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**Safeguarding
Peaker Plants Against
Lightning-Related
Disruptions**

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**Calling in
the Experts:
Mold Solutions**

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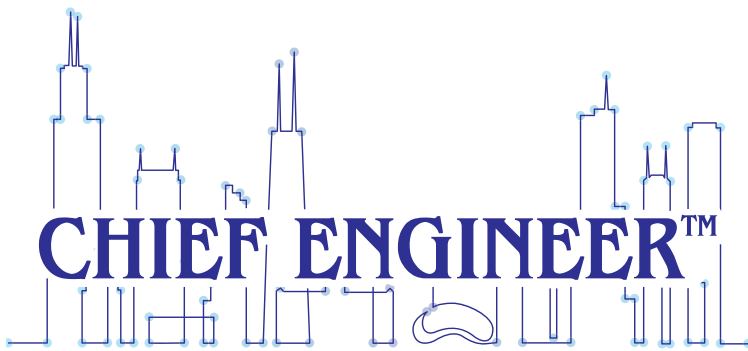
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16 18 Years of Platinum

A specialized engineering team is entrusted with maintaining the LEED Platinum-certified FBI Chicago Regional Office.

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New technology defending against lightning strikes for peaker plants takes a proactive view to preventing strikes before they occur.

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Mold Solutions has earned its success by focusing entirely on mold mitigation and prevention, and delivering the best customer experience possible.

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Dear Members,

Another year of CEAC meetings and events is almost at a close, but before we all adjourn for the summer to take some time off for travel, vacation or just to spend some quantity time with family and friends, don't forget that we have one more big event on the schedule, and that's our annual CEAC Night at Chicago White Sox on the Fan Deck at Rate Field. This year, we'll be seeing the South Siders take on the Kansas City Royals on Friday, June 26, with a concert by Marshmello to follow. The Fan Deck opens at 5:30pm, with the umpire hollering "Play ball!" at 6:40pm. Tickets are available in blocks of 10 and include a wristband for beer and food. Reservations can be made for your group by emailing events@chiefengineer.org. As always, our sincere thanks to Tom Phillips for his efforts in securing the Fan Deck for all of us.



Thanks also to everyone who attended our May BBQ event last month, and to our Events Committee for putting it all together. It's always great to see everyone and enjoy some great barbecue, cigars and conversation. We're exceedingly grateful to our sponsors, including our Co-Sponsor Air Comfort, our Bar Sponsors DSI Door and Core Mechanical. Please remember to give them your support when you require outside help.

Even though the summer months ahead will be free of meetings, the biggest event of the year, our 86th Annual CEAC Golf Outing at Cog Hill, is just around the corner, and it takes a lot of planning. Many thanks to Kevin Kenzinger, Brendan Winters and Alex Evans for taking the point for this event once again. It'll be held Friday, Sept. 11, with a 9:00am shotgun start. Registration should be open at chiefengineer.org by the time you read this, and sponsorship opportunities are abundantly available. Please reach out to golf@chiefengineer.org with any questions you might have, or to become a sponsor.

Lastly, as we focus on maintaining our chillers and towers to keep our buildings cool, this is a good time to start planning our boiler maintenance and inspections, keeping in mind any issues we experienced last season that we should plan to correct for the coming season. Please don't hesitate to reach out to one of our valued vendors for any assistance you need.

I wish you and your loved ones a safe and happy summer — and hope to see you at Rate Field!

Sincerely,

Larry McMahon



ASHRAE Announces New Study Quantifying Global CO₂ Reduction Enabled by BACnet Building Automation


ASHRAE recently announced the release of a new groundbreaking study from the University of New Hampshire (UNH) that, for the first time, quantified the global climate impact of BACnet®.

BACnet is the global data communication protocol for Building Automation and Control networks. Developed under the auspices of ASHRAE, it allows building systems including heating, ventilation, air-conditioning, lighting, life-safety and other systems to communicate and cooperate, driving the efficiency of the modern built environment.

The study reveals that BACnet-enabled building automation systems have mitigated 1.4 billion tons of CO₂ since 1995. This is equivalent to removing 300 million cars from the road for one year or offsetting the entire annual emissions of Japan. The research highlights BACnet's role as a catalyst for smart building adoption worldwide.

"This study clearly shows the power of smart buildings and the critical role BACnet plays in reducing global carbon emissions," said 2025-26 ASHRAE President Bill McQuade, P.E., CDP, Fellow ASHRAE, LEED AP. "For nearly three decades, BACnet's open, interoperable framework has enabled building owners and operators to optimize energy use, improve efficiency and deliver measurable climate impact. ASHRAE is proud that our standards and technologies are helping drive the transition to a low-carbon future, proving that the built environment can be a true leader in sustainability."

Looking ahead, projections indicate that BACnet systems could help avoid 2.06 billion tons of CO₂ by 2030, underscoring the critical role of smart, connected building technologies in achieving global sustainability goals.

The full study is available for download at on the ASHRAE Free Resources page at ashrae.org/freeresources. For BACnet technical resources, visit ashrae.org/bacnet. 

ASHRAE Highlights Industry Priorities in 2026 Annual Conference Technical Program

ASHRAE recently released its technical program for its 2026 Annual Conference, taking place June 27-July 1 in Austin, Texas. The conference will bring together industry professionals, researchers and practitioners from around the world for a week of knowledge-sharing, technical exploration, professional development and peer engagement.

The complete schedule is now available online and through ASHRAE 365, enabling attendees to build personalized conference itineraries in advance.

This year's technical program features a comprehensive range of sessions across eight distinct tracks, highlighting both foundational principles and emerging directions in the HVAC&R industry:

- Fundamentals and Applications
- HVAC&R Systems and Equipment
- Research Summit
- Workforce Development
- Ground Source Heat Pumps
- Hot Climate Building System Design, Operation and Resilience
- AI in Building Design and Construction
- Building Decarbonization

"The ASHRAE Annual Conference brings together established practices and new ideas that are reshaping how we design, build and operate buildings," said 2025-26 ASHRAE President Bill McQuade, P.E., CDP, Fellow ASHRAE, LEED AP. "Attendees will find opportunities to deepen their expertise, discover innovative approaches and connect with peers tackling similar challenges."

With sessions led by subject matter experts from around the globe, the program offers a mix of research-driven presentations, interactive discussions and collaborative opportunities designed to support professionals at every stage of their careers.

Key sessions include:

- AI, Cloud and Cybersecurity: Why Do They Matter for Smart Building Design?
- Integrated Modeling and Optimization of Data Center Cooling and Waste Heat Reuse
- Minding Your Business: Preparing for Tomorrow's Workforce Today
- Resilience, Affordability, and Regulation: The Future of Community Energy Systems
- Achieving Healthier Buildings with Lower Cost and Energy Use
- Engineering the Backbone of AI Cooling: TCS Design and Commissioning

The ASHRAE Learning Institute (ALI) will also offer 10 continuing education courses, all approved for continuing education credits toward maintaining P.E. licensure.

New and updated courses being offered include:

- Laboratory Controls - Devices and Strategies for Proper Airflow
- Basic Concepts for Demystifying Dehumidification
- Understanding Design and Installation Requirements for A2L Refrigerant Systems
- Advanced Dehumidification System Design
- Decarbonization Tactics: Making Buildings Grid-Interactive
- Starting the Path to Net Zero Buildings Using ASHRAE 90.1 – Featuring 2025 Updates

The conference will feature a plenary session with Society updates and the farewell address from President McQuade. During the President’s Luncheon, ASHRAE will install its new officers and directors, and incoming 2026-27 ASHRAE President Sarah Maston will deliver her inaugural address on the Society’s new theme: “Changing the Game: Retrofitting for Resilience.”

For more information and to view the full schedule, visit ashrae.org/2026annual.





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2026 Construction Tech Conference

July 15-16, 2026

Convene – Willis Tower

233 South Wacker Drive, Chicago

BuiltWorlds' annual Construction Tech Conference explores the trends and trajectories of innovation and emerging technologies involved in the construction of buildings and infrastructure. The conference places an emphasis on field operations, providing actionable insights and proven strategies to effectively evaluate, manage and improve jobsite productivity, efficiency, safety and logistics. Attendees gain exclusive access to the latest trends, connect with top innovators, and leverage BuiltWorlds' in-depth research for data-driven insights that shape the future of the industry.

No other event provides the same level of objective, comprehensive, and actionable insights on emerging technology adoption, making the Construction Tech Conference a must-attend event for those spearheading construction innovation.

What attendees can expect from their Construction Tech Conference experience:

- Harmonizing of design, estimating, and preconstruction integration
- Constructing a bulletproof GC-sub partnership
- Synthesizing AI readiness to optimize data outcomes } and deployments
- Optimizing project closeout, handover and commissioning
- Engineering a human centric and collaborative robotics ecosystem
- Scaling domain expertise with AI-assisted project delivery
- Orchestrating a high-yield construction technology lifecycle

A broad array of dynamic presentations and lively discussions available will include:

Panel Discussion – The Predictive Planning Frontier: Design, Estimating, and Preconstruction Integration

Wednesday, July 15

9:40-10:20am

Unpack how modern design tools, model-based estimating, dynamic scheduling, and integrated preconstruction platforms are reshaping workflows. We will explore how predictive modeling serves as a central intelligence layer, translating massive datasets into actionable insights that flow seamlessly from initial design through estimating to final preconstruction execution. By leveraging these integrated forecasts, teams can proactively identify risks and coordination challenges, allowing for strategic re-sequencing and resource optimization during preconstruction.

Breakout Discussion – Building Buy-In for Realistic and Reliable Project Schedules

Wednesday, July 15

10:50-11:20am

Explore how leading contractors are using modern platforms and integrated data workflows to break down silos, improve schedule reliability, and drive faster, more confident decision-making in both the field and the office. Examine the lifecycle and complexity of large-scale construction schedules, and how forward-thinking teams are combining technology, process and governance to build more resilient, decision-ready project plans.

Breakout Discussion – The Future of Zero Incidents: Integrating Lean, AI, and Human Performance for Proactive Safety

Wednesday, July 15

3:05-3:40pm

This session redefines safety as a strategic advantage by merging Lean management's waste-elimination discipline with high-impact AI tools that shift organizations from reactive incident reporting to predictive risk prevention. Leveraging human performance science and real-world case studies from industry leaders, the discussion explores how Natural Language Processing and predictive analytics amplify human judgment to reveal hidden trends and to enhance leadership visibility. Participants will gain a comprehensive roadmap for fostering an adaptive safety culture that prioritizes total worker wellbeing — integrating mental health collaboration and suicide prevention frameworks with cutting-edge technology to build high-trust, incident-free jobsites.

Panel Discussion – The Human Stack: Scaling Domain Expertise with AI-Assisted Project Delivery

Thursday, July 16

10:55-11:30am

See how leaders are leveraging predictive analytics and behavioral assessments to empower tradespeople with deep domain expertise to build their own digital solutions. We will discuss strategies for transforming field-level insights into technical force multipliers, ensuring the next generation of builders can lead with both sound craftsmanship and the ability to automate complex workflows in real-time. By bridging the gap between field experience and software development, firms can successfully transition these automated workflows from simple generative assistance into fully autonomous, agentic systems that manage project delivery with minimal oversight.

Breakout Discussion – The High-Voltage Sprint: Leveraging Construction Tech to Scale Resilient Energy Grids

Thursday, July 16

2:00-2:35pm

Explore how technology and innovation leaders are utilizing industrial prefabrication, generative design, and AI-powered

risk modeling to bypass traditional permitting bottlenecks and accelerate the delivery of complex energy infrastructure. Attendees will gain a strategic roadmap for integrating robotics and automated field operations into large-scale power projects to ensure system reliability, safety, and security.

Lightning Round – Closing the Loop: Data-Driven Handover and the Future of Digital Commissioning

Thursday, July 16
3:05-3:35pm

This session analyzes the shift from reactive task-tracking to integrated digital lifecycles, exploring how leaders are utilizing automated commissioning workflows and “as-built” digital twins to transform handover into a strategic competitive advantage. We will examine how institutionalizing data continuity — from the field to the facility manager — enables firms to deliver high-fidelity, high-yield assets on day one. Attendees will gain a roadmap for leveraging automated documentation platforms to eliminate “closeout drag” and ensure execution certainty through the final mile of the project. 📄

For more information and to register, visit builtworlds.com/event/2026-construction-tech-conference.



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Commissioner Sharon Waller, Vice President Patricia Theresa Flynn, Director of Operations at Willis Tower Barbara Hickey, President Keri K. Steele, Commissioner Eira L. Corral Sepúlveda, Commissioner Precious Brady Davis, and Commissioner Beth McElroy Kirkwood. (Photo courtesy of Metropolitan Water Reclamation District of Greater Chicago.)

CEAC’s Barbara Hickey Delivers Keynote Address at MWRD Leadership Event

Current Vice President of the Chief Engineers Association of Chicagoland (CEAC) and Director of Operations at Willis Tower Barbara Hickey recently served as a keynote speaker at the Metropolitan Water Reclamation District of Greater Chicago’s event “Leading the Change: Women Shaping a Sustainable Future.” Hickey shared her professional journey, from her early career as an Operating Engineer to her current leadership role, and highlighted several of her abundant accomplishments. An outstanding representative of Local 399 and a strong advocate for organized labor, Hickey offered inspiration to attendees and underscored the vital role that women play in advancing sustainability across the industry.



Barbara Hickey addresses the crowd at the MWRD’s “Leading the Charge: Women Shaping a Sustainable Future” event. (Photo courtesy of Metropolitan Water District of Greater Chicago.)

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National Lift Truck President Jeff Scott and Regional Manager Will Owensby accepting the CLARK Dealer of Excellence Masters Award from CLARK executive leaders.

National Lift Truck Awarded CLARK Dealer of Excellence Masters Award

National Lift Truck recently was awarded the CLARK Material Handling Company Dealer of Excellence Masters Award for the second year in a row. "This award is especially meaningful to us because our goal has never been to be the best at selling forklifts — it's to be the best service and solution provider to our customers," offered a statement on the company's website.

"By partnering with CLARK to offer quality forklifts for sale or rent and CLARK OEM parts backed by our experienced shop and field service team, we've been able to offer our customers more choices for forklift rentals, new, or used equipment," it continued.

National Lift Truck first began as a forklift service company in 1956, and through the decades has built lasting partnerships with its customers as well as with the manufacturers it represents. Supporting industrial, construction, and commercial businesses with reliable and responsive service and flexible equipment solutions tailored to the needs of its customers, National Lift Truck and its team of experts are trusted industry partners who deliver flexible and reliable solutions as needed.

"CLARK lift trucks are known for their 'Built to Last' quality, and we're proud to be a top CLARK forklift dealer in the Chicago, Ill., and Little Rock, Ark., areas," National Lift Truck's statement said. "We're grateful to CLARK for the strong dealer support they provide, but most of all, grateful for our incredible team for their continued excellence in service for the past 70 years!"
 Congratulations, National Lift Truck!

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OSHA Recommended Practices: Hazard Identification and Assessment

Third in a series focusing on the core elements of OSHA's safety and health program.

One of the "root causes" of workplace injuries, illnesses, and incidents is the failure to identify or recognize hazards that are present, or that could have been anticipated. A critical element of any effective safety and health program is a proactive, ongoing process to identify and assess such hazards.

In an effectively implemented safety and health program:

- Procedures are put in place to continually identify workplace hazards and evaluate risks.
- Safety and health hazards from routine, nonroutine, and emergency situations are identified and assessed.
- An initial assessment of existing hazards, exposures, and control measures is followed by periodic inspections and reassessments, to identify new hazards.
- Any incidents are investigated with the goal of identifying the root causes.
- Identified hazards are prioritized for control.

Some hazards, such as housekeeping and tripping hazards, can and should be fixed as they are found. Fixing hazards on the spot emphasizes the importance of safety and health and takes advantage of a safety leadership opportunity. (Fixing other hazards identified using the processes described here will be addressed in next month's Best Practices feature, "Hazard Prevention and Control.")

Action Item 1: Collect existing information about workplace hazards

Information on workplace hazards may already be available to employers and workers from both internal and external sources.

How to accomplish it:

- Collect, organize, and review information with workers to determine what types of hazards may be present and which workers may be exposed or potentially exposed.
- Information available in the workplace may workers include:
 - o Equipment and machinery operating manuals.
 - o SDSs provided by chemical manufacturers.
 - o Self-inspection reports and inspection reports from insurance carriers, government agencies, and consultants.
 - o Records of previous injuries and illnesses, such as OSHA 300 and 301 logs and reports of incident investigations.



Proper hazard identification and assessment involves an initial assessment of existing hazards, exposures and control measures is followed by periodic inspections and reassessments to identify new hazards.

- o Workers' compensation records and reports.
- o Patterns of frequently occurring injuries and illnesses.
- o Exposure monitoring results, industrial hygiene assessments, and medical records (appropriately redacted to ensure patient/worker privacy).
- o Existing safety and health programs (lockout/tagout, confined spaces, process safety management, PPE, etc.).
- o Input from workers, including surveys or minutes from safety and health committee meetings.
- o Results of job hazard analyses (JHAs, also known as job safety analyses or JSAs).
- Information about hazards may be available from outside sources, such as:
 - o OSHA, National Institute for Occupational Safety and Health (NIOSH), and Centers for Disease Control and Prevention (CDC) websites, publications, and alerts.
 - o Trade associations.
 - o Labor unions, state and local occupational safety and health committees/coalitions ("COSH groups"), and worker advocacy groups.
 - o Safety and health consultants.

Action Item 2: Inspect the workplace for safety hazards

Hazards can be introduced over time as workstations and processes change, equipment or tools become worn, maintenance is neglected, or housekeeping practices decline. Setting aside time to regularly inspect the workplace for hazards can help identify shortcomings so that they can be addressed before an

incident occurs.

How to accomplish it:

- Conduct regular inspections of all operations, equipment, work areas, and facilities. Have workers participate on the inspection team, and talk to them about hazards that they see or report.*
- Be sure to document inspections so you can later verify that hazardous conditions are corrected. Take photos or video of problem areas to facilitate later discussion and brainstorming about how to control them, and for use as learning aids.
- Include all areas and activities in these inspections, such as storage and warehousing, facility and equipment maintenance, purchasing and office functions, and the activities of on-site contractors, subcontractors, and temporary employees.
- Regularly inspect both plant vehicles (e.g., forklifts, powered industrial trucks) and transportation vehicles (e.g., cars, trucks).
- Use checklists that highlight things to look for. Typical hazards fall into several major categories, such as those listed below; each workplace will have its own list:
 - General housekeeping
 - Slip, trip, and fall hazards
 - Electrical hazards
 - Equipment operation
 - Equipment maintenance
 - Fire protection
 - Work organization and process flow (including staffing and scheduling)
 - Work practices
 - Workplace violence
 - Ergonomic problems
 - Lack of emergency procedures
- Before changing operations, workstations, or workflow; making major organizational changes; or introducing new equipment, materials, or processes, seek the input of workers and evaluate the planned changes for potential hazards and related risks.

Action Item 3: Identify health hazards

Identifying workers' exposure to health hazards is typically more complex than identifying physical safety hazards. For example, gases and vapors may be invisible, often have no odor, and may not have an immediately noticeable harmful health effect. Health hazards include chemical hazards

(solvents, adhesives, paints, toxic dusts, etc.), physical hazards (noise, radiation, heat, etc.), biological hazards (infectious diseases), and ergonomic risk factors (heavy lifting, repetitive motions, vibration). Reviewing workers' medical records (appropriately redacted to ensure patient/worker privacy) can be useful in identifying health hazards associated with workplace exposures.

How to accomplish it:

- Identify *chemical hazards* — review SDSs and product labels to identify chemicals in your workplace that have low exposure limits, are highly volatile, or are used in large quantities or in unventilated spaces. Identify activities that may result in skin exposure to chemicals.
- Identify *physical hazards* — identify any exposures to excessive noise (areas where you must raise your voice to be heard by others), elevated heat (indoor and outdoor), or sources of radiation (radioactive materials, X-rays, or radiofrequency radiation).**
- Identify *biological hazards* — determine whether workers may be exposed to sources of infectious diseases, molds, toxic or poisonous plants, or animal materials (fur or scat) capable of causing allergic reactions or occupational asthma.**
- Identify *ergonomic risk factors* — examine work activities that require heavy lifting, work above shoulder height, repetitive motions, or tasks with significant vibration.
- Conduct quantitative exposure assessments, when possible, using air sampling or direct reading instruments.
- Review medical records to identify cases of musculoskeletal injuries, skin irritation or dermatitis, hearing loss, or lung disease that may be related to workplace exposures.

Action Item 4: Conduct incident investigations

Workplace incidents — including injuries, illnesses, close calls/near misses, and reports of other concerns — provide a clear indication of where hazards exist. By thoroughly investigating incidents and reports, you will identify hazards that are likely to cause future harm. The purpose of an investigation must always be to identify the root causes (and there is often more than one) of the incident or concern, in order to prevent future occurrences.

*Many hazards can be identified using common knowledge and available tools. For example, you can easily identify and correct hazards associated with broken stair rails and frayed electrical cords. Workers can be a very useful internal resource, especially if they are trained in how to identify and assess risks.

** Identifying and assessing health hazards may require specialized knowledge. Small businesses can obtain free and confidential occupational safety and health advice services, including help identifying and assessing workplace hazards, through OSHA's On-site Consultation Program (see www.osha.gov/consultation).

How to accomplish it:

- Develop a clear plan and procedure for conducting incident investigations, so that an investigation can begin immediately when an incident occurs. The plan should cover items such as:
 - Who will be involved
 - Lines of communication
 - Materials, equipment, and supplies needed
 - Reporting forms and templates * * *
- Train investigative teams on incident investigation techniques, emphasizing objectivity and open-mindedness throughout the investigation process.
- Conduct investigations with a trained team that includes representatives of both management and workers.
- Investigate close calls/near misses.
- Identify and analyze root causes to address underlying program shortcomings that allowed the incidents to happen.
- Communicate the results of the investigation to managers, supervisors, and workers to prevent recurrence. * * * *

Action Item 5: Identify hazards associated with emergency and nonroutine situations

Emergencies present hazards that need to be recognized and understood. Nonroutine or infrequent tasks, including maintenance and startup/shutdown activities, also present potential hazards. Plans and procedures need to be developed for responding appropriately and safely to hazards associated with foreseeable emergency scenarios and nonroutine situations.

How to accomplish it:

- Identify foreseeable emergency scenarios and nonroutine tasks, taking into account the types of material and equipment in use and the location within the facility. Scenarios such as the following may be foreseeable:
 - Fires and explosions
 - Chemical releases
 - Hazardous material spills
 - Startups after planned or unplanned equipment shutdowns

- Nonroutine tasks, such as infrequently performed maintenance activities
- Structural collapse
- Disease outbreaks
- Weather emergencies and natural disasters
- Medical emergencies
- Workplace violence

Action Item 6: Characterize the nature of identified hazards, identify interim control measures, and prioritize the hazards for control

The next step is to assess and understand the hazards identified and the types of incidents that could result from worker exposure to those hazards. This information can be used to develop interim controls and to prioritize hazards for permanent control.

How to accomplish it:

- Evaluate each hazard by considering the severity of potential outcomes, the likelihood that an event or exposure will occur, and the number of workers who might be exposed.
- Use interim control measures to protect workers until more permanent solutions can be implemented.
- Prioritize the hazards so that those presenting the greatest risk are addressed first. Note, however, that employers have an ongoing obligation to control all serious recognized hazards and to protect workers. * * * * *

Source: OSHA

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***OSHA has special reporting requirements for work-related incidents that lead to serious injury or a fatality (29 CFR 1904.39). OSHA must be notified within 8 hours of a work-related fatality, and within 24 hours of an amputation, loss of an eye, or inpatient hospitalization.

****Effective incident investigations do not stop at identifying a single factor that triggered an incident. They ask the questions “Why?” and “What led to the failure?” For example, if a piece of equipment fails, a good investigation asks: “Why did it fail?” “Was it maintained properly?” “Was it beyond its service life?” and “How could this failure have been prevented?” Similarly, a good incident investigation does not stop when it concludes that a worker made an error. It asks such questions as: “Was the worker provided with appropriate tools and time to do the work?” “Was the worker adequately trained?” and “Was the worker properly supervised?”

*****“Risk” is the product of hazard and exposure. Thus, risk can be reduced by controlling or eliminating the hazard, or by reducing workers’ exposure to hazards. An assessment of risk helps employers understand hazards in the context of their own workplace, and prioritize hazards for permanent control.

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18 Years of Platinum

A specialized engineering team keeps the FBI Chicago Regional Office running smoothly in the years since historic certification.
Second in a sequence of articles highlighting the FBI Chicago Regional Office.

By Marcy Marro

The FBI Chicago Regional Office received the world's first LEED Platinum certification for Existing Buildings: Operations & Maintenance from the U.S. Green Building Council 18 years ago. (Photo: ©David Seide/DefinedSpace.com)

It has been 18 years since the FBI Chicago Regional Office received the world's first LEED Platinum certification under LEED for Existing Buildings: Operations & Maintenance from the U.S. Green Building Council. Since then, a specialized engineering team has been tasked with keeping the building running smoothly.

Owned by Affinius Capital as part of their U.S. Government Building Fund, the build-to-suit FBI Chicago Regional Office opened in 2006 and is located just west of Chicago's business district. Situated on a 10.8-acre site, the building complex includes the 430,000-square-foot, 10-story Class A property with an attached annex area and a detached two-story exterior garage.

Thomas P. Rountree is the Operations Manager with Cushman & Wakefield at the FBI Chicago Regional Office, where he oversees engineering, janitorial and management functions, as well as tenant communications, project planning,

budgeting and forecasting. The rest of the engineering team consists of three full-time engineers and one assistant property manager that staff the building. Frank Gallina, the Chief Engineer, has been with the building for 11 years along with Cory Lane, the AM Lead Engineer, and Jamie Garcia, the Assistant Property Manager.

Stringent Specifications

Designed by Lohan Anderson, the building required more stringent specifications than that of a regular office building. "The government's program of requirements included specifications influencing site size, heightened security requirements and special building design," Rountree explains.

The building's façade primarily is composed of architectural precast concrete, which is a green material. The exterior wall of the building with the 60 percent precast concrete and high-performance, low-E glass creates a very energy-efficient envelope.

The requirements that went into the design allowed for improved structural enhancements that not only supported the stringent security requirements but also allowed the finished product to be more efficient, more flexible, and able to provide more views and natural light in the building with its curved façade taking advantage of the solar orientation. The lobby has a two-story-high glass wall held in place with a cable net structure for maximum transparency, providing expansive views of the neighborhood and Chicago skyline. Additionally, an on-site annex building contains vehicle maintenance and forensic laboratories.

LEEDing the Way

In December 2008, the building earned 74 out of a possible 92 points for LEED certification. According to Rountree, "Stakeholder alignment and targeted improvements to MEP systems, recycling and IAQ programs helped push the building to LEED Platinum status." The site was recertified at LEED Platinum level in 2014 and won the TOBY International Earth Award in 2011. The building currently has an Energy Star rating of 90 and continues to reduce its energy consumption with tracking and trending of its daily energy usage.

Some of the improvements that the LEED certification included were increasing building-wide recycling, with the FBI starting its own tenant-recycling committee, which brought the building's recycling figures from 47.5 percent to more than 70 percent. Ownership also looked to improve the building's indoor air quality (IAQ), as well as water and energy efficiency.

Low-flow faucets, showerheads, rain sensors on irrigation systems, and tracking and trending HVAC start and stop times and overall system performance were just a few ways to make these improvements. Reducing irrigation, adding new aerators in bathroom and breakroom sinks, low-flow showerheads in the locker rooms and new flushometers on urinals save more than 3 million gallons of water annually, achieving a 43-percent reduction in water usage.

The site design also incorporates many important green features, including a large detention pond that is planted with native and water tolerant grasses. This low-maintenance design saves energy, and the grasses help clean and filter the stormwater before it's released offsite into the city's sewer system. More than 50 percent of the site is landscaped with



The façade and exterior wall of the FBI Chicago Regional Office is composed of about 60 percent architectural precast concrete, and high-performance, low-E glass, making for a very energy-efficient envelope. (Photo: ©David Seide/DefinedSpace.com)



The building's lobby features a glass wall maintained via a cable net structure that offers expansive views of the Chicago skyline. (Photo: ©David Seide/DefinedSpace.com)

native or adaptive sustainably plantings that do not have to be mowed or trimmed, fertilized or irrigated. The results of these efforts are lower operating costs, lower lawn equipment emissions, reduced harsh chemical applications and a significant reduction of water usage.

The Chicago FBI building started out with an Energy Star rating of 78 out of 100 points. A continuous commissioning plan was created that included all HVAC equipment, lighting and building automation system sensors, ensuring the building was always working at optimal levels. New sub-meters on major equipment gave ownership the opportunity to see what each

system was doing in real time. Additional changes included adding all lighting back to the BAS schedule for better control, changing the equipment operation schedules to better reflect occupancy levels, creating staggered start-time schedules, adjusting boiler programming for after hours and weekends, and changing the sequencing of the cooling system. Little adjustments throughout made for big improvements, bringing the building's Energy Star rating to a score of 90.

Building Systems Monitoring

During the building commissioning process, Rountree says several adjustments were needed between the design



Chief Engineer Frank Gallina and Engineer Cory Lane take readings on a 650-ton Trane Centrifugal Chiller.



The chiller plant at the FBI Chicago Regional Office. Adjustment of the sequencing of the cooling system was one change among many that helped to bring the building's Energy Star rating to 90.

intent and field performance, all of which were corrected and tracked.

The FBI Building, which operates 24 hours a day, 365 days a year, has a robust sub-metering system and building automation system platform that collects data in real-time intervals, which enables precise monitoring and issue detection. The system can adjust environments on thresholds, schedules and occupancy. Rountree says smart building upgrades were explored but restricted due to security restrictions within the building.

According to Rountree, sub-metered energy usage is regularly monitored, including but not limited to daily water, electric, natural gas and various mechanical loads. Cooling tower metrics are measured daily, weekly and monthly.

Given the building's 20-year age, Rountree says several recent upgrades have occurred at the FBI building, including some exterior repairs, carpet replacement, lighting and plumbing retrofits, chiller overhauls, ongoing switchgear

maintenance, variable frequency drive (VFD) inspections and roof maintenance.

Upcoming projects include fan wall retrofits, new pump skids and high-efficiency motor replacements. Rountree says, "Looking down the road, we always have a list of potential projects and are grateful for the support we receive from the vendors and contractors within the Chief Engineers Association of Chicagoland.

"The FBI facility was designed with expansion and redundancy in mind," he continues. "In a utility outage, critical systems can continue running on emergency power and the tenant agency can continue their critical operations without skipping a beat. Our team takes tremendous pride in delivering a Class A experience to our tenant agency every day at FBI Chicago Regional Offices." ■■

Marcy Marro is an experienced communications professional and writer specializing in the architecture and construction industries.



Twin emergency generators at the FBI Chicago Regional Office offer redundancy and continuity for its critical infrastructure in case of power disruption.



Performing a 150-horsepower motor replacement on a vane axial fan system. Planned projects include a fan wall retrofit.



Engineer Cory Lane demonstrating arc flash gear.



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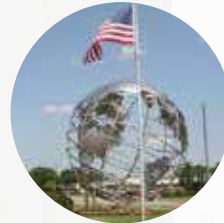
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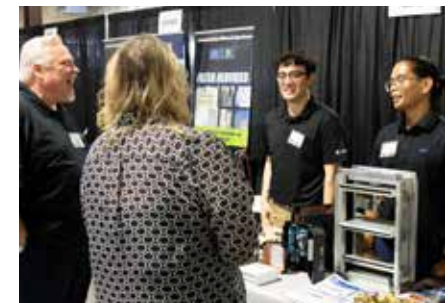
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Our annual White Sox Outing will take place Friday, June 26, on the Fan Deck at Rate Field, 333 W. 35th St., as we cheer on our Chicago White Sox against the Kansas City Royals. Marshmello will perform a set immediately following the game. Sponsorship opportunities are still available, so if you're interested in elevating your company's profile at this or at any other Chief Engineers meeting, please don't hesitate to reach out to events@chiefengineer.org. 



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Safeguarding Peaker Plants Against Lightning-Related Disruptions

By Jeff Elliott

Peaking facilities run only when supplemental capacity is needed and are designed for rapid startup, which often means long periods offline.

According to the latest federal data, the United States currently has just over one thousand peaking power plants in active service. Also known as peaker plants, these electric power generation facilities are designed to operate only during periods of high electricity demand. Their function is to supply additional grid support, activating when baseline utility power generators such as nuclear, coal, hydroelectric or large combined cycle plants cannot meet short-term spikes in load.

Although simpler in infrastructure and more compact than traditional power generation facilities, peaker plants are among the most vulnerable to operational disruptions caused by direct lightning strikes and their secondary effects.

Peaker plants are particularly susceptible to lightning effects for several reasons. They often include prominent structures such as exhaust stacks, transmission towers and open-air substations, all of which act as likely lightning strike collection points. Within the facility, large amounts of electrically conductive equipment are directly tied into the grid. Generating units, power transformers, switchgear lineups, control platforms and communications networks operate under high electrical stress, and are susceptible to transient overvoltage.

Even in areas with infrequent thunderstorms, severe lightning events can still occur, leading to catastrophic damage, injury, downtime, fines and negative impact to corporate reputation. When this occurs, the financial consequences can be devastating. A single strike can ignite fires, destroy valuable assets, and lead to costly downtime and environmental damage.

The secondary effects of lightning are also significant. Ground potential rise and electromagnetic energy coupling into control and instrumentation cabling can disrupt plant functions or damage sensitive hardware where grounding, bonding, surge protection and shielding are not in place.

The operating profile of a peaking facility adds another layer of exposure. These units run only when supplemental capacity is needed. They're designed for rapid startup, which often means long periods offline. Insulation systems, grounding networks and related protective features must therefore remain dependable despite long periods of inactivity and cold equipment conditions.

Lightning-induced surges can introduce hidden degradation that may not appear during routine maintenance and

inspections, but that later interferes with startup when the unit is urgently required for peak demand or grid support. The impact is considerable because these plants are called upon during periods of system grid stress.

For these reasons, peaker plants typically incorporate comprehensive lightning protection measures, including air terminals, which are designed to attract lightning and will only protect structures. Low-impedance grounding grids and transient voltage surge protection devices are also included in the lightning protection measures. Lightning avoidance technologies may also be utilized, such as Charge Transfer technologies. A Charge Transfer System not only protects structures but allows reliable operation of the control and monitoring automation through the storm.

“Rather than offering a one-size-fits-all solution, lightning protection and mitigation recommendations should be tailored to a facility’s unique vulnerabilities, whether that involves direct strike avoidance, secondary damage caused by a nearby strike, or grounding improvements,” says Peter Carpenter, Director of Applied Engineering at Lightning Eliminators & Consultants, Inc. (LEC), a pioneer in the field of lightning protection since 1971.

LEC’s solutions protect critical operations and structures for some of the world’s most recognized companies, including Tennessee Valley Authority (TVA) nuclear facilities, Exelon, Constellation Energy, Duke Energy, and Consumers Energy, Federal Express, UPS, Marathon Petroleum, Chevron, ExxonMobil and thousands of others.

Prevention Is the Best Defense

According to Carpenter, the most effective defense is to prevent a lightning strike from occurring.

“This is a far superior solution than a lightning rod-based system that attracts lightning to the protected site and then attempts to manage the strike,” explains Carpenter.

Lightning occurs when the difference in potential between storm clouds and the earth reaches a critical level, triggering an electrical discharge. For lightning to strike, it requires a connection between a downward leader from the cloud and an upward streamer from the ground.

The Dissipation Array System (DAS®) from LEC is designed to prevent direct lightning strikes within its designated protection area by lowering the electric field to levels below those required for lightning to form.

“DAS prevents these connections by using point discharge technology, which neutralizes the charge differential before a strike can occur. Through a system of well-grounded points, DAS facilitates the exchange of ions between the air and the ground, disrupting the conditions necessary for a lightning strike,” says Carpenter.

DAS can be integrated with a wide range of structures, including buildings, towers, tanks and stacks. Since its inception, over 4,500 DAS installations have been deployed worldwide, accumulating more than 100,000 system-years of effective performance. Testimonials from industry leaders confirm its effectiveness, with companies reporting significant reductions in downtime, maintenance costs and improved reliability.



Comprehensive lightning protection measures help keep peaker plants in a constant state of readiness.



A thorough site assessment like one from Lightning Eliminators helps facilities identify vulnerabilities and implement customized mitigation strategies.

LEC even offers a “No-Strike” warranty for all supervised installations, ensuring complete protection when the system is properly maintained and inspected.

The effectiveness of DAS is enhanced when combined with a comprehensive lightning protection system that includes a low-impedance grounding system, transient voltage surge suppression and modular strike prevention devices. Together, these components ensure optimal protection against both direct strikes and secondary electrical surges.

Lightning Risk Assessments


Due to the wide range of available technologies, mounting an effective defense against lightning-related threats typically requires a tailored strategy that integrates multiple solutions, each having its own specific purpose for minimizing damage or avoiding it altogether. The optimal combination depends on the specific site conditions and the nature of the operation.

Carpenter says the appropriate combination of solutions can only be determined through a comprehensive evaluation of each facility’s current protection measures, grounding systems, and overall risk exposure.

“Understanding a peaker plant’s past issues, vulnerabilities and protection goals helps determine whether the solution should focus on grounding enhancements, surge protection, direct strike avoidance, secondary damage from a nearby strike, or a combination of all three,” says Carpenter.

By conducting a thorough site assessment, LEC helps facilities to identify vulnerabilities and to implement customized mitigation strategies, whether that means improving grounding, adding targeted surge protection, or implementing direct strike mitigation solutions.

This proactive step not only safeguards critical infrastructure and personnel, but also helps to prevent costly disruptions, and reinforces a facility’s long-term resilience against lightning-related threats.

For more information, call (303) 447-2828 or complete the Free Lightning Risk Assessment for Critical Operations at www.lightningprotection.com. 

Jeff Elliott is a Torrance, Calif.-based technical writer. He has researched and written about industrial technologies and issues for the past 20 years.



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Calling in the Experts: Mold Solutions

By Karl J. Paloucek

Mold Solutions personnel observes all proper safety protocols in its site cleanups.

All it takes is a bit of moisture. A bit of trapped, humid air. A slow leak at the basement level or in the roof. Add a bit of time, and you have a perfect invitation to one of the built environment's worst enemies — mold. It's one of the most insidious problems to deal with for property owners and tenants, and it's one that you can't afford to delay. It's also not something most people are qualified to deal with on their own, because it's not just the mold that needs to be mitigated, but the conditions that created it in the first place. This is when qualified experts are needed, who know the terrain and how to deal with it safely and efficiently, to isolate it and to prevent it from spreading.

We recently sat down with Bob Ayres and Michael Lemmons, President and Owner, respectively, of Mold Solutions in Frankfort, Ill., to discuss the problem of mold in commercial properties and how they go about dealing with it on behalf of their clients who find themselves in the unenviable position of needing mold mitigation and prevention. Founded in 2007, Mold Solutions has made its mark by dealing exclusively with mold issues.

"We came across this opportunity and analyzed the market, and realized that at the time, virtually nobody was out there just doing mold work," Lemmons remembers of the time when he and his cousin, Michael Nastepniak, worked out their plan for establishing the business. "There were all sorts of restoration companies, but nobody made [mold] their focus. Nobody tried to become an expert just in that, so we decided to give it a go. That's what we've done, and that's what we still do, to this day."

It's been an advantageous decision for the team at Mold Solutions — they're not dividing their time dealing with insurance companies, water restoration, fire and smoke damage, or requiring personnel to drop scheduled work to respond to emergency situations. "We just stay focused on mold, and try to provide the best customer experience we can," he says. "I think that that focus on doing the right thing, finding the right source, getting the right solution, instead of just treating a problem, has been one of the main reasons that people keep coming back to work with us."

Ayres points to this focus as the core philosophy of their business, and something that he feels was there at its start. “One of the great things that Mike did when he started the company was to base the company on the IICRC certifications — that is, essentially, the gold standard,” he says. “The second thing — our staff has been with us a long time. I think both of our lead inspectors have been with us well over 10 years — probably 15-plus years. So they’ve got that wealth of experience where there’s not too much that could happen that they haven’t seen out there.”

And Oh, What They’ve Seen

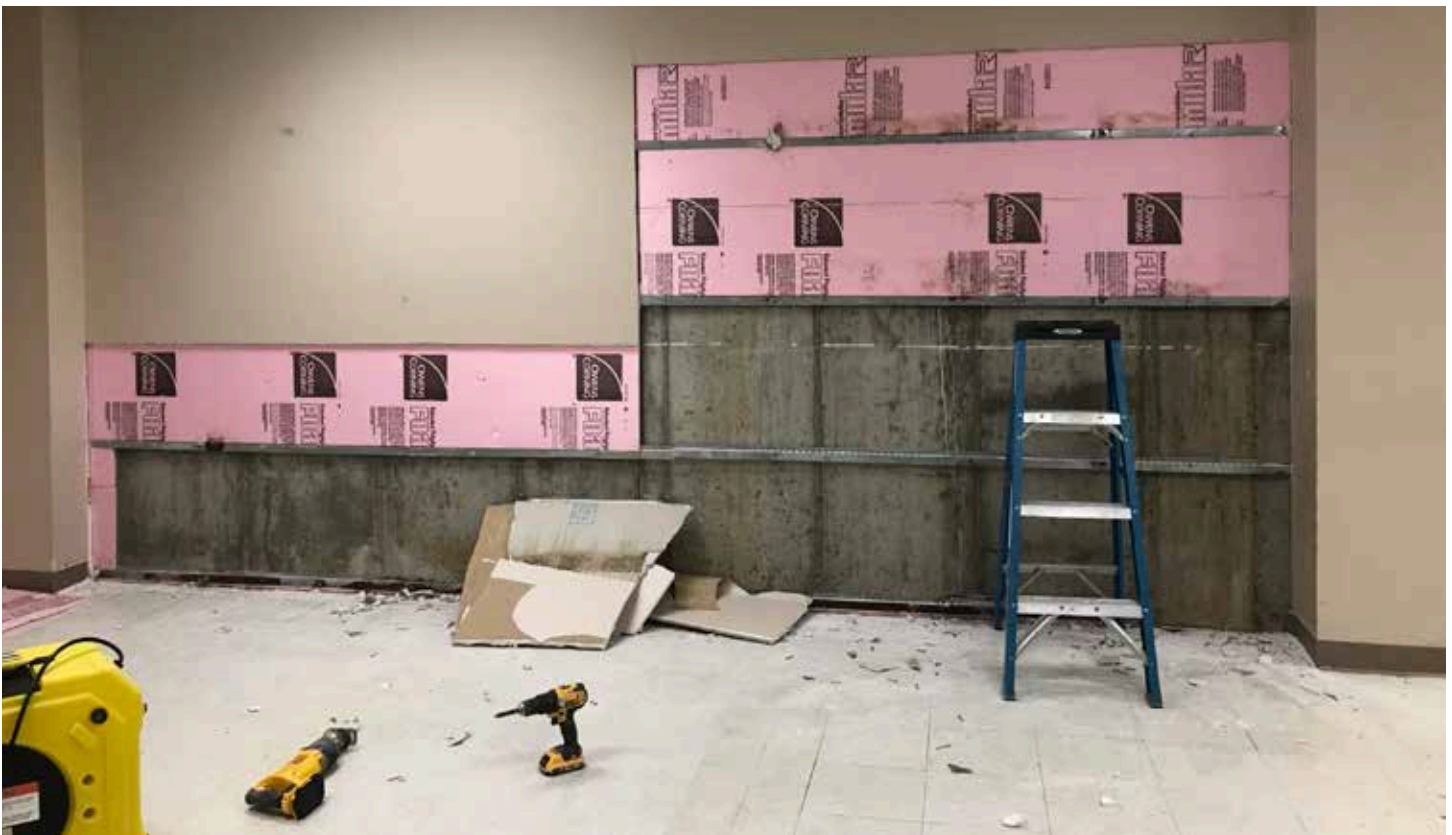
Dealing with mold can be a nasty business, and Lemmons remembers that it wasn’t too long after they had opened their doors that they had a particularly memorable inspection that turned into one of the biggest jobs they ever tackled. It started with a call from a church. “They called us in and we went in and they were like, ‘Is this mold?’” he remembers. “There was stuff growing, literally, on the pews, the altar — the main part of the church — they had just had services on Sunday. We started going back and it was even a little bit worse. They had a little kitchen area, and then there was a door, and we’re like, ‘What’s through the door?’ and they say, ‘Oh, we never go down there, that’s the basement area, a bunch of old storage.’ We go down, and we could barely get down the steps. There was mold hanging — you know, like you see in caves in Kentucky? Stalactites hanging down like that! We were like, ‘You can’t let anybody in this place right now. This is all mold. Even in the pews.’ We did an air test — it was off the charts, which we knew it would be, but they needed the documentation and

we needed the documentation before we did the cleanup, but that was crazy. That was a long cleanup. That was our first, very, very big, all-inclusive job. It was also the most mold in an environment I’ve ever seen to this date.”

While obviously astounded at the scope of the damage in this particular case, there’s an equally detectable sense of pride as Lemmons and Ayres discuss these sorts of jobs. It’s an incredible accomplishment to rescue an environment from such a state and to render it habitable again. They do it well, and they have the stories to back it up.

Ayres cites a location they were asked to inspect not terribly long ago — a distribution center that was in the process of being sold, that hadn’t been used during the summer. Fluctuating temperatures and humidity had allowed mold spores within the structure to flourish over its months of disuse. “Humidity levels were rising, and when [the prospective buyers] were coming to do a walk-through in there, one of the people said that they felt bad,” he recalls. “They started to look up on the 40-foot concrete walls and went, ‘Well, some of that might be dirt, and some of that something else.’”

“We immediately got our lead inspector up there to take a look at things, to walk through, to pull together the plan on the project,” he continues. “This was a 500,000-sq.-ft. facility. From there, once they accepted the proposal, it then became, ‘Well, we need to have this done yesterday.’ Because, of course, they wanted to close the deal and have things move forward. The project was up in Kenosha, Wisconsin, so to have the right people circulating back and forth to get the project



Behind the drywall surface, trapped moisture can encourage the growth of mold, as seen here.



Proper inspection of facilities early on can avoid painful and needless downtime for more serious mitigation later.

rolling, get it done in time, and have it cleared — from start to finish, we ended up having that project cleared within three weeks so they were able to close their sale and move forward.”

The Mold Solutions Process

Of course, the cleanup and mitigation was only part of the strategy — the new owners would have to ensure that the HVAC system runs properly, to avoid a recurrence. This is an essential part of the process that Mold Solutions employs, that actually starts before they even know anything about the problem at all — with potential customers detecting something amiss in their properties. It’s not always something that immediately can be seen. But once a problem is detected and the call is made, Mold Solutions is on the case.

“In an inspection, a lot of that work is going to be visual,” Ayres says. “It’s going to be conversations with the chiefs, with the people that are operating in that area, to almost pull together the ‘health history’ of the building — what’s been going on? When did it start? What else have they seen? The who, what, why, where — that all comes together. And then, in addition to that, there are moisture tools. There are humidity reading devices that we’re using.

“We do run into situations where a problem is suspected, where people would go into a room or a workspace, and they’re feeling affected, but visually, when you look around, you don’t see things,” he continues. “Then we can do an air quality test.

We send it out to a third-party, accredited lab to do all the testing, and they’ll be able to tell us how that air sample looks versus the control sample that we took outside the building. And if we’re seeing elevations there, then we can determine our next steps.”

Once they have a full picture of what’s happening, the plan unfolds as necessary — and it doesn’t always involve extreme solutions. “A HEPA air scrubber could be coming in, and help to exchange the air,” Ayres says, for example. “It could be that an overall cleaning/sanitization of that area would help to relieve the issues. That inspection part becomes key, because that’s gathering all that information to build the plan to take forward, and it’s not always approaching things with a shotgun. We’re now coming there with that focused step to get to it, where it’s going to be minimizing the cost and the disruption for the clients to move things forward.”

Containment is key in Mold Solutions’ process — primarily systematic containment of the area of contamination to prevent the further spread of spores throughout the environment. “Think about when you throw baby powder in the air, and that just floats all over the place,” Ayres suggests. “The work that we’re doing to properly remediate mold is doing that to the spores. You visually can’t see that, but we’re going to have that area contained so that everything is within that area, so we can take care of what we need to — we can clean that up and nothing else is going to get contaminated. Sometimes it’s as simple



At a battery plant in Kansas City, a barrier encloses the scissor lift needed to treat the mold-contaminated surface high up on the facility’s wall.



A containment area in a newly built environment.

as building the right enclosure in that area, for that period of time that we're working in there. Sometimes we're adding air scrubbers in there that are creating negative air pressure to make sure all the air is staying inside and then outside an exposed window, and not flowing out of the enclosure. It's different steps like that to protect the facility we're working in."

Of course, this is only part of the strategy of containment. There's also the factor that the rest of the building may still be fully functional throughout the cleanup, and they have to work around both the site of the contamination as well as the tenants and their daily operations. Chief engineers know all about this tricky balancing act, but it can be especially ticklish when the general environment is at risk.

"We've done some work inside some [beverage] stores where they had some humidity buildup, especially because they have refrigeration and cigar rooms," Lemmons offers. "We had to try to work early and late, around their store hours. It's always a combination. But we can and have worked weekends, and worked nights, and worked early mornings, and whoever our customer is, tried to work around their schedule in a way that made it easy on them."

Sometimes the job dictates a necessarily creative solution. In one instance, Mold Solutions had been called to the site of a battery plant that was being built in the Kansas City, Mo., area, to deal with a mold incursion on the walls of its logistics facility. "We had to go in and effectively build a containment wall,

using 2" x 4"s, literally, to then put plastic up to sort of create that environment," Lemmons says. These weren't your average walls — they were "scissor-lift high," according to Lemmons. "Because they weren't actually working and it wasn't a finished building, we weren't needed to or fully able to set up actual negative air pressure, but we had to contain the mold spores as much as possible, as they were there and as we were doing our work, which is what we did by building a containment cell."

Whatever the situation, Mold Solutions has probably been there before and is ready to handle it with the ease and wisdom of prior experience. At the time of this writing, they were as busy as ever, handling the usual influx of spring residential concerns, in addition to their continuing slate of commercial work — and getting ready to talk to the Chief Engineers about the importance of proper inspections at April's Vendor Fair. If you didn't get the opportunity to interact with them that night, they encourage you to get in touch.

"The fun buzzword that we've had people tell us is that we've saved their sales — we've saved their processes; we've allowed them to continue operations instead of things shutting down for extended periods of time," Ayres says. "We're going to be able to get on projects right away." 📧 📞

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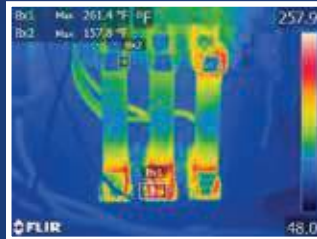
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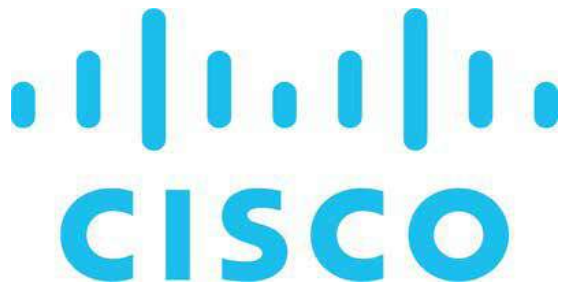
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Cisco Research: Industrial AI Moves Into Physical Operations, Readiness Gaps Determine Scale

Cisco recently announced the release of its latest annual industrial research report, the State of Industrial AI Report, examining how critical infrastructure like factories, utilities and transportation systems are accelerating their direct deployments of AI. The report provides a data driven view into how industrial organizations are adopting AI, the challenges they face as AI moves into live operations, and the opportunities created as AI becomes embedded in physical systems, infrastructure and workflows.

The double-blind global study surveyed more than 1,000 operational technology (OT) decision makers across 19 countries and 21 industrial sectors. The findings show that AI is now delivering measurable operational benefits in use cases such as process automation, automated quality inspection, predictive maintenance, logistics and energy forecasting. However, many organizations are increasingly constrained by readiness gaps in networking infrastructure, cybersecurity, and IT/OT operating models as AI shifts into real time, production grade use in physical environments.

“Industrial AI is moving from experimentation into production, where AI systems sense, reason and act in the real world,” said Vikas Butaney, SVP/GM of Secure Routing and Industrial IoT at Cisco. “At this stage, success is no longer determined by models alone, but by whether networks, security and teams are ready to support AI at the edge, in motion, and at scale. The research shows that organizations confident in scaling AI are those treating infrastructure, cybersecurity, and IT/OT collaboration as foundational, not optional.”

Key Takeaways From the State of Industrial AI Report

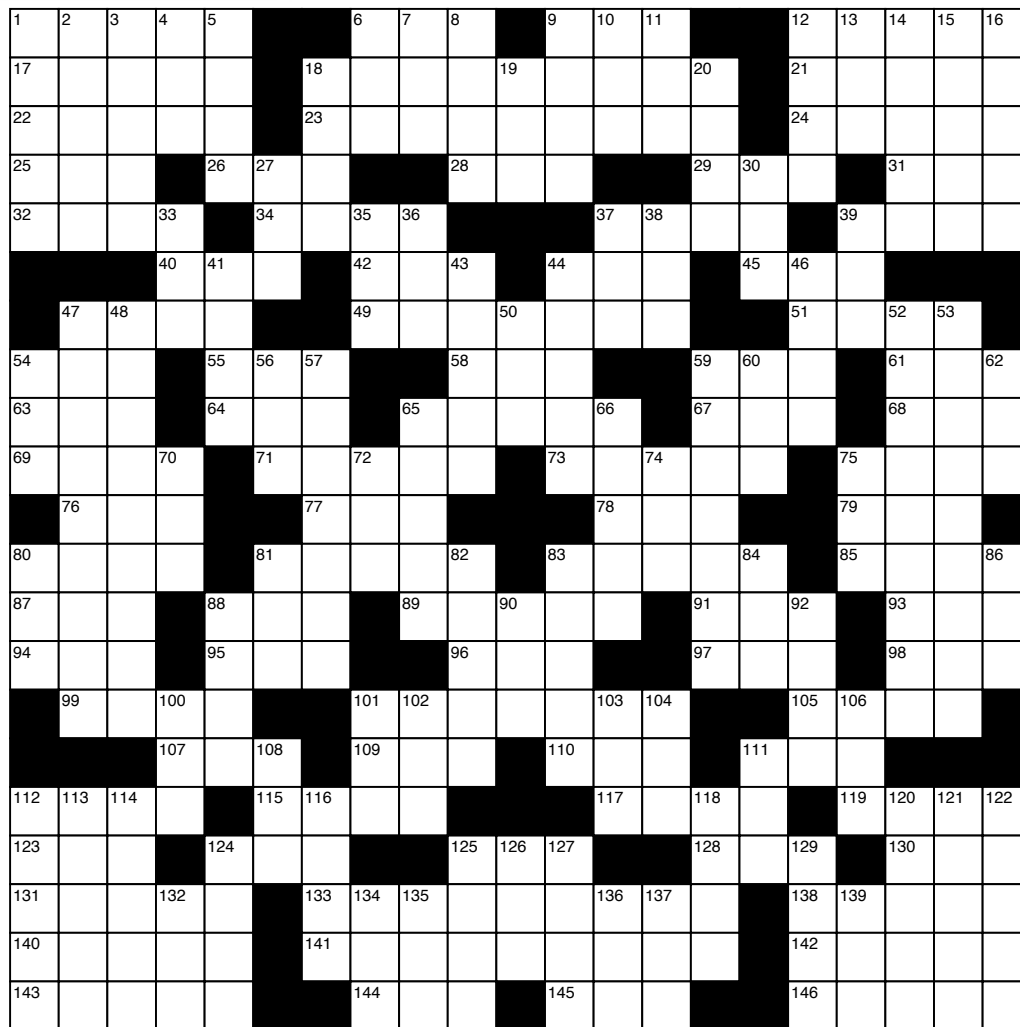
The survey shows industrial AI has moved from a future consideration to active deployment, with 61 percent of organizations now using AI in live industrial operations where performance, reliability and security have direct physical consequences, and 20 percent reporting scaled, mature deployments. Across manufacturing, transportation and utilities, AI is powering machine vision, robotics, mobility and safety critical operations. Most organizations plan to increase AI spending (83 percent), and nearly nine in 10 expect meaningful

outcomes within the next two years (87 percent). Yet as adoption accelerates, many are struggling to sustain and expand deployments, with readiness across network infrastructure, security and skills increasingly determining whether AI can scale consistently across core physical environments.

- Infrastructure readiness is emerging as a primary determinant of scale. As AI becomes embedded in machines, sensors, vision systems and autonomous operations, organizations face rising demands for reliable connectivity, wireless mobility, predictable latency, edge compute and power, making network readiness a gating factor for physical AI deployments.
 - 97 percent expect AI workloads to impact their industrial network requirements
 - 51 percent of organizations expect AI workloads to increase connectivity and reliability requirements in their industrial networks
 - 96 percent say wireless networking is essential to enabling AI
- Cybersecurity is shaping both the pace and confidence of AI adoption. As AI expands connectivity and data flows across industrial environments, security remains the top barrier to scale. At the same time, organizations increasingly view AI as part of the solution, with a majority expecting AI to strengthen monitoring, detection and operational resilience.
 - 98 percent say cybersecurity is foundational for AI-ready infrastructure
 - 40 percent cite cybersecurity as the biggest obstacle to scaling AI
 - 85 percent expect AI to improve their cybersecurity posture
- IT/OT collaboration is proving critical to operationalizing AI at scale. Organizations with closer collaboration between IT and operational teams report greater confidence in expanding AI, more stable networks supporting physical operations, and a stronger emphasis on cybersecurity as a baseline requirement, underscoring the need to build the skills required for scalable AI adoption.
 - 57 percent report some level of IT/OT collaboration
 - 43 percent report limited or no collaboration
 - 47 percent of organizations with limited IT/OT collaboration cite network instability as a top operational challenge to scale AI

You can download the State of Industrial AI Report at tinyurl.com/y48f34vv 





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ACROSS

- 1 Loafed
- 6 Unidentified flying object
- 9 Travel term
- 12 Caffeine pill brand
- 17 Steam room
- 18 Hiker's bags
- 21 Excuse
- 22 Pointed at
- 23 Eyeglasses bridge
- 24 A small number
- 25 Poisonous snake
- 26 Grow older
- 28 Container
- 29 BB association
- 31 Escudo
- 32 Saclike structures filled with fluid or diseased matter
- 34 Young Women's Christian Association
- 37 Car
- 39 Victim
- 40 Typing rate
- 42 Query
- 44 Morse code "E"
- 45 Often poetically
- 47 Footwear
- 49 Smallest phonetic unit
- 51 Food
- 54 Tell a tall tale
- 55 Ending
- 58 College football conference (abbr.)

- 59 ___ feeling
- 61 Sports official
- 63 Airport abbr.
- 64 MGM's Lion
- 65 Muslim's God
- 67 Compass point
- 68 Scarf
- 69 Lemons
- 71 Oklahoma city
- 73 Truths
- 75 Efficiently
- 76 Sign language
- 77 Swindle
- 78 Delivery service
- 79 Top
- 80 Lawyer (abbr.)
- 81 Small bird noise
- 83 Feather
- 85 Fresh
- 87 Rio de Janeiro
- 88 Period
- 89 Kinds of stars
- 91 Precedes an alias
- 93 Sea eagle
- 94 After sun.
- 95 One of these
- 96 Legume
- 97 Eastern state
- 98 Stitch
- 99 Salamander
- 101 Delude
- 105 Posttraumatic stress disorder
- 107 Pocket
- 109 Snacked

- 110 Time period
- 111 Also
- 112 Northwest by west
- 115 The alphabet
- 117 Formal "your"
- 119 Press
- 123 Lode yield
- 124 Annex
- 125 Electric spark
- 128 North by east
- 130 Certified public accountant
- 131 Fish tank dweller
- 133 Travel on a circuit
- 138 Filled
- 140 Painter Richard
- 141 Portable art case
- 142 Call up
- 143 Hinder
- 144 Pressure unit
- 145 High-school club
- 146 Several feet

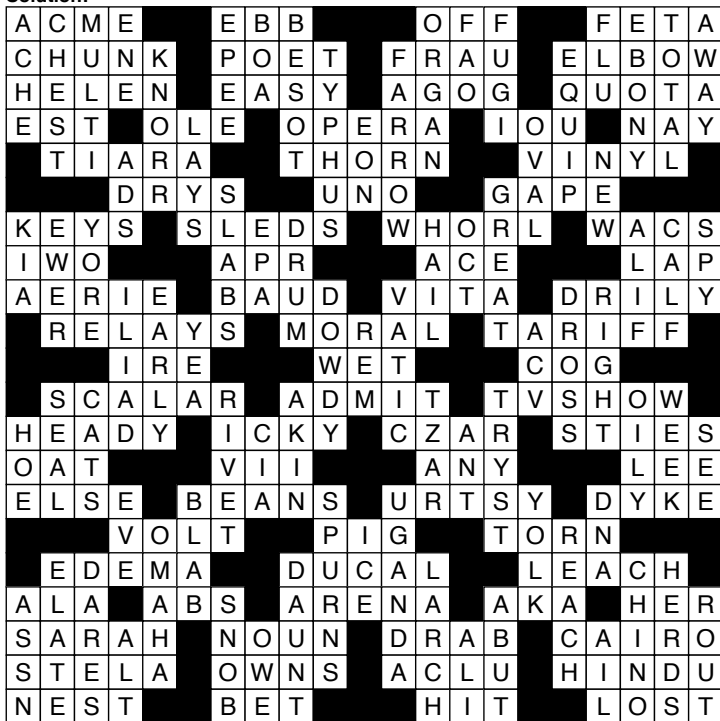
DOWN

- 1 Jacob's father
- 2 Yellow flower
- 3 Bumps
- 4 East northeast
- 5 Nineteenth century art philosophy
- 6 Card game
- 7 Foreign Agricultural Service
- 8 Organization of Petroleum Exporting Countries

- 9 Proud
- 10 Sorbet
- 11 American Kennel Club (abbr.)
- 12 Rocket builders
- 13 Bullfight cheer
- 14 Swimmer
- 15 Heavy-set
- 16 Like zinc
- 18 Had known
- 19 Resort hotel
- 20 Mailed
- 27 Workout place
- 30 Hiss
- 33 Duce
- 35 Hat
- 36 Fire remains
- 37 Place
- 38 Shoshonean
- 39 School group
- 41 Take the rind off
- 43 Kangaroo bear
- 44 Coffee shop order
- 46 Extravagant party
- 47 State
- 48 Memorial stone
- 50 Football assoc.
- 52 Obesity
- 53 Burned with little smoke
- 54 Headed
- 56 Fisherman's tool
- 57 Valiant
- 59 Angers (2 wds.)
- 60 Ship initials
- 62 Earnings
- 65 Birch-like tree
- 66 Draws
- 70 Cunning
- 72 Caustic substance
- 74 Central processing unit
- 75 Wing
- 80 Fortify
- 81 Swindle
- 82 Police
- 83 Receiver
- 84 Stretch to make do
- 86 Compass point
- 88 Input
- 90 Volume (abbr.)
- 92 Dog food brand
- 100 Compass point
- 101 McDonald's "Big ___"
- 102 That (possessive)
- 103 Music
- 104 Morse code "T"
- 106 Turkey
- 108 California (abbr.)
- 111 Vat
- 112 Student's class records
- 113 Take away
- 114 Miss Boop
- 116 Radar target
- 118 Upon
- 120 Mummer
- 121 Afford
- 122 Hell
- 124 Cinch
- 125 Negative (prefix)
- 126 Arbitrator
- 127 Harvest
- 129 Spot
- 132 Rapid eye movement
- 134 Blouse
- 135 Internal Revenue Service
- 136 Brew
- 137 Cut
- 139 Expression of surprise

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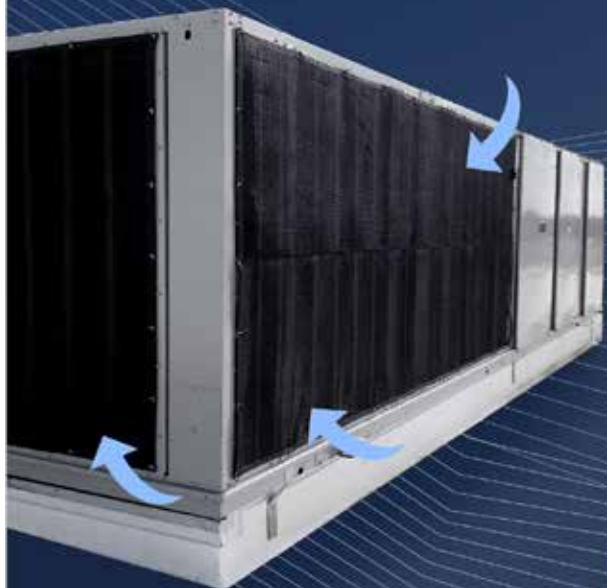


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