A high school in Alaska, a National Football League stadium, a Baltimore high-rise hotel and a Dallas airport terminal are among thousands of structures world-wide covered in combustible-core panels similar to those that burned in June's deadly London fire, The Wall Street Journal found.

Safety improvements to building interiors over the past 40 years have helped cut the number of structure fires and related deaths in the U.S. by roughly half, a remarkable victory over one of civilization's oldest threats.

Yet fire-safety experts say the more recent use of combustible-core panels to cover multistory buildings has created a hidden danger to legions of workers, students, hospital patients and hotel guests inside the structures. A loosening of the model U.S. building code could make matters worse.

“We had learned from the Great Fire of London in 1666 not to have flammable materials on the outside of buildings,” said Arnold Tarling, of the London-based real-estate firm Hindwoods Ltd. “Everything has gone backward.”
These exterior panels are typically thin sheets of aluminum that sandwich a rigid core often made of polyethylene, a plastic derived from petroleum or natural gas that can burn with great intensity. They were developed about 50 years ago and made their way to the U.S. in the early 1980s from Europe.

 Architects like the panels because they allow for more sweeping designs. Experts say they are worrisome in tall buildings because upper floors take longer to evacuate, especially ones beyond the reach of firetruck ladders.

Polyethylene-core panels made by U.S.-based Arconic Inc. are being investigated by U.K. officials for their role in London’s Grenfell Tower fire, which on June 14 spread from a kitchen to the building exterior and killed at least 80 people. Since then, at least 279 examples of panels similar to those used at the Grenfell Tower have flunked burn tests performed by the U.K. government.

The 24-floor Grenfell Tower lacked interior fire sprinklers and other safety features that left residents fewer minutes to escape. The building had beneath its exterior panels a layer of foam insulation that also burned and, along with a narrow air gap behind the panels, helped funnel the blaze to upper floors.

“It didn’t have to happen and it shouldn’t have happened,” said Niall Rowan, chief operations officer at the U.K.’s Association for Specialist Fire Protection, a trade group.

People flee fire by instinct, and building safety measures are designed to provide a head start by slowing a fire’s progress and providing safe exit. Smoke detectors, sprinklers, enclosed stairways, fire doors, fire-retardant mattresses and other product-safety laws either foil fires or add time for escape.

In Azerbaijan, a May 2015 fire in the city of Baku killed 15 people and injured 50 others trapped in a 16-story apartment building. Authorities suspect the fire was started by a cigarette butt thrown in a trash container that set the exterior panels ablaze. Six people, including the general director of the local company that made the building’s polyurethane-core panels, were convicted of safety violations and sentenced to prison for their role in the deaths.

Arconic said it expected builders using its panels to exercise caution. “Especially when it
comes to facades and roofs, the fire can spread very rapidly...as soon as the building is higher than the firefighters’ ladders, it has to be conceived with an incombustible material,” a company pamphlet said.

The standard for U.S. building codes reflected this view until five years ago.

The International Code Council, a Washington, D.C., nonprofit advisory group, has written building codes used in the U.S. since 2000. For more than a decade, the ICC codes required that metal-composite panels for high-rise exteriors pass a stringent fire test. Panels that failed, which included those with polyethylene cores, were limited to a height of 50 feet.

In 2009, at the request of a panel manufacturer, the ICC’s 14-member fire-safety committee unanimously recommended loosening the code to allow panels that failed the fire test to be used at any height. Some conditions applied, including interior sprinklers and at least 20 feet of clearance from other buildings. And the panels couldn’t cover more than half of a building’s exterior.

Some committee members now say they question their decision, which was later ratified by the ICC and added to the 2012 edition of the code.

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Committee member Douglas Evans, a fire-protection engineer and retired code-enforcement officer in Nevada, said there should have been more debate.

Another committee member, Tim Pate, the chief building official in Broomfield, Colo., also voiced doubts about his 2009 vote. Three other members declined to comment. The remaining committee members couldn’t be reached or didn’t respond to requests for comment.

Messrs. Evans and Hirschler said they expected the rules on combustible-core panels would be re-examined in spring, when the ICC begins hearings on the next round of revisions for the 2021 edition of the code.

“Anytime something big happens, we tend to look at things,” said Beth Tubbs, a senior staff engineer at the International Code Council. “The bigger the dreaded risk, the more that we react.”

Officials at the National Fire Protection Association, which helped devise the code’s burn-test standards for exterior walls, were surprised to learn this year that height limits on combustible-core panels had been lifted.

“We kept reading that saying, ‘Is that right?’ ” said Robert Solomon, of the Massachusetts-based NFPA. He and colleagues only learned of the change, he said, when they began studying the Grenfell Tower fire.

New York City, the skyscraper capital of America, doesn’t allow combustible-core panels on buildings above 50 feet. The city has yet to update its code from the ICC’s 2009 edition, and officials said it was too early to say whether the city might adopt the relaxed standard.

Architect Ben Lee, who has over his 40-year career designed a number of New York high-rises, said the city should keep the height limit.

“That product wasn’t intended for high-rise curtain-wall construction,” said Mr. Lee, president of the New Jersey chapter of the American Institute of Architects.

Atlantic City

Two years before the ICC committee reviewed height limits on combustible-core panels, firefighters in Atlantic City, N.J., saw firsthand how the panels can erupt into a wall of flames.

In September 2007, workers were near completion of the 43-story Borgata Water Club hotel when fire broke out near the third floor of a soaring curtain wall designed to mimic a sail. Flames roared up the exterior with such power that the exterior panels flew as far as 2,000 feet, said James Foley, who was the Atlantic City fire marshal at the time, now retired. No one was injured.

“I was stunned that a building built under modern building codes could have a fire that could race up a building that quickly,” Mr. Foley said in an interview. “Had it been occupied and had the wind been blowing inland, it could have been a totally different outcome.”
Local fire officials said they never determined what had caused the fire, but concluded the building’s combustible exterior panels helped fuel it.

At the time of the fire, New Jersey was using a version of the ICC code that restricted metal panels to 50 feet above ground unless the panels passed the code’s burn test.

Officials at the state agency that reviews casino-hotel plans said they couldn’t locate Borgata documents that showed why, or even if, the panels were allowed to a height many times the legal limit. Atlantic City officials didn’t respond to questions asking if the panels had been inspected before the fire.

The Borgata had used the Alucobond brand of panels made by Alcan Composites, later renamed 3A Composites. Company officials didn’t respond to requests for comment. The hotel’s owner in 2010 sued 18 contractors and later reached confidential settlements.

A Borgata spokeswoman said the hotel replaced the exterior panels in the curtain wall with different materials before it opened.

When the ICC’s fire-safety committee met in 2009, building-code consultant Rick Thornberry presented the amendment removing the height limit for panels that fail the fire test, ICC records show, on behalf of Alcan Composites.

Mr. Thornberry said during a 2009 committee hearing that the building code had long allowed combustible plastic window panes in high-rise buildings with interior sprinklers, records show. For consistency, he said, combustible exterior panels should be allowed as well.

The committee, drawn from government code-enforcement departments, testing labs and professional associations, unanimously agreed.

Looking back, the argument was weak, said Mr. Evans, a committee member. Plastic panes had been largely replaced by double-pane insulated glass, he said.

Mr. Thornberry, now retired, declined to comment.

Cost of safety
Several manufacturers sell fire-retardant panels that use mineral compounds mixed into the polyethylene core. These panels typically cost an additional 50 cents to $1 more a square foot in the U.S. compared with combustible-core ones, industry experts said.

The ICC code, where implemented, requires architects to provide local code-enforcement departments with descriptions of the panels they plan to use, including the core material and whether the panels passed the NFPA burn test, said Ms. Tubbs, the ICC engineer.

It isn’t clear whether local officials enforce that requirement, and there isn’t a tally of U.S. structures that use combustible-core panels. The ICC doesn’t catalog their use, Ms. Tubbs said, and she didn’t know of any government agency in the U.S. that does.

That leaves the panel-makers’ marketing materials as the only guide.
portions of South Anchorage High School, which opened in 2004, are clad in Reynobond PE panels, school district officials said. The district said the panels were safe and met local building codes.

In Baltimore, the 32-story Marriott Waterfront Hotel, which opened in 2001, was clad in 83,000 square feet of combustible-core panels, according to the website for Arconic, formerly part of aluminum producer Alcoa Inc.

The city confirmed this month that the hotel's exterior panels weren't fire-resistant. City officials said they learned of the panels' composition only recently, after the hotel's owner conducted tests in July.

When plans for the 750-room hotel were submitted in the late 1990s, a city spokeswoman said, the panels were identified “simply as metal.” She said it was up to the architect to ensure they met code. The architect has said he discarded his file on the hotel years ago, following normal protocol, and didn't recall details about the panels.

Michael Braverman, the city's housing commissioner, said the hotel complied with the 1990s-era code in force at the time of construction, as well as current codes. The building's owner, Harbor East Limited Partnership, said the hotel “maintains a robust set of fire and life safety systems.” A Marriott spokesman said, “We are working in conjunction with the ownership group who is taking the lead on this Baltimore property.”

The ICC said it didn’t know how frequently the 2012 amendment has been used in recently built skyscrapers. The measure gives architects more freedom to substitute combustible-core panels for fire-retardant panels, depending on other fire-safety features.

“It’s about how a building operates holistically,” said Vickie Lovell, president of InterCode Inc., a Florida-based consultant on building and fire codes. “To say that just because a building has those [combustible-core] panels it is inherently unsafe would grossly misrepresent the situation.”

She said the ICC's removal of the height limit for combustible-core panels reflected the widespread incorporation of sprinkler systems and other safety features that have lowered the fire risk in U.S. buildings.

Others said the reduction in U.S. structure fires over the years shouldn't be a reason to relax safety requirements.

“When nothing happens, people assume that we've got overkill in the code,” said John Valiulis, a fire-protection engineer in Oklahoma. “That's not the wrong code requirement. That's an example of a successful code requirement.”

Danger abroad
The Dubai skyline has been transformed over the past two decades by hundreds of new skyscrapers, many of them fanciful buildings covered in combustible-core panels. Since 2012, a half dozen high-rises using the panels caught fire, including the Torch tower, which burned twice in three years.

The panels became popular in the past decade, said A.M. Rao, the group director for Alubond U.S.A., a top Middle East supplier. “But the awareness about such cladding being conducive to the spreading of fire was low at that time—not just here, but all over the world.”

On Dec. 31, 2015, a crowd in Dubai gathered to watch a New Year's Eve fireworks display. Before the show began, a nearby 63-floor luxury hotel, the Address Downtown, sprouted flames that authorities later blamed on an electrical short-circuit.

Experts said the fire, which injured about a dozen people, appeared to spread on the building's exterior, which was sheathed largely in polyethylene-core panels made by Alubond U.S.A. Early last year, the company stopped making the type of panels used at the Address Downtown, Mr. Rao said, due to concerns about flammability.
A 2016 report by British consulting firm Probyn Miers looked at three fires in Dubai involving combustible-core panels. “Up to now the occupants have had time to escape, albeit with firefighter assistance in several instances,” the report said. “This should not be any cause for complacency. All of the major fires have had the potential for loss of life.”

Dubai has since amended its building code to require fire-resistant panels and began in September to work with owners to replace combustible panels.

In Melbourne, Australia, combustible-core panels caught fire and spread rapidly up the 23-story Lacrosse apartment building nearly three years ago. There were no serious injuries.

Investigators found that Chinese-made panels used in the structure didn't comply with building codes. An audit found more than half of the 170 apartments and buildings surveyed in central Melbourne had combustible-core panels. Phil Dwyer, president of the Builders Collective of Australia, an industry organization, said thousands more buildings nationwide likely used them.

Alucobond Architectural, the Australian distributor of the brand of panels made by 3A Composites, said its German-made panels were swapped for cheaper Chinese products in some instances, including at the Lacrosse.

“Generally, we would only find out some years after a building was complete when there was a quality issue,” said Bruce Rayment, chief executive of Halifax Vogel Group, which owns Alucobond Architectural, in an interview.

—Jason Douglas in London, Lisa Schwartz in New York and Aida Sultanova in Baku contributed to this article.