Reprinted from

POWER SYSTEMS TECHNOLOGY

Issue 44
May 2025

The Heathrow Transformer Explosion: Mitigating Future Risks

How new fleet monitoring solutions can help get in front of potential transformer failures.

By Dave Meyers, H2scan Corporation

On March 20, 2025, at 23:23 GMT, a catastrophic fire erupted at the North Hyde electrical substation in Hayes, north of Heathrow Airport. The high-voltage transformer explosion severed power to Europe's busiest airport and over 63,000 homes, disrupted more than 1,350 flights, and caused economic losses estimated at £60-120 million (~$70-150 million US) in just one day. The airport was closed for 18 hours, with approximately 150 people evacuated from properties surrounding the substation.

Could new cost-effective monitoring systems prevent this disaster?

About 60% of transformer failures are caused by internal faults that can develop over periods of days to months. These internal faults can be caused by external power events, overheating from excessive power loads or electrical arcing due to system aging, manufacturing defects, moisture ingress, etc. When these issues occur the transformer oil used for insulation and cooling breaks down, generating gases that collectively signal the presence and severity of internal issues. Lack of awareness to these early warning indicators (and corrective action) can lead to catastrophic failures. Unfortunately, the cost of traditional continuous monitor

systems to measure these gases are expensive and thus only large, expensive, highly critical transformers incorporate continuous monitoring – leaving most transformer unmonitored or receiving periodic manual measurement every 1 to 4 years, which can miss these faults. To address this gap the electrical power industry has begun to adopt cost effective single gas (hydrogen) transformer monitors that act as an early warning system for liquid-filled transformer operating health.

Hydrogen is the first gas released during a transformer abnormality, and monitoring hydrogen production in a transformer is a reliable indicator of evolving issues. It is produced 3-10x faster than other gases during thermal and electrical events. Its low oil solubility causes rapid migration through the insulating fluids, making it the ideal early warning indicator. Many transformer operators are now implementing single gas transformer monitors as part of their fleet management initiative to extend transformer operational lifespans through conditioned based maintenance.

The Heathrow incident, while still under investigation at this writing, highlights the risks of operating transformers at or beyond their limits to meet demand, the worldwide aging condition of transformers and the global shortage of new electrical transformers that currently stretches to two years.

While we don't know the precise cause of this transformer failure, we do know that many progressive power utilities and transformer operators have begun to rely upon single gas monitoring, a cost-effective technology that brings the visibility needed to avoid catastrophic failures of all transformers.

The Anatomy of a Disaster

Investigation into the root cause of the failure is underway, but likely causes reported by the UK press point to several potential contributing factors:

1. **Demand growth:** Substations often operate above capacity. North Hyde was reported at 106.2% of its rated load.

2. **Aging infrastructure:** The transformer was very old, and its insulation had likely deteriorated over time.

3. **Insulation breakdown:** A major insulation failure likely caused arcing, which ignited 6,600 (US) gallons of insulating oil.

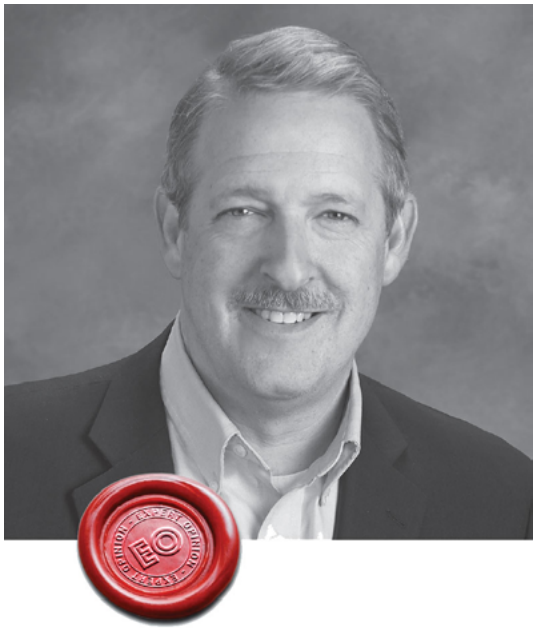
"Based on what we have read, the transformer may have experienced progressive deterioration before catastrophic failure, and in this case continuous monitoring would have detected the buildup of hydrogen and alerted operators to the impending failure", Dave Meyers, CEO of H2Scan shared.

"Many transformer operators are now implementing single gas transformer monitors as part of their fleet management initiative to extend transformer operational lifespans through conditioned based maintenance.

Conclusion: A Call to Action

The Heathrow transformer explosion stands as a stark reminder of the potential advantage of incorporating innovation in critical infrastructure monitoring. As utilities face increasing pressure to maintain aging infrastructure while supporting decarbonization initiatives, online condition monitoring represents not just a safety enhancement but an economic imperative.

> ***While we don't know the precise cause of this transformer failure, we do know that many progressive power utilities and transformer operators have begun to rely upon single gas monitoring, a cost-effective technology that brings the visibility needed to avoid catastrophic failures of all transformers.***



Author:

Dave Meyers
CEO and President
H2scan Corporation

Dave Meyers joined H2Scan in February 2022, to lead the business on its next stage of growth by leading the expansion of its product portfolio, sales team and operational infrastructure. He brings deep H2scan experience from five years on the board and previous collaboration during his time at Altran, a global engineering services firm. Meyers joined the board in 2017 after leading an investment as Altran's VP of Corporate Development for North America. He later served as General Manager of Altran's Innovative Product Development business, overseeing engineering services across energy, industrial, aerospace, and life sciences sectors. His team supported the development of H2scan's Gen 5 sensor and Automated Sensor Manufacturing (ASM) system to enhance efficiency and scale. Before Altran, Meyers held executive, technical leadership and business roles in startups and major firms across semiconductors, life sciences, defense, and aerospace, gaining strong expertise in MEMS and high-performance sensor technologies. He holds a B.S. in Mechanical Engineering from the University of Delaware, where he is a distinguished alumnus.