



Designation: E3191 – 18

Standard Specification for Permanent Foaming Fixatives Used to Mitigate Spread of Radioactive Contamination¹

This standard is issued under the fixed designation E3191; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification is intended to provide a basis for identification of non-removable permanent foaming fixatives as a long-term measure used to immobilize or isolate radioactive contamination, or both, minimize worker exposure, and to protect uncontaminated areas against the spread of radioactive contamination.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*

E3105 Specification for Permanent Coatings Used to Mitigate Spread of Radioactive Contamination

E2420 Guide for Post-Deactivation Surveillance and Maintenance of Radiologically Contaminated Facilities

3. Terminology

3.1 *Definitions:*

3.1.1 *complete pouring, n*—pouring of a sufficient volume of a foaming fixative to entirely fill a desired 3-dimensional void space.

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3.1.2 *contamination, n*—radioactive material in an unwanted location.

3.1.3 *environmental conditions, n*—external factors that may contribute to the performance of the coating including, but not limited to, temperature, humidity, and ventilation.

3.1.4 *incremental pouring, n*—pouring of fresh material onto a previously applied cured layer of the same material.

3.1.5 *long-term measure, n*—greater than six months.

3.1.6 *lower flammability limit (LFL), n*—the lower end of the concentration range over which a flammable mixture of gas or vapor in air can be ignited at a given temperature and pressure.

3.1.7 *mechanical deterioration, n*—breakdown of the materials mechanical attributes to the point that it is no longer able to retain >95 % of fixated or isolated contamination, or both.

3.1.8 *permanent foaming fixative, n*—a non-removable, durable foaming product capable of filling variable sized regular and irregular 3-dimensional void spaces used to physically isolate or chemically hold or bind radioactive particulate.

3.1.9 *waste acceptance criteria (WAC), n*—the criteria that a material must meet for acceptance in a waste disposal site; these criteria may vary per disposal site.

3.1.10 *working time, n*—the time period between the opening of the material storage container or mixing of components until the prepared material can no longer be successfully applied to a surface.

4. Significance and Use

4.1 This specification establishes performance specifications for permanent foaming fixatives that are intended to immobilize or isolate, or both, dispersible contamination deposited within a void space as might result from anticipated to unanticipated events to include normal operating conditions, decommissioning, and radiological release.

4.2 The foaming fixative is intended to be a permanent, non-removable, long-term material used for decommissioning and operations. It is intended to isolate the contamination from active working areas. It may also enable reduction in building requirements such as induced airflow or negative air pressure.

4.3 The foaming fixative is intended to be used for filling contaminated 3-dimensional void spaces of various volumes that would be difficult to otherwise coat with conventional 2-dimensional fixatives.

4.4 The foaming fixative can be applied to both porous and nonporous materials such as concrete, wood, metal, ceramics, and plastics.

4.5 Some of these specifications may prove difficult to meet. A product that meets some, but not all, of the performance specifications herein may have value, and this specification may be used as a guide by which to evaluate such products.

5. Mechanical Properties

5.1 The foaming fixative shall be compatible with at least one of the following conventional or remote application systems:

- 5.1.1 spraying,
- 5.1.2 complete pouring, or
- 5.1.3 incremental pouring.

5.2 The foaming fixative shall have sufficient mechanical properties to withstand long-term wear associated with incidental impact, abrasion, or vibration that are likely to cause loss of containment of the isolated contaminant.

5.3 The foaming fixative should be readily applied within the desired void space without significant preparation (cleaning, sanding, primer layer, etc.). This does not supersede a facilities decision for gross decontamination prior to application of the foaming fixative.

5.4 The foaming fixative should have sufficient mechanical properties to withstand contingency events such as earthquakes as outlined in a facilities' safety design basis document.

6. Chemical Properties

6.1 The foaming fixative shall not include nor generate toxic by-products as defined by U.S. Occupational Safety and Health Administration (OSHA) during preparation, application, or removal for disposal under normal conditions. A Safety Data Sheet must be provided so that appropriate personal protective equipment can be selected.

6.2 The foaming fixative shall not generate flammable by-products above 20 % of the lower flammability limit (LFL).

6.3 The foaming fixative should seek to limit the propagation of flame across the surface.

6.4 The foaming fixative should seek to limit smoke production upon incident flame.

6.5 The foaming fixative should not sustain a flame upon removal of an ignition source.

6.6 The foaming fixative shall be non-reactive after curing with respect to chemical interaction.

6.7 The foaming fixative shall maintain a near neutral pH (6-8) before curing.

6.8 The foaming fixative should not attract or be a foodstuff for animals, insects, pests, or undesirable bacteria.

6.9 The foaming fixative shall be chemically non-hazardous after curing as defined by the U.S. Environmental Protection Agency (EPA).

7. Performance Requirements

7.1 *Shelf Life*—The foaming fixative shall have a shelf life in accordance with 8.1.

7.2 *Working Time*—The foaming fixative shall exhibit a working time sufficient to meet a realistic application rate. Working time is heavily dependent on the method of application. The application method is purposely left unconstrained and is up to the manufacturer to prescribe.

7.3 *Cured Volume*—The foaming fixative upon curing shall form a fixating volume that meets the physical, mechanical, and other requirements listed in Sections 4 through 8 of this specification.

7.4 The foaming fixative shall prevent >95 % release of radioactive particles from the isolated volume.

7.5 The foaming fixative shall maintain an uncompromised volume such that significant amounts of respirable particles (<10 µm) of the fill material are not generated during instantaneous events having a 3-min duration, such as fire, abrasion, impact, or earthquake.

7.6 The foaming fixative should be impermeable to water present from both leakage sources and ambient humidity.

7.7 The foaming fixative should be compatible with temperature cycles ranging from -40 to + 120°F (-40 to +49°C) for facilities without environmental regulating systems.

7.8 The foaming fixative should be compliant with waste acceptance criteria (WAC) for potential disposition in those instances where required. The foaming fixative should be capable of segregation to allow for ease of waste package such that compliance with WAC can be easily satisfied.

7.9 The foaming fixative shall isolate contamination material that is both respirable (<10 µm) and non-respirable (≥ µm).

7.10 The foaming fixative shall not generate heat sufficient to compromise any of the components within the enclosure to which it is applied.

7.11 The foaming fixative shall not generate heat sufficient to self-ignite the foaming fixative material.

8. Minimum Performance Criteria

8.1 *Shelf Life*—Minimum of two years.

8.2 *Airborne Release Fraction*—No minimum, however a desirable characteristic would be to provide ≥95 % immobilization of ≥10 µm particles when disturbed by 50 psi air burst.

8.3 *Respirable Fraction*—No minimum, however a desirable characteristic would be to provide ≥95 % immobilization of <10 µm particles when disturbed by 50 psi (345 kPa) air burst.

8.4 *Radiation Resistance*—5 MRad over the projected lifetime of the material.

NOTE 1—Application must consider both the time requirement and the radiation in the environment to ensure the material is adequately suited for use.