Designation: E3104 – 17

Standard Specification for Strippable & Removable Coatings to Mitigate Spread of Radioactive Contamination[1]

This standard is issued under the fixed designation E3104; 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 strippable/removable materials used to immobilize radioactive contamination, minimize worker exposure, and facilitate subsequent decontamination or 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 and health 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:*[2]

D412 Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension

D4541 Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers

D4060 Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser

E2731 Specification for Materials to Mitigate the Spread of Radioactive Contamination after a Radiological Dispersion Event

3. Terminology

3.1 *Definitions:*

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

3.1.2 *decontamination, n*—removal of contamination from an unwanted location.

3.1.3 *decontamination system, n*—one or more products or procedures, or both, that, when used together, form a stabilizing material to hold or bind radioactive contamination for subsequent removal from the substrate.

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

3.1.5 *immobilize, v*—to fix in place; to prevent movement or re-aerosolization of particulates due to mechanical or environmental forces such as by tracking, precipitation, or wind. (E2731–09)

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 *removable coating, n*—products that fall outside the purview of strippable coatings, that is, products that are temporary coatings and removed through methods other than stripping, that are used to physically or chemically hold or bind radioactive particulate that may also be capable of subsequent removal of radioactive contamination.

3.1.8 *strippable coating, n*—durable film-forming product used to physically or chemically hold or bind radioactive particulate that may also be capable of subsequent removal of radioactive contamination.

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.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

4. Significance and Use

4.1 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.

4.2 This specification establishes performance specifications for a coating that is intended to immobilize dispersible radioactive contamination deposited on buildings and equipment as might result from anticipated to unanticipated events to include normal operating conditions, post-operational cleanout (decontamination), decommissioning, and radiological release.

4.3 The strippable/removable coating is intended to be removable during subsequent decontamination operations. It is intended to reduce: *(1)* migration of the contamination into or along buildings, equipment, and other surfaces; *(2)* resuspension of contamination into the air; and *(3)* the spread of contamination as a result of external forces such as pedestrian traffic.

4.4 The strippable/removable coating is intended to reduce the airborne intake hazards of the radioactive contamination.

4.5 The strippable/removable coating shall be applicable to both vertical and horizontal surfaces.

4.6 The strippable/removable coating should be able to work within a range of environmental and radiological conditions.

4.7 The strippable/removable coating should be readily applied to both porous and nonporous materials such as concrete, wood, metal, ceramics, and plastics.

4.8 The strippable/removable coating may include constituents that will physically or chemically bind and immobilize radioactive contamination.

4.9 The strippable/removable coating shall allow for controlled removal from the site or equipment. The strippable/removable coating and the method for controlled removal should result in minimal or no destruction or disfigurement of the substrate.

4.10 An additional feature that would be desirable would be the ability to act as a decontamination system when it is subsequently removed. It is expected that a certain amount of contamination will be removed from the treated surface as a function of removing the strippable/removable coating, thereby accomplishing some degree of decontamination.

5. Mechanical Properties

5.1 The strippable/removable coating shall be compatible with at least one of the following application systems: conventional or remote spray, foam, brush, fog, or roll.

5.2 The strippable/removable coating shall immobilize radioactive contamination physically, chemically, or both.

5.3 The strippable/removable coating shall have sufficient mechanical properties to withstand long-term wear associated with incidental abrasion and abrasive foot traffic that are likely to cause resuspension or transport of the stabilized contaminant.

5.4 The strippable/removable coating should be applicable to the desired surface without significant surface preparation (cleaning, sanding, primer layer, etc.)

6. Chemical Properties

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

6.2 The strippable/removable coating shall not generate flammable by-products above 20 % of the lower flammability limit (LFL).

6.3 The strippable/removable coating shall be non-volatile after curing with respect to chemical interaction under normal operating conditions.

6.4 The strippable/removable coating shall maintain a near neutral pH (5-8).

6.5 The strippable/removable coating shall not stain the substrate upon which it is applied.

6.6 The strippable/removable coating should not attract or be a foodstuff for animals, insects, pests, or undesirable bacteria.

6.7 The strippable/removable coating shall be chemically nonhazardous after curing as defined by the U.S. Environmental Protection Agency (EPA).

7. Performance Requirements

7.1 *Shelf Life*—The strippable/removable coating shall have a shelf life in accordance with 8.1.

7.2 *Working Time*—The strippable/removable coating 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 *Cure Time*—The strippable/removable coating shall exhibit a curing time sufficient to meet realistic operational and environmental conditions (that is, <24 h).The strippable/removable coating shall form a film that meets the physical, mechanical, and other requirements listed in Sections 4–8 of this specification.

7.4 The strippable/removable coating shall prevent release of radioactive particles when applied to the following surfaces commonly found in a working environment under normal wear conditions: concrete, asphalt, granite, limestone, brick, aluminum, stainless steel, painted and unpainted steel, painted and unpainted wood, glass, and plastic.

7.5 The strippable/removable coating shall maintain a film such that significant amounts of respirable particles (<10 μm) of the coating material are not generated during abrasion, impact, or earthquake.

7.6 The strippable/removable coating shall be removable by peeling or scrubbing.

7.7 The strippable/removable coating must be compliant with waste acceptance criteria (WAC) for anticipated final disposition site. The strippable/removable coating should be easily segregated to allow for ease of waste package such that compliance with WAC can be easily satisfied.

8. Minimum Performance Criteria

8.1 *Shelf Life*—Minimum of 2 years.

8.2 *Tensile Strength (Test Method D412)*—≥200 psi (1378.9 kPa).

8.3 *Adhesion (Test Method D4541)*—≥50 psi (345 kPa) on concrete under normal environmental conditions.

8.4 *Abrasion Resistance (Test Method D4060)*—<0.002 oz (50 mg) loss.

8.5 *Dry/Cure Time*—Forms film satisfying the above mechanical criteria within 24 h of application.

8.6 *Decontamination Factor (DF)*—No minimum, however a desirable decontamination factor would be ≥2.0.

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

9. Keywords

9.1 cleanup; contain; encapsulate; immobilize; radioactive contamination; radionuclide; removable coating; resuspension; strippable coating

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