Information provided to CSFM regarding Multi Sensor alarms

Kidde “intelligent” Alarm

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UTC Fire & Security
A United Technologies Company

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Overview of Kidde Multi-sensor alarm

EXECUTIVE SUMMARY **(Arthur Lee, March 2010, pilot study of smoke alarms with nuisance alarms associated with cooking)**
In 2005, there were an estimated 375,100 unintentional residential structure fires resulting in 2,630 deaths, 12,820 injuries and $6.22 billion in property loss. Almost all households in the U.S. have at least one smoke alarm, yet from 2000-2004, smoke alarms were not operating or were intentionally disabled in almost half (46%) of the reported home fires. Nearly all of the non-working smoke alarms were due to dead or missing batteries.
Despite the almost universal presence of smoke alarms in homes, research on smoke alarms installed in homes has shown that many alarms are disabled by the occupants because of frequent nuisance alarms from cooking. As many as 20 percent of the smoke alarms installed in U.S. homes have been disabled, and that number may be higher in high risk areas, such as inner cities and rural communities.

2 Sensors in 1 Alarm

Smoke Ionization Sensor	Carbon Monoxide Sensor	Alarm Condition
Smoke Sensor Detects Nothing	CO Sensor Detects Nothing	Idle
Sensor Detects Smoke Like Particles	CO Sensor Detects Nothing	Alarm reduces smoke sensitivity– Possible false alarm
Smoke Sensor Detects Nothing	Sensor Detects Carbon Monoxide	Alarm increases smoke sensitivity -Possible fire
Sensor Detects Smoke Like Particles	Sensor Detects Carbon Monoxide	Alarm detects CO and smoke. Alarm alerts homeowner of danger!

Intelligent alarm:
- Algorithm (uses CO & ionization sensors)
- Also UL listed as a single station CO alarm
- Retail ~$38

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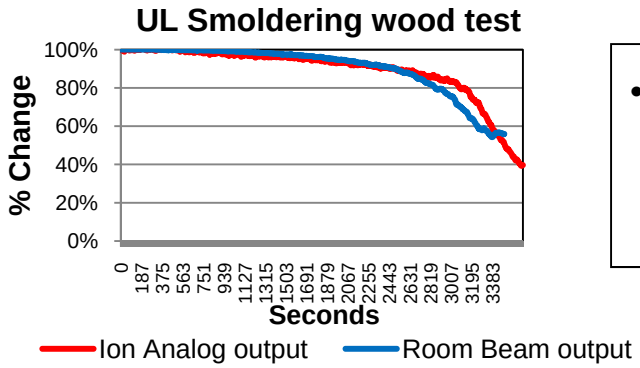
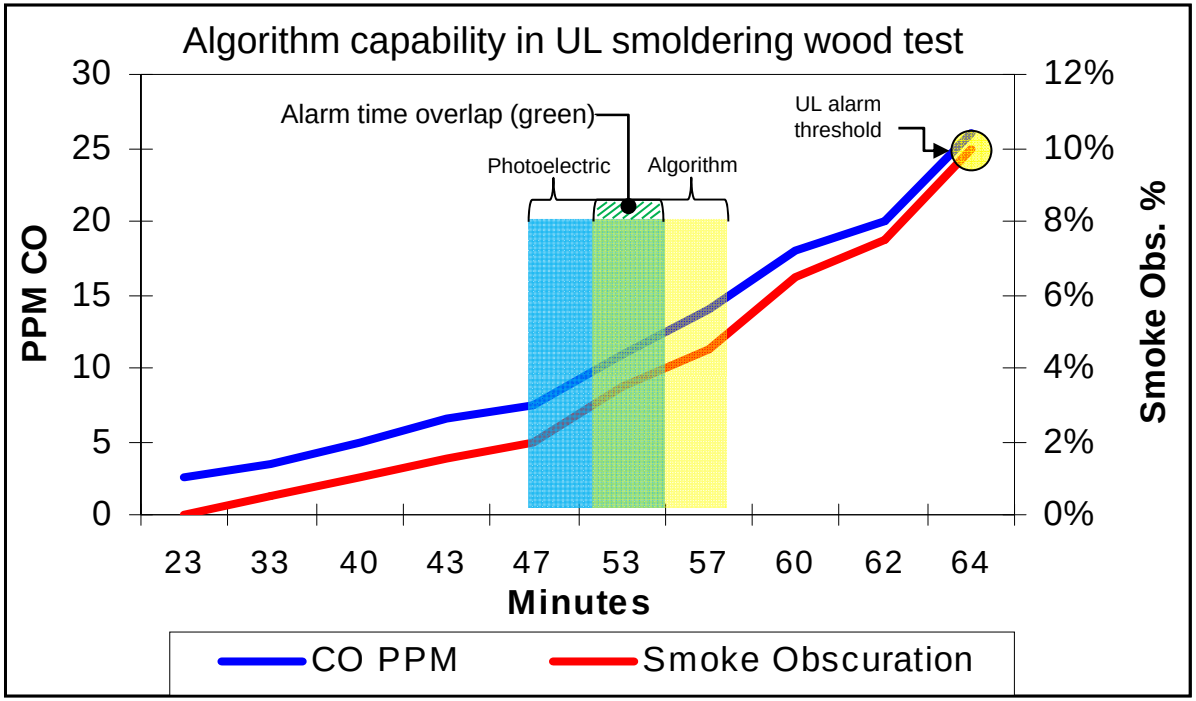
Smoldering Fire



- Ion sensors do detect smoldering fire
  - Provides for an obvious opportunity because:
    - Incipient stages generate detectable levels of CO



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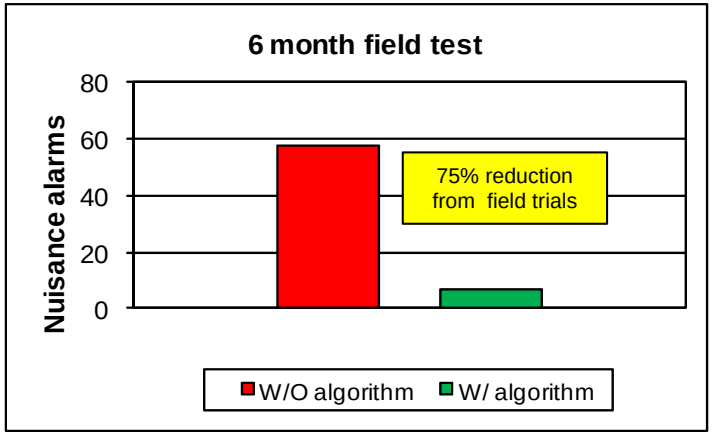
Nuisances – From Cooking Sources

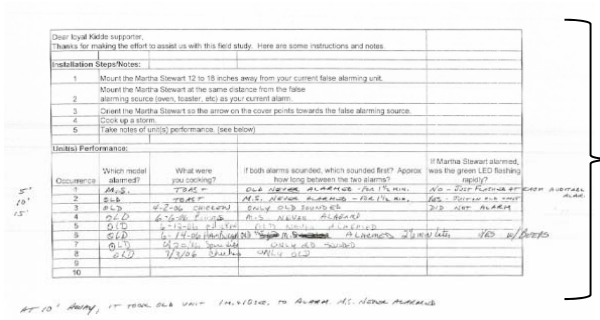
Predicted From Field Trials

Test media in Kidde fire test room (stove and range)

- 1Lb. Bacon until burned
- Boiled spaghetti
- 2 Meat pizzas
- 1Lb. of butter
- 4 fried hamburgers
- Broiled steak with teriyaki marinade
- Toast - 4 white bread toaster capacity

Tests showed algorithm reduced nuisances compared to controls alarms





Dear loyal Kidde supporter,
Thanks for making the effort to assist us with this field study. Here are some instructions and notes.

Installation Steps/Notes:	
1	Mount the Martha Stewart 12 to 18 inches away from your current false alarming unit.
2	Mount the Martha Stewart at the same distance from the false alarming source (oven, toaster, etc) as your current alarm.
3	Orient the Martha Stewart so the arrow on the cover points towards the false alarming source.
4	Cook up a storm.
5	Take notes of unit(s) performance. (see below)

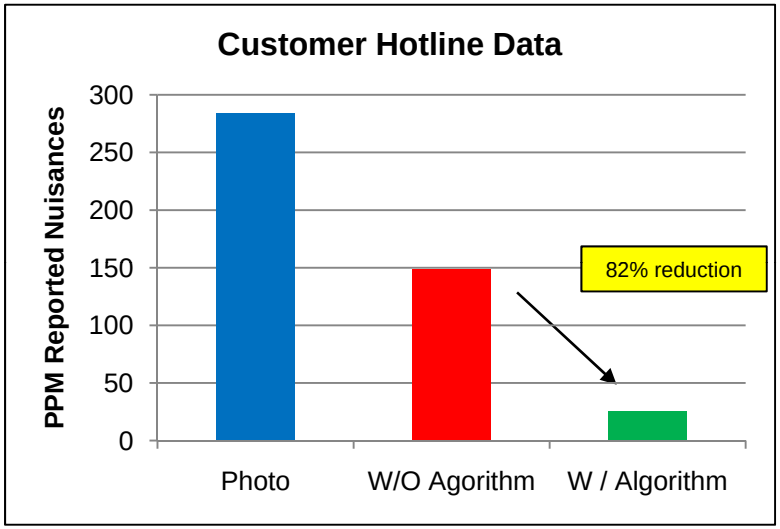
Unit(s) Performance:

Occurrence	Which model alarmed?	What were you cooking?	If both alarms sounded, which sounded first? Approx how long between the two alarms?	If Martha Stewart alarmed, was the green LED flashing rapidly?
1	M.S.	TOAST	OLD NEVER ALARMED - RAN 15 MIN.	NO - JUST FLASHING AT EACH ALARM ALAR.
2	OLD	TOAST	M.S. NEVER ALARMED - RAN 15 MIN.	YES - TURN ON UNIT
3	M.S.	6 EGG OMELETTE	ONLY OLD SOUNDED	YES NOT ALARM
4	OLD	6 EGG FRYING	M.S. NEVER ALARMED	
5	O.D.	6-13-10 FRYING	O.D. ALARMED - M.S. NEVER ALARMED	
6	OLD	6-14-10 FRYING	M.S. ALARMED 2 MINUTES LATER	YES W/ BEEPS
7	O.D.	9/23/10 SMOKE	ONLY OLD SOUNDED	
8	OLD	7/3/06 SMOKE	ONLY OLD	
9				
10				

AT 10' AWAY, IT TOOK OLD UNIT 1 MINUTE TO ALARM. M.S. NEVER ALARMED

6 month field trial recording form

Actual Results YTD 2010



Consumer data on recorded activations:

- Algorithm alarm is 82% lower than ion
- Algorithm alarm is 91% lower than photo

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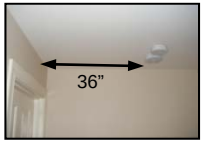
Nuisances – From Other Sources

Water Vapor (Shower Steam)

Bathroom



~8.5’ from tub center to door opening

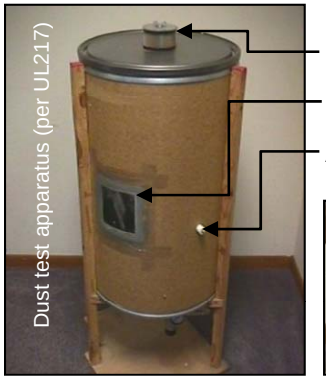
Test protocol:

- Full hot for 3 minutes (once steam observed)
- Door closed, exhaust fan off
- Door opened walked into and out of room

Alarm position with respect to door opening	Trials run	Photo activations	Intelligent activations
18 inches	2	2	0
36 inches	3	3	0
60 inches (offset ~20°)	1	1	0

Algorithm alarm did not nuisance alarm in water vapor test

Other (example: Dust)



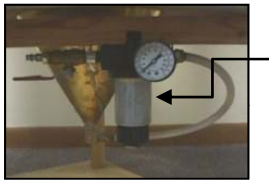


Photo alarms *always* nuisance alarms to dust test

Algorithm alarm *never* nuisance alarms to dust test

57 Dust Test

57.1 The sensitivity of an alarm shall not be reduced abnormally by an accumulation of dust, without an alarm or audible trouble signal being produced.
57.2 To determine compliance with 57.1, a sample in its intended mounting position, is to be placed, de-energized, in an air tight chamber having an internal volume of at least 3 cubic feet (0.09 m3).
57.3 Two ounces (0.06 kg) of cement dust, maintained in an ambient room temperature of 23 ±2°C (73.4 ±3°F) at 20 – 50 percent relative humidity and capable of passing through a 200 mesh screen, is to be circulated for 15 minutes by means of compressed air or a blower so as to completely envelop the sample in the chamber. The air flow is to be maintained at an air velocity of 50 fpm (0.25 m/s).
57.4 Following the exposure to dust, the alarm is to be removed carefully, mounted in its intended position, energized from a source of supply in accordance with 33.3.1, and tested for sensitivity using gray smoke, unless a trouble signal or a false alarm is obtained. Sensitivity measurements following this test shall not vary by more than specified in 34.4.1. For those units whose sensitivity varies by more than 50 percent in the direction of high sensitivity, the unit shall be capable of being returned to its initial sensitivity value (plus or minus 0.25 percent per foot obscuration) after following the manufacturers specified cleaning procedure.

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Industry Experts

Using Multiple Sensors for Discriminating Fire Detection

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Summary

A multi-sensor fire detector coupled with intelligence provides improved performance in detection time and discrimination of the signatures of fire and nuisance sources as compared to currently available detectors…

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Industry Experts *(Continued)*

Advanced fire detection using multi-signature
alarm algorithms *

Daniel T. Gottuk*, Michelle J. Peatross, Richard J. Roby',
Craig L. Beyler
Hughes Associates, Inc., 3610 Commerce Drive, Suite 81 7. Baltimore. MD 21227-1652, USA
Received 9 March 2000; received in revised form 27 August 2000; accepted **15 September 2001**

Numerous alarm algorithms were evaluated. Parameters that were studied included ionization and photoelectric smoke measurements, CO and CO2 concentrations, and rate of rise of these variables. Generally, the algorithms that incorporated the ionization detector instead of the photoelectric detector signals were more effective overall. Some combinations of photoelectric and CO signals were able to detect more real sources than ionization and CO; however, this was accompanied by significant increases in nuisance alarms.

As presented in this paper, the CO/smoke detector with the alarm algorithm (Ion*CO 2 10) significantly improves life safety. The detector responds to real fire sources faster than a smoke detector, affording the occupants more time, up to several minutes, to escape a fire. Additionally, the multi-sensor detector eliminates many nuisance alarms.

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Industry Experts *(Continued)*

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www.elsevier.com/locate/firesaf

Advanced fire detection algorithms using data from the home smoke detector project

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Received 4 October 2003; received in revised form 1 June 2004; accepted 22 July 2004

3. Summary

The proposed algorithms are practical because they utilize relatively inexpensive sensors that are commonly used in residential occupancies. Based on cost considerations, a combined detector could be installed only in areas where nuisance aerosols are expected, however, the advantages of early fire detection would then be lost. The algorithm development procedures utilized here are general. Any of these algorithms can be adjusted if the design criteria for nuisance immunity or fire sensitivity are changed, i.e. a different balance is sought than applied in this paper.

- Multi-sensor detection algorithms can provide higher levels of nuisance immunity and fire sensitivity as compared to conventional ionization and photoelectric detectors.
- CO measurements detect smoldering fires earlier than conventional photoelectric detectors.
- The CO detector also provides a much higher level of nuisance immunity than either of the conventional smoke detectors.
- The rate of temperature rise provides detection of flaming fires at least as fast as conventional ionization detectors. The rate of temperature rise also provides a greater level of nuisance immunity than either of the conventional smoke detectors.
- Both ionization and photoelectric detectors are found to be sensitive to nuisance aerosols (i.e. prone to nuisance alarms). Increasing the ionization threshold in a combined ionization/photoelectric detector is not effective in the current data set.
- The [rate of temperature rise/CO detector/ionization detector] algorithm provides a high level of nuisance immunity and generally similar or earlier fire detection compared to conventional detectors.

Summary

The fire science experts agree that advances in fire detection are made with multi sensing technologies – We encourage CSFM smoke alarm task force to review these reports

The fire science experts agree that using CO is a good choice for achieving nuisance reduction and faster fire detection

The detection industry adds CO sensing in fire detectors as a premium - faster response and nuisance reduction

Kidde is the first to bring multi sensing technology cost effectively to the residential environment

Kidde data confirms the improved performance to all fire types as well as the reduction to nuisance alarms

The State of California will benefit from this technology

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