

Domestic Smoke Detectors Are Safe

Smoke detectors perform a life-saving function in the event of fire which far outweighs any radiation risk from the small amount of radioactive material contained in the detectors. Smoke detectors are now more common as fire safety requirements have been introduced to have detectors installed in all Victorian houses. This leaflet has been prepared to provide information on the radiation risk from smoke detectors.

What Are the Benefits?

Smoke detectors perform a life-saving function in the event of fire. They are highly recommended by fire protection authorities around the world. The life-saving benefits of smoke detectors far outweigh any risk due to radiation exposure that may result from their use.

What Are the Risks?

The risk of harm from radiation exposure from smoke detectors is considered to be minuscule. Alpha radiation, which is emitted by the radioactive source used to make the detector operate, will not even penetrate through air for more than a few centimetres and is therefore contained within the chamber of the detector. Gamma radiation emitted by the source is of low intensity (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 1 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 radiation¹. Everyone is exposed to 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 detector would be much less than this since the americium-241 source is shielded by the metal chamber and a person would not normally be at a distance of 1 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 minuscule.

The probability of the source being removed from the tamperproof chamber and then swallowed is extremely remote. The internal radiation hazard is therefore minimal. A case has been documented, where a worker in a factory making smoke detectors swallowed two of the radioactive sources. Even in this case, the radiation exposure was small as the sources passed through his body with very little leakage.

Disposal of Smoke Detectors

Smoke detectors are required to be returned to the supplier for disposal and not disposed of with normal household refuse. One of the conditions of the licence to sell smoke detectors is that the sales company must accept unwanted detectors for disposal. The detector is required to be marked with

supplier return details followed by the name and address for return purposes.

Should there be any difficulty in returning unwanted detectors (particularly older detectors) to the supplier they may also be returned to a metropolitan fire station or to the Department of Human Services, Radiation Safety Program.

The individual hazard from a smoke detector being disposed of to landfill is very small¹. However, with the large numbers of detectors being sold, a conservative approach of controlling the disposal of detectors, in line with National Health and Medical Research Council (NHMRC) recommendations, has been adopted. The public is requested to act responsibly by returning unwanted detectors as indicated on the labelling.

Regulations on Smoke Detectors

The sale of smoke detectors by companies in Victoria is subject to the *Health (Radiation Safety) Regulations 1994*². A company cannot sell smoke detectors containing radioactive material unless a licence is held to sell sealed radioactive substances. The licence is normally issued to the distributor or importer and is approved only after each brand of smoke detector has met all requirements under the Regulations. The requirements are based on recommendations of the NHMRC³ and have also been adopted into an Australian Standard⁴ on smoke detectors. The detector must therefore be demonstrated to be an effective fire protection device before it is sold.

How Smoke Detectors Work

Smoke detectors contain a minute quantity of the radioactive material americium-241 (Am-241). The radioactive material is in the form of a foil and is rigidly mounted inside a steel chamber which 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 inside the 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.

Further Information

Further information on smoke detectors can be obtained from:

Radiation Safety Program
Department of Human Services
17th floor, 120 Spencer Street
Melbourne Victoria 3000

Phone: (03) 9637 4167
Fax: (03) 9637 4508
email: radiation.safety@dhs.vic.gov.au

References

1. Robertson, M. 1990, 'Domestic Smoke Detectors - A Safe Investment', *Radiation Protection News and Notes*, National Radiation Laboratory, New Zealand, No. 9 January 1990.
2. *Health (Radiation Safety) Regulations 1994* Statutory Rule No. 165/1994
3. Australian Radiation Laboratory, 'Domestic Smoke Detectors using Radioactive Material', *Information Bulletin No. 10*, July, 1985
4. Australian Standard, AS 3786 - 1993 Smoke Alarms.