



Tech Talk provides accurate and timely information on topics of interest to the fire protection community. Topics are selected based on inquiries and suggestions that USFA receives from readers. To suggest a topic for a future edition of Tech Talk, [please contact us](#).

Disposal of Fire/Smoke Detectors

Introduction This edition of Tech Talk looks at the disposal of fire/smoke detectors. Depending on where you live and what type of fire or smoke detector you need to dispose of, there may be regulations that apply to the disposal of scrap detectors.

Types of Smoke Detectors The two types of smoke detectors most commonly encountered in the United States are ionization detectors and photoelectric detectors. Ionization-type smoke detectors contain a very tiny amount of radioactive material. Photoelectric-type smoke detectors do not contain any radioactive material. Combination smoke detectors, which contain both ionization and photoelectric smoke sensors, also contain a very tiny amount of radioactive material.

How to tell the difference If a smoke detector contains radioactive material, it is required by law to have a warning label on the body of the smoke detector. The label is usually located at the “top” of the detector, facing the mounting base that attaches to the ceiling or wall. Remove the smoke detector from its base, and look at the label. A typical label might read:

This product is designed to detect products of combustion using ionization technology. It contains 0.9 microcurie of Americium 241, a radioactive material.



The label may have the international symbol for radiation on the label.

If a smoke Detector does not include either the warning or the radiation symbol on the label, and if there is no evidence that the label has been removed or destroyed, it is safe to assume that the device does not contain any radioactive material. If the label has been removed or destroyed, it is best to treat the device as if it is an ionization unit, and dispose of it as described below.

Radiation from Ionization Smoke Detectors



Modern ionization smoke detectors contain about 0.28 microgram (0.0000000098 ounce) of Americium-241, which is a radionuclide. Americium-241, in the form of americium dioxide, is used as the source of ionizing radiation. Americium has a half-life of 432.2 years, and decays into Neptunium-237.

The health hazard posed by a radioactive material depends on the activity level of the material (how strong it is) and on the type of radiation that the material emits. The activity level of radioactive material is measured in units called Curies (**Ci**). Due to the very tiny amount of Americium present in the smoke alarm, the activity level is measured in micro-Curies (**μCi**), which is 10^{-6} or 1/1,000,000 of a Curie. Ionization smoke detectors manufactured today use no more than 1 μCi of Americium-241.

Americium-241 emits alpha particles and low-energy gamma rays when it decays. The low-energy alpha particles emitted from the detector penetrate the air no more than a few centimeters (about 1 inch). The gamma radiation is a low intensity gamma ray, and much of this is absorbed by the case of the detector.

The Americium-241 used in smoke detectors is bonded to a metallic foil, which is sealed inside the ionization chamber. According to the Nuclear Regulatory Commission (NRC), this presents no hazard to users as long as it is undisturbed. The NRC advises that the amount of radiation that escapes from a modern smoke detector is roughly 3,000 times less than the normal background radiation exposure rate when measured 1 meter (3 feet) from the detector. Background radiation consists of the radiation from everyday sources such as the sun, rocks, soil, air, etc.

Important Exception—High Voltage Smoke Detectors

In the early days of smoke detector manufacturing, the amount of radioactive material used in the smoke detector was larger than what has been used in the past 20 or so years. (Some very early smoke detectors were made using Radium-226 instead of Americium-241.) These older smoke detectors were sold for use in industrial or commercial facilities. Replacement parts for these systems are still available on the Internet, so they are occasionally encountered in some older facilities.

These old high-voltage ionization detectors have about 80 μCi of Americium-241, compared to typical modern low-voltage ionization detectors that contain less than 1 μCi . Due to the larger amount of radioactive material in these older smoke detectors, they must be handled differently than modern smoke detectors to ensure safety. Refer to the *Disposal* and *Storage* headings later for information on how to handle these detectors. They are, however, considered to be safe when installed and operating as part of a fire detection and alarm system.

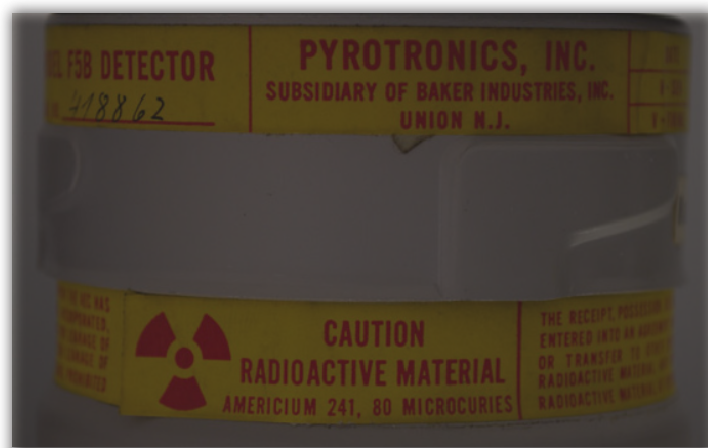
The most commonly encountered of these older high-voltage smoke detectors were manufactured by the Pyrotronics Corporation in the 1960s. They were marketed under the model numbers F3/5, F5/B and FES.5, and using the trade name “PYR-A-LARM.” The photos that follow show examples of these detectors. (As a result of a series of business transactions, the legacy of Pyrotronics Corporation has been merged into Siemens AG - Building Technologies Division.)



Model F3 Ionization Smoke Detector



Model F5/B Ionization Smoke Detector



Model F5/B Ionization Smoke Detector with outer housing removed to show label

Recycling Electronic Devices

Recycling is almost always preferable to disposal in a landfill or an incinerator. According to the U.S. Environmental Protection Agency (EPA), recyclers recover more than 100 million pounds of materials from electronics each year. For up-to-date information on recycling of electronics (eCycling), visit the EPA's eCycling Web page: <http://www.epa.gov/epawaste/consERVE/materials/ecycling/basic.htm>

To locate a recycling facility for electronics in your area, visit the Web site of the Institute of Scrap Recycling Industries (ISRI), Electronics Recycling Industry: <http://www.isrielectronics.org/search/>

Many States and municipalities offer periodic recycling opportunities for electronic devices and/or smoke detectors. Check with your State or local solid waste disposal authority for the most current local guidance.

Disposal of Fire and/or Smoke Detectors



Regulatory Factors: Federal regulations do not address the disposal of smoke detectors, heat detectors, flame detectors and/or other types of fire detection systems and/or components. However, there may be State or local requirements applicable to disposal of **ionization** smoke detectors; see *Disposal of Ionization Smoke Detectors* for more information.

General Guidance: Recycling is the preferred option for disposal of all fire alarm components. The *Recycling Electronic Devices* section of this Tech Talk provides information about recycling of electronics. In the absence of state or local regulations to the contrary, scrap fire detection and alarm system components may be disposed of in the normal municipal waste stream.

Disposal of Ionization Smoke Detectors



Ionization smoke detectors containing less than 1 μCi of Americium-241 are exempt from Nuclear Regulatory Commission regulations. This means that Federal Law does not prohibit the disposal of these detectors in the normal municipal waste stream. There are, however, a number of State and local regulations and/or laws that do prohibit disposal of ionization smoke detectors in the municipal waste stream. Contact the local solid waste management authority for up-to-date information about local regulations or directives.

Older ionization detectors that contain more than 1 μCi of Americium-241 are subject to regulation by the NRC, and they are subject to more stringent requirements. Smoke detectors with 5 μCi or more of Americium-241 should never be disposed of in the municipal waste stream.

Some State Radiation Control Programs conduct an annual roundup of ionization smoke detectors similar to the roundup of batteries or hazardous household chemicals. Other State or local governments recommend that you return the unneeded smoke detectors to the manufacturer. The address of the manufacturer is usually listed in the product warranty or user's manual.

Be sure to remove any battery from the smoke detector and dispose of it at a hazardous waste disposal event or facility.

The table below provides general recommendations for disposal of ionization smoke detectors based on the amount of Americium-241 in the detector. Modern ionization smoke detectors contain less than 1 μCi of Americium-241, while some older units may contain as much as 80 μCi of Americium-241.

Note: The label on the detector should list the amount of Americium-241 that is inside the detector.

Caution! Never disassemble or take apart ionization smoke detectors!

This table provides disposal guidelines for ionization smoke detectors.

If the amount of Americium-241 in the detector is	Then dispose of the detector in this way:
Less than 5 µCi	These smoke detectors should be recycled if possible. (The <i>Recycling Electronic Devices</i> section of this Tech Talk provides information about how to recycle unneeded electronics.) Alternately, unless State or local regulation requires otherwise, they may be disposed of as normal municipal waste.
More than 5 µCi	These smoke detectors must be returned to the manufacturer for proper disposal. The entire smoke detector needs to be returned to the manufacturer by ground mail; not via airmail. Contact the manufacturer directly, and they will provide instructions regarding the special packaging and shipping requirements that apply to these detectors.

**Storing Smoke/
Fire Detectors**

The guidelines that follow apply only to the storage of detectors. They do not apply to detectors that are installed and working.

**Other than
ionization type**

There are no recommendations concerning the number of photoelectric or other nonionization detectors which may be stored in any one location. The normal limitations on the quantity of combustible materials that may be stored in a space, and the configuration of that storage, should be followed.

**Ionization type
smoke detectors**

Due to the radiation hazard that may be present if a large number of ionization smoke detectors are stored closely together, additional safety precautions are recommended. Never place more than 100 ionization smoke detectors in any one box, cabinet, or room, except as noted in the following table.

Note: The label on the detector should list the amount of Americium-241 that is inside the detector.

Note: The storage guidelines for ionization detectors are different from the regulations that must be followed when shipping them. Be sure to follow the applicable shipping regulations if you are shipping ionization detectors.

**Recommended Storage Guidelines for Smoke Detectors containing
less than 80 μ Ci of Americium-241**

This table includes guidelines applicable to most modern low-voltage ionization smoke detectors

If you are storing this many detectors	Then follow this guidance:
Each detector	Each detector should be placed in its own sealed plastic bag. When fewer than 100 detectors are stored together, there are no other special storage recommendations.
More than 100 detectors	<p>Detectors should be stored in areas not normally occupied by personnel. Each detector should be individually wrapped in sealed plastic bags, and placed in sturdy cardboard boxes with shock absorbent material.</p> <p>The weight of each box should not exceed 50 pounds.</p> <p>The boxes should be located in an area that is not continuously occupied by personnel.</p>
More than 400 detectors	Where more than 400 detectors are stored in the same room, radiation monitoring devices should be used to check the radiation levels in the area.

**Recommended Storage Guidelines for Smoke Detectors containing
more than 80 μCi of Americium-241, or any amount of Radium-226**

This table includes guidelines applicable to older high-voltage smoke detectors.

If you are storing this many detectors	Then follow this guidance:
Each detector	Each detector should be placed in its own sealed plastic bag. When fewer than 10 detectors are stored together, there are no other special storage recommendations.
10 to 100 detectors	Each detector should be individually wrapped in a sealed plastic bag and placed in sturdy cardboard boxes with shock absorbent material. The box(es) should be located at least 10 feet from the normal work location of any person. The weight of each box should not exceed 50 pounds.
More than 100 detectors	When more than 100 detectors are to be stored, they should be located in areas not normally occupied by personnel. Each detector should be individually wrapped in sealed plastic bags, and placed in sturdy cardboard boxes with shock absorbent material. The weight of each box should not exceed fifty 50 pounds. The boxes should be located in an area that is not continuously occupied by personnel. Individual boxes should be stored in different rooms if storage time will exceed five 5 days.
More than 200 detectors	Where more than 200 detectors are stored in the same room, radiation monitoring devices should be used to check the radiation levels in the area.