Domestic smoke detectors

Smoke detectors

Smoke detectors perform a life-saving function in the event of a fire. They provide an early warning of a fire and give time to escape. Smoke detectors are compulsory and must be installed in every residential building. Smoke detectors must meet the Australian Standard AS 3786.

There are two main types of smoke detector – ionisation chamber detectors and photoelectric detectors. Both ionisation chamber and photoelectric smoke detectors meet the requirements of AS 3786.

Ionisation chamber smoke detectors contain a small amount of radioactive material.

Both types of smoke detectors are permitted in Victoria. Many hardware stores no longer sell ionisation smoke detectors. However, historically the majority of smoke detectors were ionisation smoke detectors.

Ionisation chamber smoke detectors

Ionisation chamber smoke detectors contain a small quantity of radioactive material – Americium-241 (Am-241). The radioactive material is in the form of a foil and is rigidly mounted inside a steel chamber. It is designed to be resistant to mechanical, chemical and thermal abuse.

The Am-241 radioactive source emits two types of radiation – alpha radiation and gamma radiation.

The alpha radiation ionises the air within the metal chamber. A low electric voltage applied across the chamber causes a current to flow through the ionised air. When smoke particles enter the chamber, the current flow is altered and this in turn triggers an alarm.

Ionisation chamber smoke detectors can be quicker to detect smoke from fast flaming fires.

A domestic smoke detector containing less than 40 kBq of Am241 has been declared not to be a radiation source under the Radiation Act 2005.[1]

Photoelectric smoke detectors

Photoelectric smoke detectors do not contain radioactive material. They comprise a light source and a sensor. Normally the light passes through, missing the sensor. When smoke particles enter the detector, the light is scattered and some light then reaches the sensor, which triggers an alarm.

Photoelectric smoke detectors can be quicker to detect smoke from slow smouldering fires. They are also less likely to give a false alarm.

[1] Victorian Government Gazette, No. S 207 [https://www2.health.vic.gov.au/about/publications/policiesandguidelines/Declaration-that-certain-material-and-apparatuses-are-not-radiation-sources]

Ionisation chamber smoke detector safety

The risk of harm from exposure to radiation from ionisation smoke detectors is negligible. The alpha radiation, which is emitted by the radioactive source, will not even penetrate more than a few centimetres through air and is therefore contained within the chamber of the detector. The gamma radiation emitted by the source is of low energy (penetrating ability) and is substantially shielded by the detector housing. Gamma radiation intensity decreases rapidly with increasing distance from the source.

The gamma radiation at one metre from an unshielded americium-241 source of the typical activity found in domestic smoke detectors would expose a person to about 3,000 times less than the radiation dose they would receive from natural background radiation. Natural background radiation includes radiation from rocks and soil and cosmic rays from the sun.

It should be noted that the actual dose received from the smoke detector would be much less than that stated above because the Americium-241 source is shielded by the metal chamber and a person would not normally be at a distance of one metre from the smoke detector for any length of time. The radiation dose that individuals receive from smoke detectors installed in their house is therefore negligible.

The smoke detector should not be dismantled. The smoke detector batteries should be changed according to the manufacturer's recommendations. There are no special requirements for the disposal of smoke detector batteries.

Disposal of smoke detectors

When a smoke detector is replaced or permanently removed, it should be disposed of in general household waste. Smoke detectors are not included in the e-waste ban[2] and must not be disposed of as e-waste, recycling or to any route that may dismantle them in any way.

Smoke detectors must not be dismantled and should be disposed as complete units.

The amount of radioactive material in a smoke detector is very small. From environmental and public health perspectives, the risk from disposing of complete smoke detectors to landfill and other related processing associated with general household waste disposal is negligible.

To receive this publication in an accessible format phone 1300 767 469 or email radiation.safety@dhhs.vic.gov.au.

Authorised and published by the Victorian Government, 1 Treasury Place, Melbourne.

Available at https://www2.health.vic.gov.au/public-health/radiation

[2] https://www.sustainability.vic.gov.au/campaigns/ewaste