

September 21, 2023

Via Electronic Mail

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Re: Mitigating Risks from Smart Technology in School Buildings

Dear Treasurer Goldberg and Executive Director Pichetti:

The design and construction of new school buildings and renovations to existing buildings increasingly integrate technology in virtually all operational dimensions. These innovations – referred to as “smart,” connected or “Internet of Things” (IoT) devices and technologies – have the potential to reduce energy use, promote safety and security, and enhance learning environments. However, adopting new technologies carries operational and fiscal risks, as evidenced by problems with Minnechaug Regional High School’s (Minnechaug) web-based lighting system. Minnechaug is located in Wilbraham, Massachusetts, and is part of the Hampden-Wilbraham Regional School District (HWRSD). The Office of the Inspector General has identified measures to mitigate risks in procurement, design and construction involving high-tech systems, such as those encountered by Minnechaug. We recommend that the Massachusetts School Building Authority (MSBA) – and its partners in local school districts – consider these measures when they approve funding for new school construction and upgrade existing buildings to modern, state-of-the-art environments.

Minnechaug lighting system failure

The problems with Minnechaug’s lighting system gained national notoriety, due in no small part to the desire to introduce new technology as an energy conservation measure without controls in place to protect the district from the dangers of proprietary technology and its underlying software. Minnechaug was a participant in the MSBA’s “Model School” program. When the school was rebuilt in 2012, a network-based “digital addressable lighting interface”

(DALI) lighting system was installed. This system was the product of Fifth Light Technology (Fifth Light). The DALI system failed in August 2021, causing the school lights to remain on continuously until the system could be repaired in February 2023. Yes, for 18 months the school in essence could not turn off the lights in a facility that was rebuilt only 11 years prior.

The lighting system ran on a server that, by design, could be accessed remotely outside the school. The server was corrupted by malware and went into default mode in August 2021, which resulted in the lights at Minnechaug remaining on. The school did not have administrative access to the server to control the lights, access to backup software to restore the system or an override switch.

In addition, by 2021, Fifth Light's lighting controls system was too old for continuing support. The company had also been acquired by another company, Cooper Industries (Cooper). In order to turn off the lights, Minnechaug needed to upgrade the system by replacing the server, lighting control panel and other hardware. Due to supply chain issues, Reflex Lighting, a vendor for Cooper, could not complete the hardware repairs until October 2022. Reflex also could not complete necessary software upgrades until February 2023, which finally allowed Minnechaug to turn off the lights. Based upon information from the HWRSD superintendent's office, during the 18-month period that the lights were on, the school district spent up to \$150,000 in excess electricity costs and to repair the system.

Smart systems and associated risks

While school districts may seek to upgrade their systems for energy usage, climate control and other key areas of building operations, this episode must serve as a cautionary tale for current and future school building projects. Certainly, there are many benefits to implementing smart building technology in schools, including improvements in student learning, work conditions for teachers, safety, operations and energy management, but risks must be considered and mitigated. Schools may incorporate software or remote access in a variety of areas, including:

- **Heating, Ventilation and Air Conditioning:** HVAC upgrades have recently been a focus in some Massachusetts schools that have sought to become more efficient and environmentally friendly while improving air quality for students. Smart HVAC controls can save resources by adjusting temperatures in unoccupied parts of a building and reducing usage during times of peak demand.
- **Lighting:** Advanced lighting controls incorporate occupancy sensors, detect ambient light levels to reduce electric lights when daylight is sufficient, and utilize high-efficiency LED bulbs to reduce maintenance.
- **Security:** School building management system access controls can enhance security with features such as electronic door monitoring and door locks that can be accessed via mobile devices. Video management systems can also detect possible unwanted activity.

Although beneficial, there are some risks unique to smart systems over the lifespan of the technology. These include:

- Dependence on proprietary systems that can require a user to rely solely on a single vendor for support;
- Vulnerability to cyberattacks and corruption;¹
- Software defects, errors and deficiencies;
- Ensuring that the technology – software and hardware – has an owner within the school district to manage and maintain the systems, warranties and end-of-life planning;
- Irregular software updates and patch management;
- Security flaws, including lack of or improperly configured firewalls or access controls and lack of network security monitoring; and
- Rapid changes in technology, which can render a system obsolete.²

Mitigation of risk in procurement and adoption of smart systems

The MSBA collaborates with municipalities to create affordable, sustainable and energy-efficient schools across Massachusetts. Consistent with this mission, the MSBA should help school districts mitigate risks arising from smart building technology by considering the following recommendations:

1. Ensure that systems are designed and installed by qualified, reputable vendors. Require prospective vendors to provide proof of prior work and references to customers.
2. Utilize open-source, rather than proprietary software, which will allow easier adaptation to future changes and give more choices for repairs and upgrades. Consider proprietary software only with a clear, written administrative, maintenance and end-of-life plan, along with administrative controls retained by the school district.
3. Establish incident response plans with the vendor for issues such as software corruption or failure. This may include manual override capabilities, administrative access to the server to update security and virus protection, and personnel training on how to control the system without outside assistance from the vendor.
4. Determine what ongoing service needs may be necessary for the technology and require service agreements for technical support and upgrades of hardware and software.

¹ The U.S. Department of Energy has published a helpful article about cybersecurity risks in smart lighting systems. U.S. Dep't of Energy, Office of Energy Efficiency & Renewable Energy, *Cyber Security for Lighting Systems* (May 2018), available at <https://www.energy.gov/femp/articles/cyber-security-lighting-systems>.

² Marsh & McLennan Companies, *Smart and intelligent buildings: Cybersecurity considerations*, available at <https://www.marsh.com/uk/services/risk-consulting/insights/smart-intelligent-buildings-cyber-security-considerations.html>.

5. Require warranty information and determine if it covers only certain aspects of a system, such as hardware or software, then require enhanced warranty protections that match the complexity of the system and criticality of the function provided, as a condition of specifying such systems in the building design and construction.

Increasingly, schools will incorporate smart technology into critical building functions in new construction and upgrades of legacy systems. By ensuring that adequate consideration is given to risks that smart systems pose, the MSBA is uniquely qualified to help school districts maximize the benefits of innovation while also preventing the waste of public funds or system failures that can jeopardize school operations.

Sincerely,



Jeffrey S. Shapiro
Inspector General

cc (via email):

James MacDonald, First Deputy Treasurer, Office of the Treasurer and Receiver General
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