandt, manager of Corporate EHS, Legacy and Acquisitions at Mosaic, based in Plymouth, Minn. “Burns & McDonnell and USC Technologies have provided valuable ingenuity and technical expertise on this very challenging project.”

Mapping a Sound Approach
Burns & McDonnell started by evaluating more than 100 caverns at the site. The study identified three particular voids — all adjacent to the BNSF Railway line, which carries more than 60 trains a day — needing remediation, because of a potential for collapse. Sonar mapping revealed roofs more than 200 feet below ground, with one of the voids large enough to enclose the entire dome of the U.S. Capitol.


Now, underground caverns that had defied such progressions for decades are spurring a fresh approach in remediation — a collection of upgrades filling a void for efficient, effective and sustainable solutions for the mining industry and its property-owning successors.

The new approach — a meticulous process to fill underground caverns with sand readily available from nearby quarries — already has provided some welcome stability in Hutchinson, Kan., where a former Carey Salt mine had been the site of subterranean mining conducted in the early to mid-20th century.
Such mapping proved critical. The images provided three-dimensional views of where filling would be needed, how much material would be required and what locations might prove conducive for drilling — both for placing sand and for opening relief wells to stabilize the caverns.

More than 127,000 tons of alluvial sand would be trucked in from nearby commercial quarries and flow into caverns at a steady pace: 1 ton per minute, for 12 hours a day, for more than a year.

"The project required out-of-the-ordinary technology and ingenuity for achievement of the project's goals," says Ed Lindgren, an associate geologist at Burns & McDonnell. "By driving well casings through layers of bedrock, crews poured sand in through the tops of caverns, sometimes approaching at an angle."

That's where more innovation and experimentation came in: Engineers, geologists and the contractor worked together to see that the falling sand — billions of tiny grains entering through a narrow chute — could spread out and reach all open crevices waiting below.

"Think of it like an hourglass," Lindgren says. "A giant, dark, irregularly shaped hourglass — underground, and with water at the bottom."

**Draining Water, Adding Sand**

Because the caverns were former solution mines — water had been pumped underground to dissolve the surrounding salt and carry the desired mineral back to the surface — Burns & McDonnell engineers and geologists carefully sited relief wells to serve as drains for brine to be displaced.

At a rate of 150 gallons per minute, air-lift pumps discharged 5.2 million gallons of the salt-saturated water into an injection well owned by the city of Hutchinson, a solution welcomed as environmentally sound.

And the swift removal of brine enabled crews to accelerate their placement of sand, helping finish the job six months ahead of schedule.

Team members also developed new techniques to track and document backfill progress and completion, establishing guidelines and procedures for a project that itself could fill an even larger void: the need for a proven, economical and effective method for eliminating risk of collapse at sites where subterranean caverns remain unfilled.

"This really is groundbreaking stuff," Lindgren said. "And it's all underground."

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