**Saskatchewan**
**Corrections and**
**Public Safety**

Office of the Fire Commissioner

Suite 310-1855 Victoria Avenue
Regina, Saskatchewan
S4P 3V7

# Technical Advisory

**Title:** Smoke Alarms

**Issued:** November 2002

Many factors influence and compliment the effectiveness of smoke alarms, such as frequent and scheduled alarm testing, practicing established home escape plans and home fire safety. A working smoke alarm does not always guarantee survivability, but rather only increases the occupant's chances of escape.

Provincial regulations (National Building Code of Canada, NBC) require that a smoke alarm be installed on every level of a residence. Where the smoke alarm is installed will greatly affect its effectiveness. Some general rules regarding location are:

Smoke alarms shall be located on the ceiling no closer than 10 cm (4") to a side wall or on a wall located no less than 10 cm (4") and no more than 30 cm (12") from the ceiling. These distances are required to keep the smoke alarm out of a dead air space.
On ceilings with exposed joists or beams, smoke alarms shall be mounted on the bottom of such structures.
Smoke alarms should be installed a minimum of 1m from the centre of bathroom or laundry room doors.
Smoke alarms should not be located near air-conditioners, forced air ventilation, ceiling fans or where open windows may be present.
Smoke alarms should be located between the sleeping area and other rooms in the house. The detectors should be close enough to the bedrooms so that the alarm can still be heard when the bedroom door is closed.

Smoke alarms require specific inspection, testing, and maintenance. Manufactures instructions should be followed in testing and maintaining the smoke alarm. This should be done on a monthly basis and batteries should be replaced annually.

There are other factors that may influence the ability of smoke alarms to activate as designed. These factors include, inadequate coverage within accommodation spaces, poorly maintained or tested alarms, smoke movement effects and smoke particulate size and colour. Although each factor is equally important, the least understood is particulate size and colour in relationship to the right type of smoke alarm. Certain factors affect the particle size and color of smoke.

For Example:

- Plastics tend to produce larger particle and darker smoke than cellulose material produces.
- Smoldering fires tend to produce larger particles and lighter smoke than fast flaming fires.
- "Aged Smoke" or "Cold Smoke" is smoke that has moved some distance away from the fire and tends to have larger particles than the same smoke that is nearer the fire. This can occur with light or dark color smoke.

In addition to the fact that there are different kinds of smoke (large and small particulate, dark and light color as well), each type of smoke alarm (ionization and photoelectric) reacts in different ways, since each operates on different principals.

**Ionization Alarms**
An ionization smoke alarm has a small amount of radioactive material that ionizes the air in the sensing chamber, rendering the air conductive and permitting a current flow through the air between two charged electrodes. This gives the sensing chamber an effective electrical conductance. When smoke particles enter the ionization area, they decrease the conductance of the air by attaching themselves to the ions, causing a reduction in ion mobility. When the conductance is below a pre-determined level, the alarm sounds.

**Photoelectric Alarms**
A photoelectric alarm operates on a light scattering principal. They contain a light source and a photosensitive device arranged so the light rays normally do not fall onto the device. When smoke particles enter the light path, light strikes the particles and is scattered onto the photosensitive device, causing the alarm to respond.

These differences can impact on an alarms response time. As a rule ionization alarms are most sensitive to smaller particulate (aerosols produced from fast flaming fires) and darker colored smoke. Photoelectric alarms are more sensitive to larger particulate and lighter coloured smoke. Cold smoke or smoke from slow smoldering fires, which typically contain larger particulate may not even activate an ionization detector at all. In addition photoelectric alarms tend to show a decreased sensitivity to dark smoke. This is due to the fact that dark smoke absorbs rather than refracts the light, which the photoelectric alarm relies upon to activate. As a consequence different kinds of smoke will cause each type of alarm to respond differently or possibly not at all. The need for a balanced combination of each type of alarm in most occupancies would be beneficial, to afford occupants the earliest possible warning.