

The Mayfield Village Tests

On May 9, May 12 and May 13, 2014 NEOFPA conducted six full-scale, real-world smoke alarm comparison tests in the city of Mayfield Village, Ohio. Tests 5 and 6 conducted on May 13 were videotaped for a story by ABC's Good Morning America.

The home, which was slated for demolition by the city of Mayfield Village, was a one-story wood framed three bedroom, one bath ranch-style single-family home. The interior walls and ceiling finish were of painted drywall. The ceiling height was 8 feet.

During the tests, all doors and windows were in the closed position. Also, there was no artificial air movement in the home during the tests.

The six tests conducted included three smoldering and three fast flaming type tests.

The smoldering fire tests were created by inserting a brand new soldering iron between the cushions of two new couches. Each couch was positioned in the living room in the typical location. The living room was approximately 14' x 20' in size. The heated soldering iron caused the cushions to smolder without igniting for a considerable length of time and create large volumes of smoke, replicating a typical smoldering fire incident in a single-family residence. A firefighter in full turnout gear and self-contained breathing apparatus was stationed approximately 10' from the couch during the tests to observe and report conditions.

The flaming fire tests were created by igniting class A combustibles including paper and cardboard in a galvanized tub. The tub was positioned in the center of the kitchen floor. The kitchen was approximately 11' x 12' in size. The resulting fire replicated a typical trash can fire incident in a kitchen.

A firefighter in full turnout gear and self-contained breathing apparatus was stationed approximately 10' from the tub during the tests to observe and report conditions.

The brand new smoke alarms were mounted to a wooden board which was then mounted to the bedroom hallway ceiling in what would have been the recommended location per national standards. This hallway connected the front living room, foyer, kitchen, bathroom and bedrooms and was approximately 28' long by 3' wide. The smoke alarms were identified by manufacturer and sensor type and were numbered. The distance from the ignition point on the couches to the smoke alarms was approximately 23 feet. The distance from the ignition point in the galvanized tub to the smoke alarms was approximately 11 feet.

A firefighter in full turnout gear and self-contained breathing apparatus was stationed directly below the smoke alarms during the tests to observe and report conditions and smoke alarm functioning.

Test 1: May 9, 2014 at 10:43 am-Smoldering Test

Equipment used:

Heat source: Weller 110 volt, 25 watt soldering-iron model SP23LK. Maximum temperature of 750°F.

Furniture/Fuel Source: Sofa. (96x44x39") New condition. Jackson Furniture Industries. Body: textile waste fiber, resinated polyester fiber batting, polyurethane foam pad. Seat: polyurethane foam pad, resinated polyester fiber batting. Wood frame.

Smoke alarms used:

- 1: Kidde ionization sensor model I9010. Manufacture date: 12-24-13. Sealed lithium-ion battery.
- 2: Kidde Photoelectric sensor model P3010H. Manufacture date: 8-30-12. Sealed lithium-ion battery.
- 3: Blank
- 4: First Alert ionization sensor model SA304. Date of manufacture 2-6-14. 9 volt battery.
- 5: First Alert photoelectric sensor model P900E. Date of manufacture: Not reported. Battery not reported.
- 6: First Alert dual sensor (photoelectric and ionization) model SA320. Date of manufacture: Not reported. Battery not reported.

Carbon monoxide detector used:

Carbon monoxide meter: Fire department owned. The make and model number were not recorded.

Test 1 Time Line:

(Time in hh:mm:ss indicates hours, minutes and seconds since first smoke.)

- 10:43 AM: Start test. Heat on.
- 10:44 AM: 00m:00s: First smoke.
- 10m:00s: CO level: 1 ppm. Light smoke in living room. No smoke in hall.
- 12m:35s: Smoke production increasing.
- 15m:00s: CO level: 4 ppm. Light smoke throughout living room, foyer and entry to hallway.
- 15m:44s: CO level: 10 ppm.
- 17m:52s: Smoke migrating down hall.
- 20m:00s: CO level: 16 ppm. Visible haze down the hall.
- 21m:30s: Smoke alarm 2 activates. CO level: 17 ppm.
- 21m:35s: Smoke alarm 5 activates. CO level: 17 ppm.
- 22m:44s: Smoke alarm 6 activates. CO level: 21 ppm.
- 26m:00s: Smoke is now visible in the kitchen.

30m:00s: CO level: 30 ppm. Visibility is approximately 25 feet in smoke. No smoke visible on the exterior of the home.
35m:00s: CO level: 36 ppm.
39m:30s: CO level: 50 ppm.
44m:00s: Smoke alarm 4 activates. CO level: 52 ppm.
45m:30s: Smoke alarm 4 stops sounding.
48m:10s: Less than 25 feet visibility in smoke. No smoke visible on the exterior of the home.
49m:30s: CO meter ceases to function.
51m:28s: Smoke alarm 4 activates again.
1h:02m:00s: Visibility is approximately 15 feet at 3 feet above the floor.
1h:13m:44s: Smoke is now solid floor to ceiling. No smoke visible on the exterior of the home.
1h:14m:00s: Test stopped. Smoke alarm 3 did not activate during this test. Test button was pushed and alarm sounds verifying it was operating.

Test 1 Summary:

The Kidde photoelectric smoke alarm (#2) sounded at 21m:30s.

The First Alert photoelectric smoke alarm (#5) sounded at 21m:35s. 5 seconds after the first photoelectric smoke alarm sounded.

The First Alert dual sensor smoke alarm (#6) sounded at 22m:44s. One minute and 14 seconds after the first photoelectric smoke alarm sounded.

The First Alert ionization smoke alarm (#4) first sounded at 44m:00s. 22 minutes and 30 seconds after the first photoelectric smoke alarm sounded. It sounded for one minute and 30 seconds then stopped sounding. It began sounding continuously again at 51m:28s.

The Kidde ionization smoke alarm (#1) never activated during this test.

Test 2: May 9, 2014 at 2:46 pm-Smoldering Test

Equipment used:

Heat source: Weller 110 volt, 25 watt soldering-iron model SP23LK. Maximum temperature of 750°F.

Furniture/Fuel Source: Sofa. (96x44x39") Same sofa that was used in test 1. New condition. Jackson Furniture Industries. Body: textile waste fiber, resinated polyester fiber batting, polyurethane foam pad. Seat: polyurethane foam pad, resinated polyester fiber batting. Wood frame.

Smoke alarms used:

- 1: Kidde dual sensor (ionization & carbon monoxide) model KN-COSMXTR-BA
- 2: First Alert photoelectric sensor model: Atom
- 3: Kidde ionization sensor model I9040
- 4: Kidde dual sensor (photoelectric & ionization) model PI9010.
- 5: First Alert dual sensor (photoelectric & ionization) model SA320.
- 6: First Alert ionization sensor model FG200.
- 7: First Alert photoelectric sensor (One Link) model SA511. Date of manufacture: 4-12-13. Two AA batteries.

Carbon monoxide detector used:

Carbon monoxide meter: Fire department owned. The make and model number were not recorded.

Test 2 Time Line:

(Time in hh:mm:ss indicates hours, minutes and seconds since first smoke.)

2:46 PM: Start test. Heat on.

2:48PM (00m:00s): First Smoke.

05m:00s: Light smoke collecting at living room ceiling.

10m:00s: Smoke halfway down to floor in living room. Some smoke now in foyer.

15m:00s: Smoke now entering hallway, 5 feet off of floor.

20m:00s: CO: 3 ppm. Smoke in hall now at floor level.

21m:10s: CO level: 9 ppm.

21m:18s: Smoke alarm 5 activates.

22m:04s: CO level: 16 ppm.

22m:30s: Smoke alarm 7 activates. Smoke now visible in kitchen.

24m:17s: Smoke alarm 4 activates.

24m:57s: CO level: 24 ppm.

28m:42s: Smoke alarm 2 activates.
29m:47s: CO level: 38 ppm.
30m:30s: Can not see the end of the hallway.
32m:13s: CO level: 45 ppm.
33m:30s: Would need to crawl to see in the hallway and living room areas. No smoke visible on the exterior of the home.
34m:30s: CO level: 54 ppm.
35m:40s: Smoke alarm 1 activates indicating carbon monoxide.
37m:30s: Visibility at the floor level is down to approximately 10 feet.
39m:15s: CO level: 70 ppm.
40m:10s: Smoke alarm 1 activates indicating fire.
40m:41s: CO level: 74 ppm.
46m:00s: CO meter no longer functioning.
54m:00s: Still no smoke visible on the exterior of the home.
1h: 05m:00s: End of test. Smoke alarms 3 and 6 did not sound during the test. Test buttons were pushed and alarms sound verifying they were operating.

Test 2 Summary:

The First Alert dual sensor alarm (#5) sounded at 21m:18s.

The First Alert photoelectric alarm (#7) sounded at 22m:30s. One minute and 12 seconds after the first smoke alarm sounded.

The Kidde dual sensor alarm (#4) sounded at 24m:17s. Two minutes and 59 seconds after the first smoke alarm sounded.

The First Alert photoelectric alarm (#2) sounded at 28m:42s. Seven minutes and 24 seconds after the first smoke alarm sounded.

The Kidde dual sensor alarm (#1) sounded for *carbon monoxide* at 35m:40s. 14 minutes and 22 seconds after the first smoke alarm sounded.

The Kidde dual sensor alarm (#1) sounded for *fire* at 40m:10s. 18 minutes and 52 seconds after the first smoke alarm sounded.

The Kidde ionization alarm (#3) and the First Alert ionization alarm (#6) never activated during this test.

Test 3: May 12, 2014 at 9:20 am-Flaming Test

Equipment used:

Heat source: Standard wooden kitchen match.

Furniture/Fuel Source: Class A combustibles including paper and cardboard in a galvanized tub.

Smoke alarms used:

- 1: First Alert photoelectric sensor.
- 2: First Alert ionization sensor.
- 3: Kidde ionization sensor.
- 4: Kidde photoelectric sensor.
- 5: First Alert dual sensor (photoelectric & ionization). Model SA320. Date of manufacture: 8-9-13. Two AA batteries.
- 6: Kidde dual sensor (photoelectric & ionization). Model PI9010. Date of manufacture: 11-29-13. 9 V battery.

Carbon monoxide detector used:

Carbon monoxide meter: Fire department owned. The make and model number were not recorded.

Test 3 Time Line:

(Time in hh:mm:ss indicates hours, minutes and seconds since ignition.)

- 9:20 AM: (00m:00s) Start test. Ignition.
00m:40s: Smoke alarms 3, 6 and 2 activate.
01m:20s: Smoke alarms 4 and 1 activate.
01m:34s: Smoke alarm 5 activates.
01m:34s: End of test.

Test 3 Summary:

The Kidde ionization alarm (#3), the Kidde dual sensor alarm (#6) and the First Alert ionization alarm (#2) all sounded at 00m:40s.

The Kidde photoelectric alarm (#4) and the First Alert photoelectric alarm (#1) both sounded at 01m:20s. 40 seconds after the first alarms sounded.

The First Alert dual sensor alarm (#5) sounded at 01m:34s. 54 seconds after the first alarms sounded.

Test 4: May 12, 2014 at 9:47 am-Flaming Test

Equipment used:

Heat source: Standard wooden kitchen match.

Furniture/Fuel Source: Class A combustibles including paper and cardboard in a galvanized tub.

Smoke alarms used:

- 1: First Alert photoelectric sensor.
- 2: First Alert ionization sensor.
- 3: Kidde ionization sensor.
- 4: Kidde photoelectric sensor.
- 5: First Alert dual sensor (photoelectric & ionization). Model SA320. Date of manufacture: 12-18-12. Two AA batteries.
- 6: Kidde dual sensor (photoelectric & ionization). Model PI9010. Date of manufacture: 11-29-13. 9 V battery.

Carbon monoxide detector used:

Carbon monoxide meter: Fire department owned. The make and model number were not recorded.

Test 4 Time Line:

(Time in hh:mm:ss indicates hours, minutes and seconds since ignition.)

- 9:47 AM: (00m:00s) Start test. Ignition.
- 00m:40s: Smoke alarms 2 and 3 activate.
- 00m:50s: Smoke alarms 4 and 1 activate.
- 00m:55s: Smoke alarm 6 activates.
- 01m:00s: Smoke alarm 5 activates.
- 01m:00s: End of test.

Test 4 Summary:

The First Alert ionization alarm (#2) and the Kidde ionization alarm (#3) both sounded at 00m:40s.

The Kidde photoelectric alarm (#4) and the First Alert photoelectric alarm (#1) both sounded at 00m:50s. 10 seconds after the first alarms sounded.

The Kidde dual sensor alarm (#6) sounded at 00m:55s. 15 seconds after the first alarms sounded.

The First Alert dual sensor alarm (#5) sounded at 01m:00s. 20 seconds after the first alarms sounded.

Test 5: May 13, 2014 at 4:34 PM-Smoldering Test

Equipment used:

Heat source: Weller 110 volt, 25 watt soldering-iron model SP23LK. Maximum temperature of 750°F. (The first soldering iron failed during the test and a second and third were added of the same make and model number.)

Furniture/Fuel Source: Sofa. (96x44x39") New condition. Jackson Furniture Industries. Body: textile waste fiber, resinated polyester fiber batting, polyurethane foam pad. Seat: polyurethane foam pad, resinated polyester fiber batting. Wood frame.

Smoke alarms used:

(Mounted to board #1)

- 1: Kidde photoelectric sensor model P3010H. Date of manufacture: 11-26-13. Sealed 10 yr. lithium-ion battery.
- 2: First Alert ionization sensor model SA304. Date of manufacture: 8-19-13. 9 volt battery.
- 3: Kidde ionization sensor model I9010. Date of manufacture: 11-6-14. Sealed 10 yr. lithium-ion battery.
- 4: First Alert photoelectric sensor. Model P900E. Date of manufacture 9-12-13. 9 volt battery.
- 5: First Alert dual sensor (photoelectric & ionization) model SA320. Date of manufacture: 3-15-14. Two AA batteries.
- 6: Kidde dual sensor (photoelectric & ionization). Model PI9010. Date of manufacture: 7-10-13. 9 volt battery.

Carbon monoxide detector used:

Carbon monoxide meter: Fire department owned. The make and model number were not recorded.

Test 5 Time Line:

(Time in hh:mm:ss indicates hours, minutes and seconds since first smoke.)

- 4:34 PM: Start test. Heat on.
- 4:35 PM: (00m:00s): First smoke.
- 08m:30s: Light smoke entering hallway.
- 12m:09s: Smoke alarm 1 activates.
- 13m:33s: Smoke alarm 4 activates.
- 14m:06s: Smoke alarm 4 stops sounding.
- 14m:44s: Smoke alarm 4 activates and stays on.

19m:10s: CO level 1–2 ppm.
20m:00s: Smoke is beginning to bank down to the floor in the living room.
22m:15s: Smoke alarm 5 activates.
27m:18s: CO level 4–5 ppm.
47m:30s: CO meter ceases to function.
49m:00s: Smoke is now to the floor. It is difficult to see.
49m:20s: Smoke alarm 6 activates.
52m:25s: Smoke is rolling across the hallway ceiling and all alarms.
56m:00s: First soldering iron is now destroyed. Replaced with two others.
56m:30s: Smoke alarm 6 stops sounding.
59m:13s: Smoke alarm 6 activates again and stays on.
01h:05m:20s: Visibility less than 10 feet at the floor level.
01h:10m:00s: End of test. Smoke alarms 2 and 3 did not sound during this test.
01h:10m:15s: Smoke alarm 2 test button pushed. Alarm sounds verifying it is operating.
01h:10m:40s: Smoke alarm 3 test button pushed. Alarm sounds verifying it is operating.
01h:13m:00s: Firefighters exit the home.

Test 5 Summary:

The Kidde photoelectric smoke alarm (#1) sounded at 12m:09s.

The First Alert photoelectric smoke alarm (#4) sounded at 13m:33s to 14m:06s then stopped sounding. One minute and 24 seconds after the first smoke alarm sounded.

The First Alert photoelectric smoke alarm (#4) sounded again and remained on at 14m:44s. Two minutes and 35 seconds after the first smoke alarm sounded.

The First Alert dual sensor alarm (#5) sounded at 22m:15s. 10 minutes and six seconds after the first smoke alarm sounded.

The Kidde dual sensor alarm (#6) sounded at 49m:20s. 37 minutes and 11 seconds after the first smoke alarm sounded.

The Kidde dual sensor alarm (#6) stopped sounding at 56m:30s.

The Kidde dual sensor alarm (#6) sounded again and remained on at 59m:13s.

The First Alert ionization alarm (#2) and the Kidde ionization alarm (#3) never activated during this test.

Test 6: May 13, 2014 at 6:48 PM-Flaming Test

Equipment used:

Heat source: Standard wooden kitchen match.

Furniture/Fuel Source: Class A combustibles including paper and cardboard in a galvanized tub.

Smoke alarms used:

(Mounted to board #2)

- 1: Kidde photoelectric sensor. Model PE3010H. Date of manufacture: 11-26-13. Sealed 10 yr. lithium-ion battery.
- 2: First Alert ionization sensor. Model SA304. Date of manufacture: 3-4-14. 9 volt battery.
- 3: Kidde ionization sensor. Model I9010. Date of manufacture: 2-6-14. Sealed 10 yr. lithium-ion battery.
- 4: First Alert photoelectric sensor. Model P900E. Date of manufacture: 6-20-13. 9 volt battery.
- 5: First Alert dual sensor (photoelectric & ionization). Model SA320. Date of manufacture: 3-4-14. Two AA batteries.
- 6: Kidde dual sensor (photoelectric & ionization). Model PI9010. Date of manufacture: 7-10-13. 9 volt battery.

Carbon monoxide detector used:

Carbon monoxide meter: Fire department owned. The make and model number were not recorded.

Test 6 Time Line:

(Time in hh:mm:ss indicates hours, minutes and seconds since ignition.)

- 6:48 PM: (00m:00s) Start test and ignition.
- 00m:45s: Smoke alarms 2 and 3 activate
- 01m:05s: Smoke alarms 5 and 6 activate.
- 04m:30s: Smoke alarm 1 activates.
- 05m:19s: Smoke alarm 4 activates.
- 05m:19s: End of test.

Test 6 Summary:

The First Alert ionization alarm (#2) and the Kidde ionization alarm (#3) both activate at 00m:45s.

The First Alert dual sensor alarm (#5) and the Kidde dual sensor alarm (#6) both activate at 01m:05s. 20 seconds after the first alarms sounded.

The Kidde photoelectric alarm (#1) sounded at 04m:30s. Three minutes and 45 seconds after the first smoke alarm sounded.

The First Alert photoelectric alarm (#4) sounded at 05m:19s. Four minutes and 34 seconds after the first smoke alarm sounded.

Pictures From The Tests









