



Designation: D 5819 – 99

## Standard Guide for Selecting Test Methods for Experimental Evaluation of Geosynthetic Durability<sup>1</sup>

This standard is issued under the fixed designation D 5819; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. Scope

1.1 This guide covers a designer/specifier through a systematic determination of those factors of the appropriate application environment that may affect the post-construction service life of a geosynthetic. Subsequently, test methods are recommended to facilitate an experimental evaluation of the durability of geosynthetics in a specified environment so that the durability can be considered in the design process.

1.2 This guide is not intended to address durability issues associated with the manufacturing, handling, transportation, or installation environments.

### 2. Referenced Documents

#### 2.1 ASTM Standards:

- D 1204 Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature<sup>2</sup>
- D 1987 Test Method for Biological Clogging of Geotextiles or Soil/Geotextile Filters<sup>3</sup>
- D 2990 Test Methods for Tensile, Compressive, and Flexural Creep and Creep-Rupture of Plastics<sup>4</sup>
- D 3083 Specification for Flexible Poly(Vinyl Chloride) Plastic Sheeting for Pond, Canal, and Reservoir Lining<sup>5</sup>
- D 3895 Test Method for Oxidative-Induction Time of Polyolefins by Differential Scanning Calorimetry<sup>4</sup>
- D 4355 Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus)<sup>3</sup>
- D 4594 Test Method for Effects of Temperature on Stability of Geotextiles<sup>3</sup>
- D 4716 Test Method for Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head<sup>3</sup>

- D 4886 Test Method for Abrasion Resistance of Geotextiles (Sand Paper/Sliding Block Method)<sup>3</sup>
- D 5101 Test Method for Measuring the Soil-Geotextile System Clogging Potential by the Gradient Ratio<sup>3</sup>
- D 5262 Test Method for Evaluating the Unconfined Tension Creep Behavior of Geosynthetics<sup>3</sup>
- D 5322 Practice for Immersion Procedures for Evaluating the Chemical Resistance of Geosynthetics to Liquids<sup>3</sup>
- D 5397 Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test<sup>3</sup>
- D 5496 Practice for In Field Immersion Testing of Geosynthetics<sup>3</sup>
- D 5567 Test Method for Hydraulic Conductivity Ratio (HCR) Testing of Soil/Geotextile Systems<sup>3</sup>
- D 5885 Test Method for Oxidative Induction Time of Polyolefin Geosynthetics by High Pressure Differential Scanning Calorimetry<sup>3</sup>
- D 5970 Test Method for Deterioration of Geotextiles from Outdoor Exposure<sup>3</sup>
- G 23 Practice for Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials<sup>6</sup>
- G 53 Practice for Operating Light- and Water-Exposure Apparatus (Fluorescent UV-Condensation Type) for Exposure of Nonmetallic Materials<sup>6</sup>
- G 151 Practice for Exposing Nonmetallic Materials in Accelerated Test Devices That Use Laboratory Light Sources<sup>6</sup>
- G 152 Practice for Operating Open Flame Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials<sup>6</sup>
- G 153 Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials<sup>6</sup>
- G 154 Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials<sup>6</sup>

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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 08.01.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 04.13.

<sup>4</sup> *Annual Book of ASTM Standards*, Vol 08.02.

<sup>5</sup> Discontinued; see 1997 *Annual Book of ASTM Standards*, Vol 04.09.

### 3. Summary of Guide

3.1 The effects of a given application environment on the durability of a geosynthetic must be determined through

<sup>6</sup> *Annual Book of ASTM Standards*, Vol 14.04.

**TABLE 1 Functions<sup>A</sup> and Other Performance Characteristics<sup>B</sup>**


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<b>Containment<sup>B</sup>(C)</b> —A geosynthetic provides containment when it encapsulates or surrounds materials such as sand, rocks, and fresh concrete. <sup>C</sup>
<b>Filtration<sup>A</sup>(F)</b> —A geosynthetic performs the filtration function when the equilibrium geotextile-to-soil system allows for adequate liquid flow with limited soil loss across the plane of the geotextile over a service lifetime compatible with the application under consideration.
<b>Fluid Barrier<sup>A</sup>(FB)</b> —A geosynthetic performs the fluid barrier function when it essentially eliminates the migration of fluids through it.
<b>Fluid Transmission<sup>A</sup></b> (a.k.a. <i>drainage</i> )—A geosynthetic performs the fluid transmission function when the equilibrium geotextile-to-soil system allows for adequate flow with limited soil loss within the plane of the geotextile over a service lifetime compatible with the application under consideration.
<b>Insulation<sup>B</sup>(I)</b> —A geosynthetic provides insulation when it reduces the passage of heat, electricity, or sound.
<b>Protection<sup>A</sup>(P)</b> —A geosynthetic, placed between two materials, performs the protection function when it alleviates or distributes stresses and strains transmitted to the material to be protected.
<b>Reinforcement<sup>A</sup>(R)</b> —A geosynthetic performs the reinforcement function when it provides often synergistic improvement of a total system's strength created by the introduction of a tensile force into a soil (good in compression but poor in tension) or other disjointed and separated material.
<b>Screening<sup>B</sup>(Scr)</b> —A geosynthetic, placed across the path of a flowing fluid (ground water, surface water, wind) carrying particles in suspension, provides screening when it retains some or all soil fine particles while allowing the fluid to pass through. After some period of time, particles accumulate against the screen which requires that the screen be able to withstand pressures generated by the accumulated particles and the increasing fluid pressure.
<b>Separation<sup>A</sup>(S)</b> —A geosynthetic placed between dissimilar materials so that the integrity and functioning of both materials can remain intact or be improved performs the separation function.
<b>Surface Stabilization<sup>B</sup>(SS)</b> —A geosynthetic, placed on a soil surface, provides surface stabilization when it restricts movement and prevents dispersion of surface soil particles subjected to erosion actions (rain, wind), often while allowing or promoting vegetative growth.
<b>Vegetative Reinforcement<sup>B</sup>(VR)</b> —A geosynthetic provides vegetative reinforcement when it extends the erosion control limits and performance of vegetation.

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<sup>A</sup>Functions are used in the context of this guide as terms that can be quantitatively described by standard tests or design techniques, or both.

<sup>B</sup>Other performance characteristics are qualitative descriptions that are not yet supported by standard tests or generally accepted design techniques.

Note—during the placement of fresh concrete in a geotextile flexible form, the geosynthetic functions temporarily as a filter to allow excess water to escape.

appropriate testing. Selection of appropriate tests requires a systematic determination of the primary function(s) to be performed and the associated degradation processes that should be considered. This guide provides a suitable systematic approach.

3.2 Primary functions of geosynthetics are listed and defined in Table 1. With knowledge of the specific geosynthetic application area and end use, the corresponding primary function(s) is (are) identified. Table 2 gives degradation concerns as they relate to geosynthetic functions. Table 3 gives the environmental elements that relate to the various degradation processes and the currently available ASTM Committee D-35 test method for the experimental evaluation of specific types of geosynthetic degradation. The following appendixes are included to provide background information:

- X1. Terminology
- X2. Application/End Use/Primary Function Tables
- X3. Example of Test Method Selection Procedure
- X4. Design-by-Function Discussion
- X5. Commentary on Geosynthetic Durability
- X6. Bibliography

#### 4. Significance and Use

4.1 Designers/specifiers of geosynthetics should evaluate geosynthetic durability as an integral part of the geosynthetic specification/selection process. This guide is intended to guide a designer/specifier through a systematic determination of degradation concerns based on the intended geosynthetic function or performance characteristic. This guide then provides a guide to select available test methods for experimentally evaluating geosynthetic durability and to identify areas where no suitable test exists.

4.2 This guide does not address the evaluation of degradation resulting from manufacturing, handling, transporting or installing the geosynthetic.

#### 5. Suggested Procedure

5.1 To utilize a structured procedure for selecting appropriate test methods, the geosynthetic designer/specifier must have knowledge of:

- 5.1.1 The intended geosynthetic application,
- 5.1.2 The end use of the geosynthetic via its primary function(s) or performance characteristic(s), or both,
- 5.1.3 The specific environment to which the geosynthetic will be exposed,
- 5.1.4 The types of geosynthetics that may or will be used, and
- 5.1.5 The duration or time of use (that is, service life).

5.2 With this knowledge, the designer/specifier follows the following procedure:

5.2.1 Identify the primary function(s) or performance characteristic(s), or both, to be performed by the geosynthetic in the specific application and end use intended. Functions and performance characteristics are defined in Table 1. (Tables for guidance in identifying primary function(s) and performance characteristics are given in Appendix X2.)

5.2.2 Using Table 2, identify the potential degradation process(es) that will almost always (denoted as “A”) or sometimes (denoted as “S”) be of concern when a geosynthetic performs the primary function(s) or provides the performance characteristic(s), or both, which were identified in 5.2.1. Annex A1 contains associated notes to Table 2 that help to identify the process(es) that is (are) sometimes a concern in the specific expected application environment.

5.2.3 Using Table 3, select the test method(s) that applies to the potential degradation process(es) identified in 5.2.2 as a concern(s) in the specific application environment expected.

NOTE 1—Guidance is given in Table 3 to identify the most important elements or variables relating to each degradation process.

#### 6. Keywords

6.1 aging; degradation; durability; environment; exposure; geosynthetic; long-term performance

**TABLE 2 Geosynthetic Function/Durability Assessment<sup>A</sup>**

Function	Potential Degradation Process <sup>B</sup>														Explanations of Primary Long-Term Concerns
	Abbreviation	Bio-logical Degradation	Chem-ical Degradation	Chem-ical Dissolution	Clogging/Piping	Creep	Environ-mental Stress Cracking	Hydroly-sis	Mechan-ical Damage	Photo-Degrada-tion	Plastici-zation	Stress Relax-ation	Temper-ature Insta-bility	Thermal-Degrada-tion	
Containment	C	P <sup>C,D</sup>	S <sup>E</sup>	S <sup>E</sup>	S <sup>F</sup>	S <sup>G</sup>	N	S <sup>H</sup>	S <sup>I</sup>	S <sup>J</sup>	N	S <sup>G</sup>	N	S <sup>K</sup>	Remain intact and maintain filtration performance
Filtration	F	P <sup>C,D</sup>	S <sup>E</sup>	S <sup>E</sup>	A <sup>L</sup>	S <sup>M</sup>	N	S <sup>H</sup>	S <sup>I</sup>	S <sup>J</sup>	N	S <sup>M</sup>	N	S <sup>K</sup>	Maintain design filtration and resist deformation and intrusion
Fluid Barrier	FB	S <sup>C</sup>	S <sup>E</sup>	S <sup>E</sup>	N	S <sup>G</sup>	A <sup>N,O</sup>	S <sup>H</sup>	S <sup>I</sup>	S <sup>J</sup>	N	S <sup>G</sup>	S <sup>P</sup>	S <sup>K</sup>	Maintain intended level of essential impermeability
Fluid Transmission	FT	P <sup>C,D</sup>	S <sup>E</sup>	S <sup>E</sup>	A <sup>Q</sup>	A <sup>R</sup>	A <sup>O</sup>	S <sup>H</sup>	S <sup>I</sup>	S <sup>J</sup>	N	A <sup>R</sup>	N	S <sup>K</sup>	Maintain flow under compressive loads
Insulation	I	P <sup>C,D</sup>	S <sup>E</sup>	S <sup>E</sup>	N	N	N	N	N	N	N	N	N	N	Minimize temperature losses and gains across geosyn
Protection	P	P <sup>C,D</sup>	S <sup>E</sup>	S <sup>E</sup>	N	S <sup>S</sup>	N	S <sup>H</sup>	N	S <sup>J</sup>	N	S <sup>S</sup>	N	S <sup>K</sup>	Maintain protective performance
Reinforcement	R	P <sup>C,D</sup>	S <sup>E</sup>	S <sup>E</sup> , P <sup>T</sup>	N	A <sup>U</sup>	P <sup>O</sup>	S <sup>H</sup>	P <sup>T</sup>	S <sup>J</sup>	P <sup>V</sup>	S <sup>U</sup>	S <sup>U</sup>	S <sup>K</sup>	Provide necessary strength, stiffness and soil interaction
Screening	Scr	P <sup>C,D</sup>	S <sup>E</sup>	S <sup>E</sup>	S <sup>W</sup>	N	N	S <sup>H</sup>	S <sup>I</sup>	S <sup>J</sup>	N	N	N	S <sup>K</sup>	Maintain filtration performance and resist deformation
Separation	S	P <sup>C,D</sup>	S <sup>E</sup>	S <sup>E</sup>	N	N	N	S <sup>H</sup>	P <sup>X</sup>	S <sup>J</sup>	N	N	N	S <sup>K</sup>	Remain intact
Surface Stabilization	SS	P <sup>C,D</sup>	S <sup>E</sup>	S <sup>E</sup>	N	N	N	S <sup>H</sup>	A <sup>Y</sup>	A <sup>Y</sup>	N	N	N	S <sup>K</sup>	Remain intact to resist erosive forces until vegetation is established
Vegetative Reinforcement	VR	P <sup>C,D</sup>	S <sup>E</sup>	S <sup>E</sup>	N	N	N	S <sup>H</sup>	A <sup>Y</sup>	A <sup>Y</sup>	N	N	N	S <sup>K</sup>	Remain intact throughout vegetation

<sup>A</sup>Refer to Appendix X1 for terminology relating to Table 2.

<sup>B</sup>M = Not a generally recognized concern; S = Sometimes a concern; A = Almost always a concern; P = Potential concern being researched.

<sup>C</sup>Microorganisms have been known to attack and digest additives (plasticizers, lubricants, emulsifiers) used to plasticize some base polymers. This attack will change physical and mechanical properties. Study is needed to determine relevance to polymers incorporated into geosynthetic products. Embrittlement of geosynthetic surfaces may influence interaction properties.

<sup>D</sup>Microbial enzymes have been known to initiate and propagate reactions deteriorative to some base polymers. Study is needed to determine relevance to polymers used in geosynthetic products.

<sup>E</sup>Chemical degradation or dissolution, or both, including the leaching of plasticizers or additives from the polymer structure, may be a concern for some geosynthetics exposed to liquids containing unusually high concentrations of metals, salts, or chemicals, especially at elevated temperatures.

<sup>F</sup>If select fill is not available, then a clogging resistance test should be performed with the job-specific soil.

<sup>G</sup>Geosynthetics in containment structures which require long term strength characteristics should be designed using appropriate creep and stress relaxation criteria.

<sup>H</sup>Hydrolysis may be a concern for polyester (PET) and polyamide (PA) geosynthetics exposed to extreme pH conditions, especially at elevated temperatures.

<sup>I</sup>When subject to rocking (abrasion), puncture (floating or airborne debris), or cutting (equipment or vandalism).

<sup>J</sup>When permanently exposed or in extended construction phases (>2–4 weeks) and in "wrap-around" construction, photo degradation may be a concern for the exposed geosynthetic.

<sup>K</sup>Geosynthetics in applications such as dam facings and floating covers which results in exposure to temperatures at or above ambient must be stabilized to resist thermal oxidation.

<sup>L</sup>Clogging resistance of geotextiles can only be assessed by testing with site-specific soil and (sometimes) liquid.

<sup>M</sup>If a filter geotextile is used with a geonet, it is important to assess short-term extrusion and long-term intrusion into the net.

<sup>N</sup>Residual stresses and surface damage may produce synergistic effects with other degradation processes.

<sup>O</sup>Polyethylene geosynthetics may experience slow crack growth under long-term loading conditions in certain environmental conditions.

<sup>P</sup>Excessive expansion and contraction resulting from temperature changes may be a concern for geosynthetics without fabric reinforcement.

<sup>Q</sup>Composite drains must resist clogging due to soil retention problems and intrusion of filter medium.

<sup>R</sup>Geosynthetics relying on a 3-D structure to facilitate flow must demonstrate resistance to compression creep.

<sup>S</sup>Sufficient thickness must be maintained by a protective layer over an extended period of time.

<sup>T</sup>Chemical dissolution of, or mechanical damage to geosynthetic surfaces or coatings may effect their interaction properties, i.e. lead to surface or joint slippage.

<sup>U</sup>Geosynthetics creep and stress relax at different rates depending primarily on manufacturing process, polymer type, load levels, temperature, and application.

<sup>V</sup>Plasticization may be a concern for polyester (PET) geosynthetics exposed to humid conditions or polypropylene and polyethylene geosynthetics exposed to hydrocarbons while under stress.

<sup>W</sup>If the screen is expected to operate indefinitely, then clogging should be assessed often. Commonly, screens are considered temporary.

<sup>X</sup>Holes resulting from mechanical damage may alter the effectiveness of separators.

<sup>Y</sup>Always exposed therefore resistance to photo oxidation and mechanical damage must be determined.

**TABLE 3 Environmental Factors of Degradation**

Potential Degradation Process	Environmental Elements Relating to Degradation										Test Methods Relating to Geosynthetics			
	Air Chemistry	Fluid Content	Geometry of Exposure	Liquid Chemistry	Macro-Organisms	Micro-Organisms	Radiation	Soil Chemistry	Stress	Temperature of Exposure			Time of Exposure	
Biological degradation	X	X			X	X		X			X	X	D 3083	Microbiological Attack (In Soil)
Chemical degradation				X				X			X	X	D 5322	Chemical Immersion
Chemical dissolution				X				X			X	X	D 5496	In situ Immersion
Clogging/piping		X		X		X		X			X	X	None	Effect of Solvents
Creep			X						X		X	X	D 5567	Gradient Ratio
													D 1987	Biological Clogging
													None	Precipitate Clogging
													D 5262	Tension
													D 4716	Transmissivity
Environmental stress cracking	X			X				X	X	X	X	X	D 5397	Stress Cracking and Appendix
Hydrolysis		X		X						X	X	X	None	Effect of Water
Mechanical damage			X						X			X	D 4886	Abrasion
Photo-degradation	X						X				X	X	None	Fatigue
													D 4833	Puncture
													D 4355	Xenon Arc
													D 5970	Outdoor Exposure
Plasticization		X		X						X	X	X	None	Fluorescent
Stress relaxation			X						X		X	X	None	Effect of Liquids
Temperature instability										X	X	X	D 4594	Temperature Instability
Thermal degradation	X						X				X	X	D 1204	Temperature Instability
													None	Effect of Heat
													D 3895	OIT
													D 5885	HPOIT

NOTE 1—This table provides the standard test methods current at the time of the writing of this guide. ASTM Standards are in constant development, review, revision, and replacement. It is the responsibility of the geosynthetic specifier to identify the most current applicable standard test method. Refer to Appendix X1 for terminology relating to Table 3.

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## APPENDIXES

### (Nonmandatory Information)

#### X1. TERMINOLOGY

X1.1 The *application environment* in which a geosynthetic is placed can be characterized by the following environmental elements:

- Air Chemistry
- Fluid Content
- Geometry of Exposure
- Liquid Chemistry
- Organisms (micro- and macro-)
- Radiation
- Soil Chemistry
- Stress
- Temperature of Exposure
- Time of Exposure

X1.1.1 *Air chemistry* shall include the identification of the following characteristics of the gases expected to be present or created, or both:

- Oxygen content
- Gaseous pollution (for example, NO<sub>x</sub>, SO<sub>2</sub>)
- Ozone
- Organics (for example, methane)

X1.1.2 *Fluid content* is a measure of the amount of liquid or vapor, or both, which is in the environment immediately surrounding the geosynthetic.

X1.1.3 *Geometry of exposure* may be described by:

- Angle of exposure
- Degree of exposure (surface versus complete)

X1.1.4 *Liquid chemistry* shall include the identification of the following characteristics of the ground water or leachate:

- pH
- Electrolytic conditions
- Dissolved/suspended minerals
- Chemicals



B.O.D., C.O.D.

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X1.1.5 *Macro-organisms*—Those which are or could be present in the environment shall be identified. Macro-organisms such as insects, rodents and other higher life forms shall be considered.

X1.1.6 *Micro-organisms*—Those which are or could be present in the environment shall be identified. Possible micro-organisms included:

Bacteria

Fungi

Algae

Yeast

X1.1.7 *Radiation* shall be considered as including:

Ultraviolet Radiation

Ionizing Radiation

Infra-Red and Visible Radiation

X1.1.8 *Soil chemistry* shall include the identification of the following characteristics of the soil or waste:

Transition Metals

Soluble Minerals

Polarizability

Clay Mineralogy

X1.1.9 *Stress* shall be focused upon mechanical forces applied externally to the geosynthetic/soil system, resulting in tensile compressive or shear stresses, or both, on the geosynthetic. Stresses on the geosynthetic shall be described by:

Normal stresses

Planar stresses

Surface stresses

Intensity of stresses

How stresses vary with time (static, dynamic, periodic)

How stresses are distributed over the geosynthetic

X1.1.10 *Time of exposure* shall be defined by the duration of exposure to any specific set of environmental elements.

X1.1.11 *Temperature of exposure* shall be defined as the temperature of the geosynthetic, which is not necessarily that of the surrounding medium.

X1.2 The *effects* of the application environment are characterized by the following degradation processes:

Biological Macro- and Micro-Degradation  
 Chemical Degradation  
 Chemical Dissolution  
 Clogging  
 Creep  
 Environmental Stress Cracking  
 Hydrolysis

Mechanical Damage  
 Oxidative Degradation  
 Photo Degradation  
 Plasticization  
 Stress Relaxation  
 Temperature Instability  
 Thermal Degradation

X1.2.1 *Chemical degradation* is the reaction between a chemical(s) and a specific chemical structure within a polymer resulting in chain scission, and a reduction in molecular weight and physical properties.

X1.2.2 *Chemical dissolution* is the physical interaction between a solvent and polymer whereby the polymer absorbs the solvent, swells, and eventually dissolves.

X1.2.3 *Clogging* is the collection of soil particles, micro-biological growth, precipitates, or combination thereof on or within the geosynthetic altering its initial hydraulic properties.

X1.2.4 *Creep* is the time-dependent part of a strain resulting from an applied stress.

X1.2.5 *Environmental stress cracking* is the deterioration of a polymer's mechanical properties that occurs when cracks created by high stress concentrations are exposed to certain environmental conditions.

X1.2.6 *Hydrolysis* is the degradative chemical reaction between a specific chemical group within a polymer and absorbed water causing chain scission and reduction in molecular weight.

X1.2.7 *Macrobiological degradation* is the attack and physical destruction of a geosynthetic by macroorganisms leading to a reduction in physical properties.

X1.2.8 *Microbiological degradation* is the chemical attack of a polymer by enzymes or other chemicals excreted by microorganisms resulting in a reduction of molecular weight and changes in physical properties.

X1.2.9 *Mechanical damage* is the localized degradation of the in-service geosynthetic as a result of externally applied load—abrasion, fatigue and puncture are examples.

X1.2.9.1 Discussion—*Construction damage* is excluded, but is an important consideration in geosynthetic selection.

X1.2.10 *Oxidation* is the chemical reaction between oxygen and a specific chemical group within a polymer converting the group into a radical complex which ultimately leads to molecular chain scission or crosslinking, thus changing the chemical structure, physical properties, and sometimes appearance of the polymer. Oxidation can occur during photo or thermal degradation, or both.

X1.2.11 *Photo degradation* is the change in chemical structure resulting in deleterious changes to physical properties and sometimes appearance of the polymer as a result of the irradiation of the polymer by exposure and light.

X1.2.12 *Plasticization* is the physical process of increasing the molecular mobility of a polymer by absorption or incorporation of material(s) of lower molecular weight. The effects are usually reversible when the material(s) are removed.

X1.2.13 *Stress relaxation* is the decrease in stress, at constant strain, with time.

X1.2.14 *Thermal degradation* is the change in chemical structure resulting in changes in physical properties, and sometimes appearance of a polymer caused by exposure to heat alone.

X1.2.15 *Temperature instability* is the change in appearance, weight, dimension, or other property of the geosynthetic as a result of low, high, or cyclic temperature exposure.

X1.3 *Aging* is the alteration of physical, chemical, and mechanical properties caused by the combined effects of environmental conditions over time. The following tests have been utilized or considered to simulate some of these conditions.

Accelerated Soil Burial Testing (ASTM D 3083)

Environmental Stress Rupture (Withdrawn)

Environmental Stress Cracking (ASTM D 5397)

Radiation, Moisture, and Heat Exposure (ASTM G 23 Carbon Arc; D 4355 Xenon Arc; G 53 U.V. Fluorescent; G 151, G 152, G 153, and G 154 Standard Practice)

X1.3.1 Aging can manifest itself in numerous ways, including:

Blistering

Chalking  
 Changes in Chemical Resistance  
 Changes in Puncture, Burst, or Tear Resistance, or other index properties  
 Crack Propagation  
 Delamination  
 Dimension Changes  
 Discoloration  
 Embrittlement  
 Loss of Gloss  
 Permeability Changes  
 Stiffness Changes  
 Surface Cracking  
 Surface Crazing  
 Tensile or Compressive Elongation Changes  
 Tensile or Compressive Modulus Changes  
 Tensile or Compressive Strength Changes

X1.4 *Geosynthetics*—The latest versions of these terms will be inserted upon adoption of this guide by ASTM.

X1.4.1 *Geocomposites*.

X1.4.2 *Geogrids*.

X1.4.3 *Geomembrane*.

X1.4.4 *Geonets*.

X1.4.5 *Geopipe*.

X1.4.6 *Geotextiles*.

X1.5 *Geosynthetic polymers*—The following polymeric materials are the most widely used in the manufacture of currently available geosynthetics.

*Acrylics*—latex geogrid coatings

*Bitumen*—geogrid coatings

*Chlorinated Polyethylene* (CPE)

*Chlorosulfonated Polyethylene* (CSPE)

*Polyamide* (PA)—principally polycaprolactam (nylon 6).

*Polyester* (PET)—principally polyethylene terephthalate

*Polyethylene* (PE)—including a range of densities.

*Polypropylene* (PP)

*Polystyrene* (PS)

*Poly (vinyl chloride)*(PVC)—both plasticized (geomembranes and geogrid coatings) and rigid (geopipe).

*Polyurethane* (PUR)

*Ethylene Interpolymer Alloy* (EIA)

## X2. APPLICATION/END USE/PRIMARY FUNCTION

X2.1 See Tables X2.1-X2.5.

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[ASTM D5819-99](https://standards.iteh.ai/catalog/standards/sist/dc1956c4-b03c-44c0-ab80-c8108e655bb1/astm-d5819-99)

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