

# MINNESOTA DEPARTMENT OF PUBLIC SAFETY

## State Fire Marshal Division

444 Cedar Street, Suite 145, St. Paul, Minnesota 55101-5145  
Phone: 651/201-7200 FAX: 651/215-0525 TTY: 651/282/6555  
Internet: <http://www.dps.state.mn.us>



## Smoke Detector Replacement

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When you buy a VCR, radio or other electronic equipment, you don't typically expect that it will last forever. Eventually, one of the many components fails, rendering the device inoperative and usually requiring replacement. Smoke detectors too can stop working when either the power source is removed or a part breaks. Unlike your VCR, a smoke detector is not used on a regular basis, making regular testing critical to maintaining protection. Even with proper care, smoke detectors eventually require replacement to prevent an unrecognized failure from leaving your home unprotected.

In the ten years from the mid 1970's to the mid 1980's, a tremendous number of smoke detectors were installed in homes throughout the country, an important contributor to the reduction in fire fatalities seen during this period. In 1976, less than 10% of all homes had a smoke detector, while in 1986, nearly 80% did [1]. Over the next 14 years the increase in the number of protected homes slowed dramatically, so that today slightly over 90% of all homes have a smoke detector. Many of the smoke detectors installed in homes are now over 20 years old, making it time to think about replacement.

A nationwide Consumer Product Safety Commission (CPSC) study of smoke detectors in 1992 showed that 25% of the installed smoke detectors failed to respond to the test button or an aerosol smoke test spray [2]. Since the average number of smoke detectors per household is 1.6, this means that 20% of the households with smoke detectors did not have a single detector that worked. Add in the 10% of the homes without detectors and 30% of all homes in this country do not have a single operating smoke detector! The 2002 Fire in Minnesota Report shows that 60% of all building fire fatalities in the state occurred with no smoke detectors or inoperable smoke detectors present [3]. While it is clearly necessary to continue pushing for smoke detectors in homes without them, it is also necessary to address the problem of why so many installed detectors are inoperative.

### Requirements in the 2003 Minnesota State Fire Code

MSFC (03) Section 901.6 requires that fire protection equipment must be maintained operational at all times, or be repaired or replaced as necessary [MSFC (03) Section 901.6]. Furthermore, National Fire Protection Association (NFPA) Standard 72, 1999 Edition (the adopted fire alarm standard in Minnesota ) requires testing of smoke detectors at least once per month.

### Guidance from the 1999 edition of NFPA 72

New wording in Section 8-3.5 of the 1999 edition of NFPA 72 greatly clarifies the issue of smoke detector

replacement. Basically, in apartments and one and two family dwellings, smoke detectors shall be replaced when they fail to respond to tests, but shall not remain in service longer than 10 years after the date of installation. Additionally, most smoke detector manufacturers now indicate a maximum service lifetime of 10 years for their product. In fact, the new long life battery powered smoke detectors have a battery that doesn't need to be changed for 10 years. Since the battery is not designed to be changed, the directions with the detector recommend that the entire unit (battery and detector) be discarded and replaced at the end of 10 years.

### **Why was 10 years selected for replacement?**

Although incomplete, the data for smoke detectors indicate that about 3% fail in a given year [4,5].

This is the rate of detector failure based on statistically random equipment malfunction and does not represent detectors that do not operate because the power supply was removed. So at the end of one year, 97% of the detectors should still be functioning if supplied with power. In an ideal world, it would be desirable to replace detectors every year to minimize failures, but this would never happen due to cost. After 20 years, only 54% of the detectors could be expected to work, clearly not an acceptable level. Although it may seem like too many failures to allow, at 10 years about 73% of the detectors should still be operational when powered. Monthly testing and maintenance should catch failures much sooner, so that replacement at 10 years is simply a backup for people who do not test their detectors.

### **But don't most detectors fail because the power was removed?**

By far, the most common reason why detectors do not work is because the power supply has been removed. The CPSC study found that 60% of the detector failures were the result of disconnected AC power and dead or removed batteries [2]. Almost always, the power was intentionally removed because of problems with false alarms. But additional field studies by the CPSC discovered that approximately 50% of the inoperable detectors they found were over 10 years old. Several reasons lead to the discouraging fact why so many older detectors are disconnected:

- As detectors age, they experience sensitivity drifting that usually results in the detector becoming more sensitive. The detector may then alarm for no reason or more frequently when cooking, for example.
- In some cases, older detectors were manufactured to be more sensitive. Again, too many false alarms cause people to remove power from their detector.
- Newer smoke detectors incorporate hush features that allow a false alarm to be silenced.

Clearly, this makes it important that older detectors, especially the ones that were installed in the 1970's and 1980's, need to be replaced. In addition to being more likely to fail, they are more likely to have the power removed.

### **Recommendations**

Operating smoke detectors have been shown to cut your chance of dying in a home fire in half [1]. To improve the level of protection, smoke detectors should be replaced when any of the following occur:

- The detector fails to respond by the test button or with an aerosol smoke spray. Check to make sure the detector is powered and if necessary retest the detector after power has been returned.
- The detector has been painted, physically damaged or received water damage.
- The detector has been exposed to a fire, or large accumulations of grease.
- The detector frequently produces false alarms for no reason.
- The smoke detector has exceeded the manufacturer's recommended service life, or has been in use for more than 10 years.

More information is available from the Minnesota State Fire Marshal Division at (651) 215-0500. You can also email questions to [firecode@state.mn.us](mailto:firecode@state.mn.us) or visit the web page at <http://www.fire.state.mn.us> for the latest information on fire in Minnesota.

## References

[1] Ahrens, Marty, "Batteries not Included," NFPA Journal. National Fire Protection Association, May/June 1998, pages 98-109.

[2] Smith, C. L., "Smoke Detector Operability Survey: Report on Findings (revised)," U. S. Consumer Product Safety Commission, October 1994. Results published in the International Journal for Consumer Safety, Vol. 1, No. 1, March 1994.

[3] "Fire in Minnesota, Fire Reporting System" Minnesota Department of Public Safety, State Fire Marshal Division, 2002

[4] Ontario Canada Housing Corporation field study on smoke detector performance.

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Last Modified: September 12, 2013.

For additional information, contact **Robert Dahm**, Minnesota State Fire Marshal Division, at [Robert.Dahm@state.mn.us](mailto:Robert.Dahm@state.mn.us) or (651)215-0500.

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444 Cedar St., Suite 145

St. Paul, MN 55101-5145

651-215-0500 – voice

651-215-0525 – fax

651-282-6555 - TDD