
TO: Director, National Institute for Occupational Safety and Health

FROM: Iowa FACE Case no.: 2011 IA 035 Report date: 10 October 2012

SUBJECT: Convenience store cook died from smoke inhalation

SUMMARY

A 53-year-old female convenience store cook was working in an unopened store preparing food for the upcoming morning when fire broke out near the store entrance. While working in the kitchen, the employee did not see the fire until smoke reached the kitchen. She called 911 from her cell phone to indicate that she couldn't get out of the building. Smoke and fire impeded exit through the front door and emergency exit door (the two designated means of egress), and the decedent was found by firefighters in the back store room near the northwest delivery door. No smoke detection system was present in the building.

RECOMMENDATIONS

1. Install and maintain smoke or smoke/heat detectors within the building to provide early warning of fires.
2. Review emergency evacuation plans with all employees to ensure workers know all escape routes in the event the main exit is blocked by fire.
3. Involve employees in routine testing of emergency exit door operation.
4. Incorporate emergency exit needs when designing store security, ensuring emergency exit doors are operable with single action whenever the store is occupied.
5. Mark emergency pathways with appropriate lighting.
6. Remove malfunctioning electrical equipment from service.

INTRODUCTION

In the summer of 2011, a worker died from smoke inhalation when an early-morning fire started in a convenience store. Iowa FACE investigators were alerted to this incident by news clippings and initiated preliminary investigations following closure of the OSHA inspection. Additional information was obtained from the State Fire Marshal Division, Iowa OSHA inspectors, and the State Medical Examiner's Office. No state OSHA citations were issued.

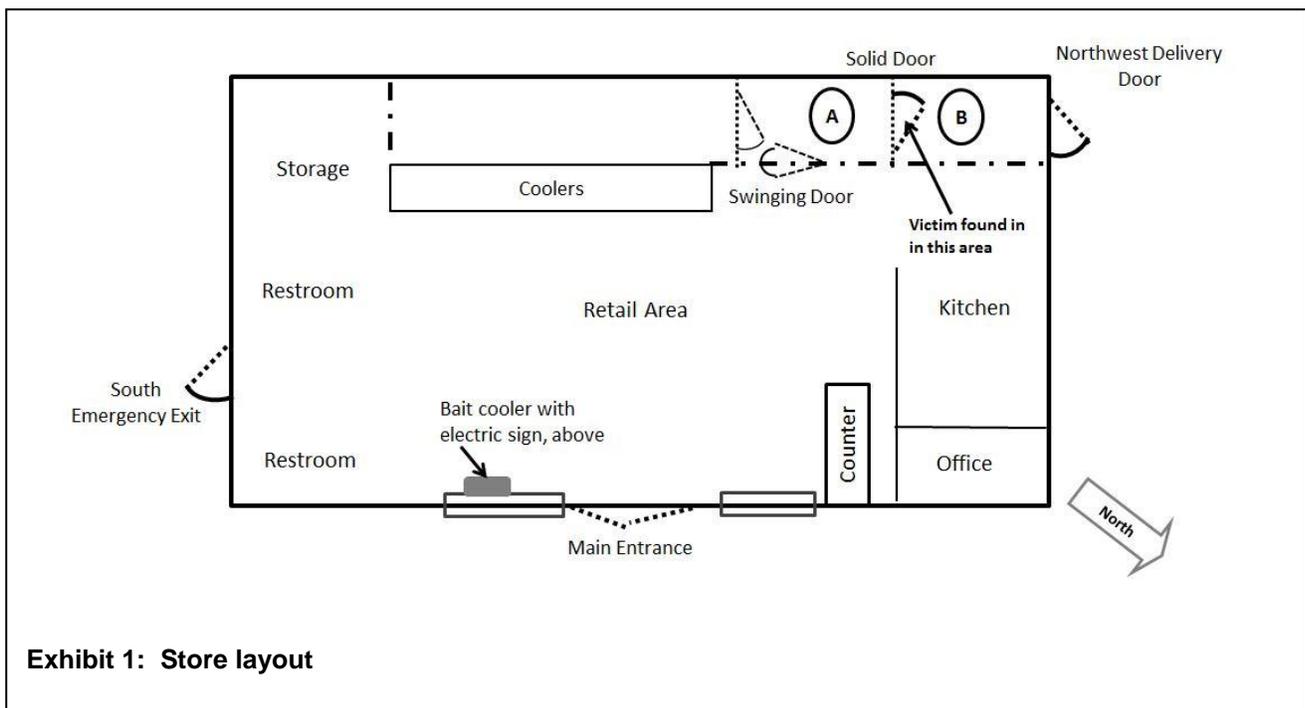
INVESTIGATION

A 53-year-old convenience store cook arrived to work at 2:52 am to a closed and locked building to begin her shift. The building was a 2740 ft² structure with wood framing and steel construction. (An approximate layout of the store is provided in Exhibit 1.) Upon arriving to the store, the employee unlocked the front door, entered the building, and then relocked the front door from the inside with her keys. Lights to the kitchen and office areas were turned on to begin her shift, but the counter and retail area lights were shut off to prevent customers from thinking the store was open. The employee went to the office area to deposit her purse and keys and proceeded to the kitchen area to prepare donuts. The store was closed to the public as the worker began preparing donuts for customers for the upcoming day.

As confirmed by store security cameras, the fire began at 3:45 am near the bait cooler and electrical advertising sign, approximately five feet to the south of the main entrance. The fire burned for five minutes before the worker realized a fire had started. When the employee realized the fire, she walked to the front office to get her keys and make a phone call prior to calling 911. The store security tapes indicate her confusion on what to do. She then went to the front of the store, near the fire source. The thick smoke prevented her from using her key to unlock the deadbolt in an attempt to exit the building through the main entry door, her typical way in and out of the store. At 3:52, the employee used her cell phone to call 911 and report the fire. She stated that she could not get out of the building. By this time, the front (main) entry door was blocked by fire and smoke, and exit access through the south hallway by the restrooms was in the path of the fire and smoke. The one remaining path out was through two storage rooms along the northern west end of the building to a delivery door that was not a designated exit.

02:52	Employee arrived at work
03:45	Fire began
03:50	Employee noticed fire, retrieved keys, and phoned her supervisor
03:52	Employee called 911
03:58-04:02	Firefighters and fire trucks arrived and commenced exterior and interior attack
04:04	Dispatcher lost communication with employee who was in rear storage room
04:14	Fire fighters located unresponsive employee in rear storage room near emergency exit

To the west of the kitchen area were the two storage rooms through which the worker would have to travel to escape through the northwest delivery door. The first room ("A" in Exhibit 1) contained a washer, dryer, hot water tank and extra soda from the store. To travel to the delivery door, one must pass through this room and through a heavy wooden door into a second storage area ("B" in Exhibit 1). This door was an outward-swinging push door (*i.e.*, swung toward the northwest exit) from room A to B, with a levered door handle, and hinges on the right of the door as exiting. This second room (B) contained a floor sink, buckets, electrical panel, the fire suppression system for the kitchen's grill, and boxes of soda for the fountain dispenser. Employees reported that the door between these two rooms was usually shut.



The employee remained on her cell phone with the 911 dispatcher, and when she was by the northwest delivery door, she indicated that it would not open. Exhibit 2 illustrates the type of panic bar installed on the door in question, although the door in this case did not contain the "Alarmed Emergency Exit" label on the panic bar itself. The installed panic bar had a keyed system to allow disabling the alarm system to facilitate moving product into the store during operating hours without activating an alarm. Once in storage room B, the decedent remained on the phone with the dispatcher until 4:04 am, when communications were lost.

The first local firefighters arrived on site six minutes after the 911 call. Four fire trucks were on site within 10 minutes of the call and began interior and exterior attacks to extinguish the fire. Search operations included forcible entry through the northwest emergency exit. Firefighters used pry bars and a K12 saw to cut the delivery door open because it had no exterior opening mechanism. Firefighters found the employee at approximately 4:14 am. She was in room B near the door jamb between rooms A and B, and close to the delivery door. At this time, she was unresponsive. Firefighters cleared materials from the storage room, throwing them out the door, to make way to move the employee outside and onto a gurney. Life-saving efforts were begun by on-site EMTs, and she was transported to the local hospital, where she was pronounced dead at 5:18 am.



Exhibit 2: Example of a panic bar ("crash bar") similar to the bar mounted on northwest delivery door

There was thermal damage to the main store area and office, and smoke damage to the south corridor, the men's and women's restrooms, kitchen, and northwest storage areas. The remote storage area (storage room B) had less smoke damage than other areas, probably because the interior wooden door remained closed for a majority of the fire event. The northwest delivery door to which the panic bar was attached was damaged by the fire responders, so investigators could not determine if the door did not open because the panic bar unlatching mechanism was broken, or because the decedent did not push the panic bar on the delivery door. There were no improper secondary locks (e.g., security bars or bolts) present on the delivery door or the south emergency exit door latches. The exterior surfaces of these doors had neither hand-pulls nor deadbolts, indicating that the only way the northwest delivery and south emergency exit doors could open was from the inside of the store.

The State Fire Marshal Division's investigation identified that the back side of the cooler and an electric advertising sign were extensively damaged by the fire, leaving uncertainty as to which of the two devices caused the fire. However, employee interviews indicated that the sign in question occasionally malfunctioned and did not work all the time.

CAUSE OF DEATH

The State Medical Examiner's autopsy report listed smoke and soot inhalation as the cause of death.

RECOMMENDATIONS AND DISCUSSION

Recommendation 1: *Install and maintain smoke or smoke/heat detectors within the building to provide early warning of fires.*

The layout of this store positioned kitchen workers with their backs to the rest of the store, limiting visibility to events in the rest of the building. The state fire code, referencing the International Fire Code (IFC) and International Building Code (IBC), does not require a fire protection system¹ in a Group M (*i.e.*, mercantile occupancy classification) building the size of this convenience store (IFC, 2009; IBC, 2009): it was rated for occupancy fewer than 100 persons. However, common smoke detectors provide early warning for building occupants. Alarms first sound when fires are generally small, allowing early awareness and action. In this event, security footage indicated the fire started at approximately 3:45 am, but the worker's response occurred at least five minutes later, with a call to 911 seven minutes after the fire broke out. Earlier action might have allowed the decedent to approach the main entrance/exit door with lower smoke levels and to have improved visibility of exit through the south emergency exit doors, if necessary. The Educational Messages Advisory Committee for the National Fire Protection Association (NFPA) recommends education talking points include the following: "Fire is fast: you may have three minutes to get to safety" (Ahrens, NFPA, 2007).

¹ Approved devices, equipment and systems or combinations of systems used to detect a fire, activate an alarm, extinguish or control a fire, control or manage smoke and products of a fire or any combination thereof (IFC 2009, 902.1)

Since workers perform activities in the kitchen at times where no one else in the building, a simple smoke detector positioned in areas not visible when working within the kitchen would have provided early detection. The smoke detector/alarms in convenience stores with operating kitchens should be positioned in areas away from the kitchen to minimize false alarms that could occur from normal cooking or high heat (Evarts, NFPA, 2011). In contacts with the Iowa Fire Marshal, installation of a commonly available smoke detector would not trigger additional fire safety regulatory compliance requirements. This non-mandatory but inexpensive device would have provided an early warning, which could have allowed the decedent to react and escape when smoke concentrations were lower, improving visibility and reducing smoke inhalation exposure.

Recommendation 2: *Review emergency evacuation plans with all employees to ensure workers know all escape routes in the event the main exit is blocked by fire.*

For any workplace that has fire extinguishers provided and expects workers to evacuate in the event of a fire or other emergency, the U.S. Occupational Safety and Health Administration (OSHA) requires the development and implementation of an emergency action plan (EAP) (29 CFR 1910.157). In the case of a convenience store, evacuation is anticipated to be the primary reaction to a fire emergency.

OSHA requires the development of a plan that clearly communicates: how to report emergencies and how to evacuate, including escape routes. All workers should be educated on the types of emergencies and evacuation procedures. Reactions during emergencies require clarity of thought, and, while not an annual training requirement, conducting routine reminders of the procedures (with walkthroughs and operation of exit doors) can reduce panic during actual emergencies. The decedent's hesitancy on how to respond, visible in the security footage, indicated that training was not effective. While county dispatcher tapes indicated that the victim had successfully made her way to the northwest delivery door, her inability to open the door might have been prevented with reinforcing training on how to activate the panic bar to escape.

Recommendation 3: *Involve employees in routine testing of emergency exit door operation.*

The NFPA 101®: Life Safety Code® (NFPA 101) recommends that emergency exit doors should be: inspected weekly to ensure they are unobstructed, have hardware tested weekly for proper operation, and have quarterly checks of measuring the door opening force (NFPA 101:4 and 7). Incorporating these activities into the duties of all convenience store employees can be useful to ensure everyone has ongoing opportunity to demonstrate their understanding of emergency action plans as well as test and understand equipment operation, should a need arise.

Although the northwest delivery door was not a designated fire exit, routine review and testing of the opening mechanism may have improved this worker's ability to escape. At this time, it is unknown whether the panic door mechanism had malfunctioned or whether the worker did not depress the panic bar on the northwest delivery door. Routine testing of the delivery door latch mechanism would have identified problems with the mechanism prior to the morning of the fire.

Recommendation 4: Incorporate emergency exit needs when designing store security, ensuring emergency exit doors are operable with single action whenever the store is occupied.

The worker in this incident attempted to exit through the main entry doors, but by the time she retrieved her key from her purse in the office, the smoke was thick and prevented her from approaching and unlocking the door to escape.

The most commonly used door by store employees was the front, main entrance. This door and the south emergency exit door were the two designated means of egress (exits) required for a building of this size and classification. The main entrance out-swing doors were secured by a keyed deadbolt that was operable from both the inside and outside; this security feature allowed workers to secure the entrance while they were working inside prior to the store opening in the morning or during clean up at night. Upon arriving to work before the store opened, employees would unlock the front entry, and then relock the door from the interior using their key, as was done on the day of this incident. When the store opened for business, they unlocked this entrance from the interior, and during business hours the door was operable simply by leaning or pushing outward in the direction of travel. The main double doors were configured without an emergency escape, or “panic bar” that had to be depressed in order to open the door. In their unlocked state during business hours, opening of the doors constituted a single-action (i.e., leaning or pushing) operation required of a designated fire exit (IFC 2009, 1008.1.9.3.5).

When the store was closed, the keyed deadbolt on the main door does not constitute a single-action operation to unlatch the door (i.e., two actions were required to open the door: *turning* of key, and *pushing* outward); however, this condition is allowed per IFC during *non-business* hours for Group M occupancy buildings (IFC 2009, 1008.1.9.3(2)), provided the business had a readily visible durable sign posted on the egress side, on or adjacent to the door stating: THIS DOOR TO REMAIN UNLOCKED WHEN BUILDING IS OCCUPIED. Although the front entry door was in compliance with IFC code requirements, the worker's necessity to locate a key, then see and approach the keylock rendered the door functionally unsuitable as an emergency exit.

Substituting the interior-keyed deadbolt with panic bar hardware that locks to prevent entry from the outside, but allows exit from within would have allowed the worker to exit the door upon first detection of fire without having to find and insert her key. The employee could have potentially exited the store within seconds of detecting the fire. Alternatively, leaving the key in the lock until the store is opened may have assisted the escape of this worker, when visibility near the front door was limited by smoke that prevented her from approaching the door after locating her keys. The panic bar, however, is the preferred mechanism for fast escape.

Convenience stores and businesses often use keyed interior deadbolts at the main entrance to prevent burglars from being able to lock police or responders *out* during a robbery. In the design of this store, the business's security concerns – choosing a keyed interior deadbolt to prevent thieves from being able to hand-lock the door during open store hours - superseded the need to provide fast accessible escape in the event of an emergency.

Although not identified as a contributing factor in this case, conversations with the State Fire Marshal Division revealed other common practices that might prevent emergency exit door operations in similar businesses. In some small stores, emergency exit doors are secured during

non-business hours by using a metal bar or other keyed locking mechanism, again to prevent theft when the building is unoccupied. This practice is in violation of Life Safety Code (NFPA 101) and OSHA regulations. If security is an issue, a panic bar/paddle system that locks to prevent entry through the door but does not restrict exit from within the building are available to address security concerns. While it is clear that this store had no fixed keyed lock or bar on the emergency exit door or the northwest delivery door, local fire marshals confirmed that this security practice is commonplace. Disabling multi-action locks on these emergency escape doors while the building is occupied is critical to preventing future injuries and fatalities in small businesses.

Finally, any doors along the emergency escape pathways must also remain unlocked whenever the building is occupied. The wooden door between storage rooms A and B had a lock on the door handle, indicating a potential for it being locked. Since the worker in this case was located in this opened doorway when firefighters arrived, having to use a key to unlock the door would have slowed her exit, increasing smoke exposures.

Recommendation 5: *Mark emergency pathways with appropriate lighting.*

As required by law, this store had two designated fire exit pathways within the building: the front door (main entrance), and the south emergency exit door between the restrooms. These designated exits were not found to have deficiencies in signage or illumination prior to the fire. The third (northwest) door was designed and configured as a delivery or “convenience” door rather than a fire exit; because of its location at the end of two storage areas separated by a solid wooden door, this door did not meet code requirements for egress, and consequently was not required to have illuminated signage and hardware required of fire exits.

While other store employees clearly demonstrated knowledge of the alternative escape path through the storage rooms and delivery door during interviews after the incident, posted maps or diagrams, refresher training on emergency response, and well-illuminated interior passageways provide critical reminders during a fire event, when mental clarity is often compromised.

It is required that designated exit paths be illuminated to facilitate exit out of a building during periods that the building is occupied (IFC 2009, 1006.1); this requirement applies to the convenience store’s two designated fire exits (the main front doors and the south emergency exit). It is not known if the lights were on in the storage rooms near the northwest delivery door, during the morning of the fire. Typically, workers arriving prior to the store's opening turn on lights only in the areas in which they have tasks, to prevent customers from thinking the store is open. In this incident, the lights to the kitchen and office were on but the main floor area lights were not illuminated because the store was not opened for customers. It is unclear whether the back storage room lights had been on to allow the worker to quickly escape through the storage rooms; by the time the firefighters arrived, the smoke levels were reported as sufficiently high to have prevented noticing any illumination in this area. However, earlier in the decedent's evacuation attempts, lighting in the back area could have offered a quicker escape from the building. Connecting the storage room lights to the kitchen / office lighting system switch (the first lights on and last lights off) is recommended. Alternatively, turning these lights on when unlocking /

inspecting emergency exit doors at the beginning of the shift (in concert with Recommendation 3) should be required, at a minimum.

Recommendation 6: *Remove malfunctioning electrical equipment from service.*

The back side of the cooler and the electric advertising sign were both extensively damaged by the fire, leaving uncertainty as to which of the two devices caused the fire. However, employee interviews indicated that the sign in question occasionally malfunctioned and did not work all the time. While the investigations did not conclusively determine whether the bait cooler or the electrical sign above the cooler started the fire, fire safety guidelines recommend taking malfunctioning electrical equipment out of service.

Iowa FACE thanks the Iowa State Fire Marshal Division for assistance in preparing this report.

Keywords: cook, convenience store, fire

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Fatality Assessment and Control Evaluation

FACE

Fatality Assessment and Control Evaluation (FACE) is a program of the National Institute for Occupational Safety and Health (NIOSH), which is part of the Centers for Disease Control and Prevention of the US Department of Health and Human Services. Nationally, the FACE program identifies traumatic work-related deaths, conducts in-depth studies of select cases, makes recommendations for prevention, and publishes reports and alerts. The goal is to prevent occupational fatalities across the nation.

The NIOSH head office in Morgantown, West Virginia, carries out an intramural FACE case surveillance and evaluation program and also funds state-based programs in several cooperating states. The Iowa FACE program is conducted by the Injury Prevention Research Center at the University of Iowa working in conjunction with the Iowa Department of Public Health and its Office of the State Medical Examiner.

NIOSH combines its and the state programs' information for wide dissemination, in a variety of forms, among the industries involved. NIOSH publications are available on the web at <http://www.cdc.gov/NIOSH/FACE/> and from the NIOSH Distribution Center (1-800-35NIOSH).

Iowa FACE also publishes its case studies, issues precautionary messages, and prepares articles for trade and professional publications. In addition to postings on the national NIOSH website, the information is posted on the Iowa FACE website (www.public-health.uiowa.edu/FACE/).

The Iowa FACE team at the University of Iowa includes Marizen Ramirez, Director; Corinne Peek-Asa, Co-Investigator; John Lundell, Co-Investigator; T. Renée Anthony, Co-Investigator; and Stephanie Leonard, Field Investigator. Additional expertise is provided from the Iowa Department of Public Health, including Rita Gergely, Principal Investigator; Kathy Leinenkugel, Surveillance Specialist; and John Kraemer, Director, Forensic Operations at Iowa Office of the State Medical Examiner.

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