

Alarm Age Fact Sheet

Why NFPA recommends home smoke alarms be replaced after 10 years

Smoke alarms are one of the most important safety features of your home. Properly installed, working smoke alarms will give you the early warning you need to safely escape from a fire. But how do you make sure your alarms are working? One important way is to replace them after 10 years.

As electronic devices, alarms are subject to random failures. Product, installation, and maintenance standards are used to assure products work as designed despite this. Part of the technical basis for the first alarm product standard was an assessment of expected failure rate, estimated at four per million hours of operation or one every 30 years. Early field studies of alarm reliability, notably by Canada's Ontario Housing Corporation, confirmed the essential accuracy of this estimate, restated as a 3% failure rate per year. This means a very small fraction of home smoke alarms will fail almost immediately, and 3% will fail by the end of the first year. After 30 years, nearly all the alarms will have failed, most years earlier.

How soon should you replace your alarm? This is a value judgment. Only 3% of alarms are likely to fail in the first year, and annual replacement would be very expensive, so that doesn't make sense. At 15 years, the chances are better than 50/50 that your alarm has failed, and that seems too big a risk to take. Manufacturers' warranties for the early alarms typically ran out in 3-5 years. So, in ten years there is roughly a 30% probability of failure before replacement. This seemed to balance safety and cost in a way that made sense to the responsible technical committees.

If a 30% failure probability still seems too high, remember that replacement on a schedule is only a backup for replacement based on testing. A national study found home smoke alarms, when they fail, tend to fail totally, as opposed to hard-to-detect creeping failure, such as a loss of sensitivity.¹ Regular monthly testing will help discover alarm failure as well as a dead or missing battery. You can replace your alarm when it needs replacing.

The same study showed *all* the inoperable alarms tested in 1992 were at least 5 years old and predated a 1987 change in product standards that reduced sensitivity to reduce nuisance alarms. Changes in alarm chip design, among other improvements, make it likely that electronic failure now occurs at a rate much less than 4 times per million hours of operation.

Replacing alarms after 10 years protects against the accumulated chance of failure, but monthly testing is still your first, best means of making sure alarms work. Today's alarms are even less vulnerable than the original alarms. Regular maintenance of the more sophisticated systems used in larger buildings can keep them working very reliably for many decades.

¹ Julie I. Shapiro, *Smoke Detector Operability Survey*, Washington: U.S. Consumer Product Safety Commission, October 1994 revised.