

QA Specifications and Work Instructions for Ecodur Spray Liner on Geotextile over Soil Substrate

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SECTION I GENERAL

1.1 Related Documents

Drawings and general provisions of the contract including the general and supplementary conditions apply to this section.

1.2 Overview

- A. This document specifies the installation of a Ecodur geotextile lining systems items and surfaces scheduled for primary and secondary containment over solid or earthen surfaces.
- B. This Specification refers to more specifically to 100% VOC free Ecodur based spray systems applied to a variety of geotextile fabrics. The Ecodur material is 100% solvent free and capable of forming a continuous seamless membrane of the desired thickness, between 20 – 150 mils, when spray applied to vertical and horizontally positioned geotextile materials.
- C. The substrate and geotextile fabric must be dry prior to application. Application of the lining system should not take place if precipitation or fog is expected imminently. Application should not be done if the surface temperature is less than 20°F (11°C) above the dew point.
- D. If application is going to be attempted below 20°F (-7°C) please consult with the Manufacturer for modified application procedures.

1.3 References and Standards

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM E-1907: Calcium Chloride Test for Moisture Vapor Transmission.
 - 2. ASTM E-337: Test Method for Measuring Humidity with a Psychrometer.
 - 3. ASTM D-6132: Test Method for Nondestructive Measurement of Dry Film Thickness of Applied Organic Coatings Using an Ultrasonic Gauge.
 - 4. ASTM D-4138: Test Method for Measurement of Dry Film Thickness of Protective Coating Systems by Destructive Means.
 - 5. ASTM D-4541: Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
 - 6. ASTM D-1894: Test Method for Static and Kinetic Coefficients of Friction of Plastic Film and Sheeting.

1.4 Submittals

- A. Submit manufacturer's technical data, MSDS and product literature indicating that the products comply with specified requirements. If submitted material is not as specified, submit complete test results from independent lab for all tests listed.

- B. Submit 2 samples coupons (6" x 6" / 15.2cm x 15.2cm) applied to the geotextile fabric that are representative of the finished Ecodur coating surface, texture and density. Approved samples shall serve as basis for acceptance of the work for the duration of the project.
- C. Submit Material Manufacturer's and Equipment Manufacturer's written certification of Approved Contractor, Contractor's qualifications, and list of project references.

1.5 Quality Assurance

- A. Single Source Responsibility:
 - 1. Provide primers and undercoat materials recommended by manufacturer, for each type of Ecodur lining to ensure compatibility, and proper chemical and mechanical bond. Provide primers and other required materials recommended by manufacturer, for Joining System specified to ensure compatibility, and proper mechanical bond. This would include physical properties noted in Appendix A, adhesion and no adverse reaction between various systems.
 - 2. It is suggested that a mock-up be performed that is at least 10 feet by 10 feet in size, using the specified system. Approval by Architect/Engineer/Owner of the surface preparation, appearance, repair, skid resistance and workmanship is required before proceeding with the application. Uniform wrinkling of the geomembranes is considered normal and acceptable, however excessive wrinkles must be avoided. Maintain the mock-up area in its originally approved condition for comparison purposes until the application is complete.
 - 3. It is suggested that the manufacturer of the specified products shall have in existence a program of training, certifying and technically supporting a nationally organized Approved Contractor Program with annual re-certification of its participants. Manufacturer should provide project histories with names, dates, locations and phone numbers of the contact persons for projects of similar scope.
- B. Applicator Qualifications:
 - 1. Engage only trained and qualified applicators who have successfully completed applications using specified materials on projects of similar size and scope. Provide references with name, location and telephone number.
 - 2. It is highly recommended that the Contractor have completed an established Manufacturer's qualification program in the use of plural-component equipment and the application of Ecodur material. Documentation of completion of this program shall be provided to the Owner.
- C. Equipment Requirements:
 - 1. For fast set spray systems, equipment shall be plural component impingement spray machine capable of producing the Ecodur system's published recommended processing characteristics.

D. Substitutions:

1. Manufacturers seeking approval of products other than the specified system must supply cured samples, full product information, project histories and references, technical data with specifications, MSDS and certifications regarding conformity of performance properties from an independent testing laboratory. The product being submitted for approval must meet all requirements of the performance properties noted within this specification (Appendix A). Contractors seeking approval to install substitute materials shall provide documented proof of training and approval status by manufacturer. Compliance with the above quality assurances should be provided in written form at least fourteen (14) days before bids are received. Omission or nonconformance of any item could result in rejection of the request.

1.6 Delivery, Storage and Handling

- A. Deliver product in the manufacturer's original, new, unopened packages and containers, clearly marked with manufacturer's identification, printed instructions, lot numbers and shelf life expiration date for each component.
- B. Store and ship materials in tightly covered containers in a dry, well ventilated area at ambient temperature of between 70° and 90° F (21° to 32° C), away from hazards. Drums should not be stored directly on the concrete substrate. If lower temperatures are experienced during storage the material temperature must be raised to 140° F (60° C) before attempting to be applied.
- C. Before use, the materials must be brought to a standard temperature as per the manufacturer.
- D. Pigmented resin blend components must be properly agitated prior to use as per manufacturer's recommendations.
- E. Geotextile materials must remain covered and protected from the weather until ready for installation. The geotextile must remain dry prior to and during installation, and remain on a roll until installation.

1.7 Project Conditions

- A. For temperatures below 20° F (-7° C) consult with the Ecodur manufacturer.
- B. For new containment area, immersion application or other excavated site, a geotechnical survey shall be conducted to determine the suitability of the proposed site. This survey will detect the presence of organic wastes, other decomposing materials, and soil instabilities that can be detrimental to liner performance. Once the suitability of the site has been established, proceed with development of an excavation plan based on the overall containment structure design.
- C. All surface preparation will depend upon the substrate involved.
- D. Provide proper safety equipment, adequate ventilation, scaffolding, lighting and clean, drinkable water supply.
- E. Surface shall be kept free of traffic once surface preparation has begun, and no trades shall be permitted in areas during the application and curing of the coating.
- F. Protect adjacent surfaces, equipment, etc from damage resulting from work of the application of the Ecodur Lining System. If necessary, mask and/or cover adjacent surfaces, fixtures, equipment, etc. by suitable means.

- G. Do not apply material over water or wet surfaces. This will lead to disbondment, pinholes and subsequent failure of the Ecodur Lining System.
- H. Do not apply material over frozen or ice capped surfaces. This will lead to disbondment/failure of the Ecodur Lining System.
- I. Do not apply the lining system over oil soaked or chemically contaminated substrates. This will lead to disbondment, pinholes and subsequent failure of the Ecodur Lining System.

1.8 Warranty

- A. The Ecodur Coating/Lining System carries a 1 year material warranty.

1.9 Health and Safety

- A. General: Ventilation, electrical grounding, and care in handling paint, solvents, and equipment are important safety precautions that shall be observed and is the sole responsibility of the Contractor.
- B. Ventilation: It is essential that the airborne particulate is removed from all areas considered a confined space. During blasting and coating operations all personnel shall wear proper respiratory and safety equipment.
- C. Grounding: Blasting and coating hoses shall be grounded to prevent accumulation of a charge of static electricity.
- D. Lighting: Explosion proof artificial lighting shall be provided for all work where and when required. Light bulbs shall be guarded to prevent breakage. Lighting fixtures and flexible cords shall comply with the requirements of NFPA 70 NEC for the atmosphere in which they will be used.
- E. Toxicity: The solvents used with some of the specified coatings or cleaning solvents are explosive at low concentrations and are highly toxic. Because of toxicity, the maximum allowable concentration of vapor for several common solvents shall be not greater than the Immediately Dangerous to life or Health (IDLH) limits as shown in the NIOSH Registry of Toxic Chemical Substrates.
- F. Protective Clothing: When handling or applying lining materials, workmen shall wear eyewear and other necessary protective clothing to assure workman's safety.
- G. Fire: During mixing and application of lining material, all spark producing material and smoking shall be prohibited in the vicinity. An appropriate type of fire extinguisher shall be kept nearby.
- H. Material Safety Data Sheet (MSDS): Contractor shall maintain MSDS Reports on all specified coating/lining materials on the project site, which should be accessible to at all times.

Section 2 Products

2.1 System Performance Requirements

- A. Material Compatibility: Provide coating, repair materials, primers, finish coat and related materials that are compatible with one another and the substrates indicated under conditions of service required as recommended by the Ecodur Manufacturer. This would include physical properties noted in Appendix A, adhesion and no adverse reaction between various systems.
- B. Ecodur lining systems must meet or exceed all of the physical properties, test results, and certifications as noted in Appendix A for each specified application. Properties listed in Appendix A are of the Ecodur product only and the type of geotextile chosen for the application will influence some of the properties of the Ecodur Lining System (e.g. elongation, tear strength, etc.)
- C. All thermoset materials experience linear shrinkage during set and cure. It is extremely important to understand the shrinkage value and account for this dimensional change when planning the installation work of the Ecodur Geotextile Liner System.

2.2 Materials

- A. Special Coating/Lining Systems:
 - 1. Spray applied Ecodur Linings.
 - 2. Brush/roller applied Ecodur Linings

2.3 Related Materials

- A. In many instances, there may be related products/materials that will be used in combination with the installation of the Ecodur lining system so as to complete the project. These may be used to enhance adhesion or the performance of the installation/application of the Ecodur lining system once the project has been completed.
- B. Accessory Materials if required may include:
 - 1. Bug-Hole Repair Material: such as polymer-modified, cementitious scratch coat as recommended by Ecodur manufacturer.
 - 2. Intercoat Adhesion Promoter: may include a "solvent system" or primer.
 - 3. Aggregate: Clean, dry aggregate appropriate to the application.
 - 4. Soluble Salt Removal: for example Chlor*Rid™ or HoldTigh®.

2.4 Geotextiles

- A. Only special geotextiles which have been tested and approved by the Ecodur supplier are recommended. These geotextiles may be pre-treated on one side (heat-set) to facilitate uniform coverage of the Ecodur lining system. These geotextile fabrics may include either woven or non-woven polypropylene fabrics.
- B. Selection of a geotextile fabric for the membrane system depends on the type and condition of the substrate and the end use of the system. For Ecodur/Geotextile Lining Systems, choose a geotextile weight based on service conditions and system supplier and Engineer recommendations.

Section 3 Site Preparation

3.1 Soil

- A. After excavation, the soil shall be compacted to a smooth surface. If a layer of clay, sand, or gravel is specified under the membrane, it shall be placed at a uniform depth on the compacted soil and the slope established according to the design recommendations of the owner, specifier, or engineer. The Ecodur membrane will not provide protection against dangerous conditions such as instability of the surrounding soil or prevention of the soil sliding under the liner.
- B. All surfaces in contact with the liner must be free of sharp stones, sticks, and other debris that can puncture or tear the liner. This may mean that the soil removal, screening and replacement will be required to assure proper surface conditions. A layer of sand or gravel can be used if the native soil is unstable. Sterilize areas of potentially harmful plant life and trees that could rupture the liner/membrane.
- C. Venting of the geotextile membrane may be required.
- D. For basins, ponds, etc., a 12" by 18" anchor trench around the perimeter of the excavation may be required to secure the geotextile and prevent damage to the liner from adverse weather or other service conditions. If the excavation is to contain liquid, this anchor trench must be above the proposed water line.

3.2 Transition Areas

- A. Where the Ecodur will form the basis of the liner without geotextile, follow the procedures in this section.
 - 1. Concrete Surfaces
 - A. Allow concrete to cure 28 days. Concrete must be structurally sound and free of all voids and delaminations. Follow ICRI Technical Guidelines 03730 and 03731, or manufacturer's recommendations. Verify dryness for moisture with a "Plastic Tape Down Test" (reference ASTM D 4263)
 - B. Cracks in excess of 1/16" (1.6mm) shall be rounded and sealed in accordance with Ecodur manufacturer's recommended details. Joint sealant/filler may be appropriate for use here.
 - C. Check for soluble salt contamination, such as chlorides, sulfates and/or nitrates, and remove as required.
 - D. The concrete shall be thoroughly cleaned to remove all dirt, oil, grease, form release chemicals and other contaminants. Refer to SSPC SP-13.

- E. Remove all laitance, contamination, (contamination will not be removed by abrasive blasting, only blast it into the profile) curing compounds, by abrasive blasting, grit blasting, or other method approved by Ecodur Manufacturer to achieve a profile equal to 80-100 grit sandpaper or per Ecodur manufacturer.

2. Concrete Block

- A. Clean concrete block as noted above. Allow mortar to cure 28 days. The concrete shall be thoroughly cleaned to remove all dirt, oil, and other contaminants, refer to SSPC SP-13.
- B. Remove all existing coatings and linings by best acceptable method available. Only well-bonded coatings and linings may remain. Consult Ecodur manufacturer for full recommendations.
- C. Remove all laitance, contamination, (contamination will not be removed by abrasive blasting, only blast it into the profile) curing compounds, by abrasive blasting, grit blasting, or other method approved by Ecodur Manufacturer to achieve a profile equal to 80-100 grit sandpaper or per Ecodur manufacturer. Surface must be clean, sound and dry prior to application.

3. Steel

- A. Steel substrate shall be structurally sound.
- B. All welds shall be continuous and ground smooth or filled. Weld spatters, burrs, gaps, skip welds, slag, etc. shall be removed. Sharp edges shall be ground smooth. Adhere to NACE standard RP0178, latest revision.
- C. Check for soluble salt contamination, such as chlorides, sulfates and/or nitrates. Remove all existing coatings and linings by best acceptable method available. Only sound well-bonded coatings/liners may remain. Consult Ecodur manufacturer.
- D. Degrease as necessary using high pressure water and biodegradable detergents. Rinse thoroughly.
- E. Generally, provide a minimum “near white metal” abrasive blast cleaning to SSPC SP-10 or NACE 2, with a 2-3 mil anchor profile or according to the coating manufacturer. Consult Ecodur manufacturer.
- F. Avoid “flash rusting”. If “flash rusting” occurs, all traces shall be removed per SSPC SP-7, Brush-Off Blast Cleaning or by pre-treating procedure as per Ecodur manufacturer.

Section 4 Ecodur / Geotextile Installation

4.1 Installation

- A. All surfaces shall be dry and cleaned of any foreign objects that may damage the liner system.
- B. The geotextile rolls shall remain covered and protected from the weather until ready for installation. Only geotextile panels for each day's spraying shall be spread. Do not place or roll onto wet substrates at any time. Plastic sheets may be used under the geotextile if this condition occurs.
- C. Due to the expected shrinkage of the Ecodur lining system, application should start near the center of the area and work to the edges/side prior to permanently anchoring the geotextile.
- D. Geotextile may be pre-coated off site prior to installation. Allow minimum 6 inches of uncoated geotextile along all edges to provide an overlap seam.
- E. The geotextile panels may or may not be anchored in place depending upon service conditions and design requirements by the owner, specifier or engineer. Anchoring nails should be U-shaped and long enough to secure the liner. Adjacent panels shall be overlapped at least 6". Care should be taken that the geotextile is positioned to conform to surface irregularities as much as possible. Uniform wrinkling of the geomembrane is considered normal and acceptable, however excessive wrinkles must be avoided.
- F. Spray the Ecodur Lining System with uniform multiple passes over the dry geotextile surface. Coat both sides of the geotextile along lap joints and seal the lap together while the Ecodur is still wet.
- G. Steps shall be taken to avoid more than three layers of geotextile in any area.
- H. Geotextile extending into an anchoring trench shall be completely coated with the Ecodur Liner System to the specified thickness.
- I. Fish mouths and air pockets are unacceptable and should be eliminated with hand tools. Areas of incompletely coated geotextile fabric are not acceptable.
- J. At the end of the workday, approximately two feet of geotextile shall be left uncoated to form a point for the following days work. Caution must be taken to keep the geotextile free of debris at all times.
- K. Footwear should be of the rubber sole type for walking on the liner system during installation.
- L. The Ecodur supplier should be consulted for specific spray application techniques to avoid shrinkage issues when applying to geotextile
- M. On sites where gas or vapors may collect under the liner, a vent system should be installed according to the owner, specifier or engineer recommendation.
- N. Penetrations through the Ecodur coated geotextile shall be treated according to Appendix B.

4.2 Cleaning

- A. Cleanup: At the end of each work day, remove trash, empty containers, rags and other discarded items from the site. After completing work, clean glass and spattered surfaces. Remove spattered coatings by washing, scrapping, or other methods, being careful not to scratch or damage adjacent finished surfaces.

4.3 Field Quality Control

- A. Applied Thickness Testing: ASTM D-1186, D-4138, or D-6132. Thickness also may be verified by logging the volume of material sprayed through the automatic counter located on the special spray equipment.
- B. Adhesion: IF required on transition areas, test according to the appropriate standard.
- C. Skid Resistance: Provide mock-ups of various textures to use for quality control. If skid resistance test are required, conform to ASTM D-2047 or ASTM D-1894.
- D. Water leak test: If required and practical, perform a leak test according to the owner, specifier or engineer required time period, or ACI 350 method.
- E. Complete daily log detailing all job conditions.

4.4 Repairs

- A. In the event damage occurs to the finished surface area the following process should be followed to repair the affected area.
 - 1. Cut away any loose or bubbled material back to the closest point there it is secured to the substrate.
 - 2. Clean around the area with water to remove any dust and/or loose particles.
 - 3. Allow surface to dry thoroughly. **Do not apply new material to wet or moist surface!**
 - 4. Apply new material to the affected area and blend in with the surrounding area.

4.5 Health and Safety Requirements

- A. Contractor shall provide and require use of personal protective lifesaving equipment for persons working in or about project sites. Equipment shall meet all current OSHA Regulations for construction industry.

- B. Equipment shall include protective helmets conforming to the current requirements of ANSI Z89.2 and shall be worn by all persons while in the vicinity of work suite where required.
- C. Workers engaged in or near the work site during surface preparation operations shall wear eye and face protection devices meeting the requirements of current ANSI Z87.1 and OSHA Regulations to include appropriate NIOSH Respirator where applicable.
- D. Proper ventilation is to be utilized to control potential hazardous air exposure in accordance with OSHA Regulation 19140.94. Methods of ventilation shall meet requirements of ANSI Z9.2 Section 3 "VENTILATION."
- E. Protective ear devices shall be worn when occupational noise exposure exceeds the maximum allowable sound level as set forth in Table D-2 of Subpart C, Section 1926 of OSHA Regulations for the construction industry.
- F. All temporary ladders and scaffolding shall conform to the applicable requirements of Subpart L, Section 1926.45 and 1926.51 of OSHA Regulations for the construction industry.

APPENDIX A

ECODUR 201 TANK LININGS AND COATINGS PRODUCT INFORMATION SHEET

Recommended Coat Thickness	0.020" – 0.100" (0.5mm – 2.5mm)
Durability – ASTM C627 (HBT AGRA)	[16,000 Passes of an average sized car] [No debonding or deterioration occurred]
Estimated Tensile Strength - ASTM D412 (HBT AGRA)	900 psi (6 MPa)
Pull-Off Strength from Steel (Charter) - ASTM D4541-09 at 73°F / 23°C	1000 psi with 95-100% cohesive
Knife Adhesion Test (Charter) - PDO SP-2095 App B.2 / ASTM D6677	0mm (2mm allowed) Rating 10 (ASTM D6677)
Estimated Elongation (HBT AGRA) - ASTM D412	50 – 100%
Flexibility (Charter) -CSA Z245.20-10 Section 12.11m @ -22°F / -30°C Shoe Radius 95mm, Chord 152mm, Arc 178mm	> 4.07 degree bend / PD
Chemical Resistance Test (Attached Cell Method) (Charter) (40% MEG & 60% Oilfield formation water) For 7 days @ 200°F / 93°C	No defects. No blisters, cracks, delaminations. No adhesion loss.
Electrical Impedence Spectroscopy (EIS) (Charter) ISO 16773-2; 2007 96 hours @ 23°C with 5% NaCl followed by 7 day attached cell method chemical test (see above test result)	Log Z value at 0.1 Hz: 9.19 ohms- cm ² before chemical test and 9.46 ohms-cm ² after chemical test test – results higher than 9, indicating good barrier and corrosion protection properties that remained excellent after chemical resistance test.
Cathodic Disbondment – EN 10288 (charter) 48 hours @ 149°F / 65°C @ -1.5V in 3% NaCl electrolyte	10mm
Crack Bridging (HBT AGRA)	1/16" (1.6mm)
Estimated Impact Resistance (IZOD) (HBT AGRA) (drops sharply at -20°C)	2 FT-LBSf/INCH (11 Kgf-mm/mm)
Hardness – Shore Durometer (HBT AGRA)	D 50 +/- 10

Heat Resistance – Continuous	212°F (100°C)
Minimum Service Temperature	-20°F to -40°F (-30°C to -40°C)
Water Absorption	0.3%
- ASTM D570 (1993) (HBT AGRA)	30 g/m ² @ 85°C
- ASTM D570-98 (2005) (Charter)	or 185°F – 30 days
Rapid Chloride Permeability (AGRA)	17 (NIL) COULOMBS
- ASTM C1202	[after 6 hours]
Tensile Bond Strength to Concrete (HBT AGRA)	200-300 psi
5 cycles freeze/thaw & water immersion	(1.5 – 2.0MPa)
Coefficient of Slip Resistance (HBT AGRA)	0.92 / 0.95
Rubber Test Surface Wet/Dry	
CAN/CGSB-75.1-M88	

Good general solvent, acid & base resistance with a few exceptions. Refer to chemical compatability charts. Specify type of chemical being contained and conditions prior to ordering to determine particulars.

This information is from independently certified tests performed by HBT AGRA, Charter Coating Services and CSA International. Since conditions of use are beyond our control, we do not assume any liability except to replace that quantity, in containers, of the product which is defective and for which we are responsible.

Certified NSF/ANSI-61 Compliant by CSA International for use in Potable Water Storage Tanks 5 gallons or greater and Potable Water Pipes with nominal pipe sizes 4 inches or greater.

Some Liquid (un-cured) Product Properties for Ecodur 201 M:

Mix Ratio by Weight	83 parts catalyst (Part A) 17 parts resin (Part B) (or 5:1 PBW)
Mix Ratio by Volume ***	4.3:1 CAT-Part A to RES-Part B

*** DO NOT use volume approach without performing a shop test to verify the ratio yields the correct combination of flexibility and hardness for a particular application. Volume measurements are subject to variations during mixing and stirring that might entrain air.

Pot Life 100 grams at 23°C (easily varied)	less than 45 minutes
Recommended Cure Cycle	36 hours at 23°C
Mixed Viscosity at 23C	2,000-3,000 CPS
Resin Viscosity at 23C	200 CPS
Catalyst Viscosity at 23C	6,000-10,000 CPS
Specific Gravity (approximate) (mixed S.G. depends on blowing)	Resin 1.2 Catalyst 1.4 Mixed (Max) 1.4

At room temperature, vapors are low due to low vapor pressure. Provide local air and/or local exhaust to control airborne levels. Spraying and certain other operations may generate vapor or aerosol concentrations sufficient to cause irritation or other adverse effects. The sprayer grade product Ecodur 201S has higher viscosity than the normal 201M grade.

Spray grade Ecodur 201S has (optionally) greatly accelerated cure rates through use of curing agents and elevated application temperatures with gel times and cure times reduced to seconds and minutes respectively where desired.

This coating is comprised of 100% solids and does not contain any flammable solvents. Eye protection must be used for all applications. In case of eye contact, wash thoroughly and contact a physician immediately. For spraying applications use approved NIOSH breathing equipment. In the event of skin contact, wash thoroughly with soap and water. Spray applications that employ highly accelerated cure rates are especially dangerous and are not to be undertaken except by specially trained personnel, while using proper safety equipment at all times. Refer to MSDS for further information.

General Finished Product Characteristics:

Flexibility Variable – based on changing CAT:RESIN Ratio.

Odor This material contains no volatile solvents. It is a vegetable oil derived plastic which has a pleasant natural odor prior to curing which is quite mild. The odor disappears once the material is fully cured.

Fire Performance When tested in accordance with CAN/ULC S102-M88 Standard method of testing for surface burning characteristics of building materials and assemblies, the flame spread classification is “1” or “A” with a flame spread value of 15 for the product used as a deck coating. For reference, untreated red oak is a combustible material that has a flame spread classification of 100 and inorganic reinforced cement board is a non-combustible material that has a flame spread classification of 0. {CAN/ULC S102-M88 (Inchcape m Warnock Hersey)}

Water Resistance High resistance to water, sea-water, hot or cold.

Solvent Resistance High resistance to most common petro-chemical solvents with a few exceptions. Refer to chemical compatibility charts.

Ultra-Violet UV causes the material to become more yellow in color after prolonged exposure. No substantial degradation of coating has been found on 5 year field samples or 1500hour weatherometer tested samples.

Maintenance Easy to clean dirty surface, etc with most solvents and detergents.

Adhesion Bonds to steel, concrete, itself, wood, asphalt, tar, paints, etc.

Reparability Since the material bonds to itself, joints, defects, etc. can be readily serviced with minimal surface or substrate preparation.

Colorado Lining International, Inc.



MATERIAL SAFETY DATA SHEET - ECODUR PART A

MANUFACTURERS NAME:

CASTAGRA PRODUCTS, INC.
200-4170 STILL CREEK DRIVE,
BURNABY, BRITISH COLUMBIA, CANADA V5C 6C6

EMERGENCY/INFORMATION PHONE:

CANUTEC (613) 996-6666

Section 1: Product Identification

PRODUCT NAME: ECODUR (PART A)
PRODUCT NUMBER: 201 A
WHMIS. CLASSIFICATION: D2b.
HMIS. CLASSIFICATION:
HEALTH: 1
FLAMMABILITY: 0
REACTIVITY: 0
PERSONAL PROTECTION: B

Section 2: Hazardous Ingredients

INGREDIENT: CASTOR OIL: 30-60% w/w
CAS. NUMBER: 8001-79-4
LD 50: LC 50: No data available.

Section 3: Physical Data

ODOUR AND APPEARANCE: Opaque, liquid with low vegetable oil odour.
(Colour will vary)
VAPOUR PRESSURE: Data not available.
VAPOUR DENSITY: More than air.
EVAPORATION RATE: Very slow.
BOILING POINT: Data not available.
FREEZING POINT: Data not available.
SOLUBILITY IN WATER: Insoluble.
SPECIFIC GRAVITY: Approx. 1.2
pH: Not applicable.

Technical Contact

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www.coloradolining.com



Section 4: Fire and Explosion Data

FLAMMABILITY ?	Yes.
UNDER WHAT CONDITIONS ?	Extreme heat plus an ignition source.
SPECIAL FIRE FIGHTING PROCEDURES:	None.
UNUSUAL FIRE & EXPLOSION HAZARDS:	None.
MEANS OF EXTINCTION:	Foam, water fog, CO2.
FLAMMABLE LIMITS:	No data available.
FLASH POINT & METHOD:	235° C (COC) (after dehydration).
AUTOIGNITION TEMPERATURE:	No data available.
HAZARDOUS COMBUSTION PRODUCTS:	Black smoke, oxides of carbon, oxides of sulfur at >1450 C
SENSITIVITY TO IMPACT:	None.
SENSITIVITY TO STATIC DISCHARGE:	None.

Section 5: Reactivity Data

CHEMICAL STABILITY:	Yes.
INCOMPATIBILITY WITH OTHER SUBSTANCES ?	Yes.
WHICH ONES ?	Strong oxidisers.
REACTIVITY AND UNDER WHAT CONDITIONS ?	None.
HAZARDOUS DECOMPOSITION PRODUCTS:	None known.

Section 6: Toxicological Properties

ROUTES OF ENTRY:	EYE CONTACT, INGESTION.
EFFECTS OF ACUTE EXPOSURE:	Irritant to eyes & digestive system.
EFFECTS OF CHRONIC EXPOSURE:	None known.
EXPOSURE LIMITS:	No data available.
IRRITANCY OF PRODUCT:	Irritant to eyes & digestive system.
SENSITIZATION OF PRODUCT:	None known.
CARCINOGENICITY:	None known.
TERATOGENICITY:	None known.
REPRODUCTIVE TOXICITY:	None known.
MUTAGENICITY:	None known.
SYNERGISTIC PRODUCTS:	None known.



Section 7: Preventive Measures

PERSONAL PROTECTIVE EQUIPMENT:

GLOVES: The use of rubber gloves is recommended.
EYE: Eye protection is recommended.
RESPIRATOR: Not usually required.
FOOTWEAR: No special requirements.
CLOTHING: Long sleeved garments and long pants recommended.

OTHER: None.

ENGINEERING CONTROLS: General ventilation is sufficient.

LEAK AND SPILL PROCEDURES: Stop leak. Mop up with mineral absorbent. Wash down floor with plenty of hot soapy water.

WASTE DISPOSAL: Dispose of in a land fill site according to all regulations.

HANDLING PROCEDURES

AND EQUIPMENT: Mix well before using.

STORAGE REQUIREMENTS: Store in a cool dry place.

SHIPPING DATA: No special shipping requirements.

EYES: Wash well with plenty of warm water. DO NOT RUB EYES. If irritation persists consult a physician.

SKIN: Wash well with plenty of soap and warm water. If irritation develops, contact a physician.

INHALATION: Not considered a hazard.

INGESTION: Give plenty of water to drink. Consult a physician.

PREPARED BY: CASTAGRA PRODUCTS, INC.

DATE: 20 MARCH 2011

Section 9: Preparation Data

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Colorado Lining International, Inc.



MATERIAL SAFETY DATA SHEET - ECODUR PART B

MANUFACTURERS NAME:

CASTAGRA PRODUCTS, INC.
200-4170 STILL CREEK DRIVE,
BURNABY, BRITISH COLUMBIA, CANADA V5C 6C6

EMERGENCY/INFORMATION PHONE:

CANUTEC (613) 996-6666

Section 1: Product Identification

PRODUCT NAME: ECODUR (PART B)
PRODUCT NUMBER: 201 B
WHMIS. CLASSIFICATION: D1b, D2a, D2b, F.
HMIS. CLASSIFICATION:
HEALTH: 3
FLAMMABILITY: 1
REACTIVITY: 2
PERSONAL PROTECTION: B
(FOR GENERAL USE)

Section 2: Hazardous Ingredients

INGREDIENT: DIPHENYLMETHANE DIISOCYANATE (MDI)
Diphenylmethane Diisocyanate, isomers and homologues
% w/w : 100
CAS #: 9016-87-9
TLV.: 0.02 ppm
LD 50: No Data Avail.
LC 50: 490 mg/m3

Section 3: Physical Data

ODOUR AND APPEARANCE: Almost odourless, dark brown liquid.
VAPOUR PRESSURE: <0.00001 mmHg @ 25° C.
VAPOUR DENSITY: Approximately 8.5 (air = 1).
EVAPORATION RATE: Very slow.
BOILING POINT (760 mmHg): Decomposes prior to boiling.
FREEZING POINT: No data available.
SOLUBILITY IN WATER: REACTS WITH WATER.
SPECIFIC GRAVITY: 1.24 (H2O = 1).
pH: Not applicable.
DECOMPOSITION TEMP.: >230 C (>446 F).
FLASH POINT - CLOSED CUP: >204 C (>399 F).

Technical Contact

Patrick Elliott

Email: pelliott@coloradolining.com
Tel: 303.841.2011
www.coloradolining.com

Section 4: Fire and Explosion Data

FLAMMABILITY ?	Yes.
UNDER WHAT CONDITIONS ?	Extreme heat.
SPECIAL FIRE FIGHTING PROCEDURES:	REACTS WITH WATER. If water is used as extinguishing agent use large amounts and wear protection against isocyanate and nitrogen oxide fumes. Wear positive pressure self contained breathing apparatus and full protective clothing.
UNUSUAL FIRE & EXPLOSION HAZARDS:	Evacuate persons from down wind of fire site. Do not re-seal contaminated containers.
MEANS OF EXTINCTION:	CO ₂ , Dry chemical or foam. AVOID WATER
HAZARDOUS COMBUSTION PRODUCTS:	Oxides of carbon & nitrogen, isocyanate vapours. Traces of hydrogen cyanide.
FLAMMABLE LIMITS:	No data available.
FLASH POINT & METHOD:	> 205° C (PMCC)
AUTOIGNITION TEMPERATURE:	No data available.
DECOMPOSITION TEMPERATURE:	Approx. 330° C.
SENSITIVITY TO IMPACT:	None.
SENSITIVITY TO STATIC DISCHARGE:	None.

Section 5: Reactivity Data

CHEMICAL STABILITY:	Yes.
INCOMPATIBILITY WITH OTHER SUBSTANCES ?	Yes.
WHICH ONES ?	Water, acids, ammonia, alcohols, alkalies, metals, surfactants. Reactions may be violent. Reacts with water to form heat, carbon dioxide and insoluble urea. Water may cause pressure build-up in sealed containers. Hazardous polymerization may be initiated by metal salts, strong bases or temperatures in excess of 175° C.
HAZARDOUS DECOMPOSITION PRODUCTS:	Isocyanate vapours, oxides of carbon and nitrogen. Traces of hydrogen cyanide.



Section 6: Toxicological Properties

ROUTES OF ENTRY: SKIN CONTACT, EYE CONTACT, INHALATION.
EFFECTS OF ACUTE EXPOSURE: May be irritant to eyes and skin at room temperatures. Elevated temperature exposure will irritate skin, eyes, respiratory tract.

EFFECTS OF CHRONIC EXPOSURE: May cause lung damage.
EXPOSURE LIMITS: ACGIH TLV 0.005 PPM. TWA & OSHA PEL 0.02 ppm (Ceiling for MDI)

IRRITANCY OF PRODUCT: May be irritant to eyes and skin.
SENSITIZATION OF PRODUCT: May cause respiratory sensitization.
CARCINOGENICITY: Lung tumours have been observed in laboratory animals exposed to 6 mg/m³ for their lifetimes.

TERATOGENICITY: No data available.
REPRODUCTIVE TOXICITY: No data available.
MUTAGENICITY: Test data inconclusive. Handle with great care.
SYNERGISTIC PRODUCTS: None known.

Section 7: Preventive Measures

PERSONAL PROTECTIVE EQUIPMENT:
GLOVES: Neoprene gloves recommended.
RESPIRATOR: Not usually required except for emergency situations.
EYE: Chemical goggles for normal use conditions.
FOOTWEAR: Impervious footwear is recommended.
CLOTHING: Long sleeved garments and long pants recommended.
OTHER: Rubber or plastic apron recommended.

ENGINEERING CONTROLS: Ventilate to keep vapours to below TLV.
LEAK AND SPILL PROCEDURES: Absorb onto mineral absorbent and place into dry open top containers & remove to outdoors. Neutralise with 5% soda ash solution, 10 parts solution to 1 part waste. Let stand 48 hours prior to disposal.

WASTE DISPOSAL: Clean up with 5% soda ash solution allowing reaction to take place for 10 minutes. Destroy mops, brooms and other clean up equipment by combustion. Used wash solutions must be disposed of according to all government regulations.

HANDLING PROCEDURES AND EQUIPMENT: Handle with great care. Read label and MSDS prior to use.
STORAGE REQUIREMENTS: Store in a cool, dry, well ventilated area. Keep containers closed when not in use.
SHIPPING DATA: NOT REGULATED



Section 8: First Aid

- EYES: Wash well with plenty of water for 15 minutes. Lift eyelids occasionally. If irritation persists contact a physician.
- SKIN: Wash well with plenty of soap and water. If irritation develops, contact a physician.
- INHALATION: Remove to fresh air. If not breathing give artificial respiration. Contact a physician.
- INGESTION: Give water or milk to drink. Do not induce vomiting. Consult a physician at once.

PREPARED BY: CASTAGRA PRODUCTS, INC.
DATE: 20 MARCH 2011

Section 9: Preparation Data

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MATERIAL SAFETY DATA SHEET
HOT SAUCE HS-01 (Diocetyl tin Dilaurate)

1. PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: Hot Sauce HS-01

CHEMICAL FAMILY: Tin Chemicals, Organometallic

MANUFACTURER/SUPPLIER

24 HR EMERGENCY TELEPHONE NUMBERS

Castagra Products, Inc.
5190 Neil Road, Suite 430
Reno, NV 89502-8535
USA

CHEMTREC (U.S.) : (800) 424-9300
Non-Emergency Phone Number: (775) 333-1143

2. COMPOSITION / INFORMATION ON INGREDIENTS

<u>Chemical Name</u>	<u>%W.t</u>	<u>#CAS</u>	<u>#EINECS</u>
Diocetyl tin Dilaurate	99 - 100	3648-18-8	N/A

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

IMMEDIATE CONCERNS: None

POTENTIAL HEALTH EFFECTS

EYES: Prolonged and repeated contact may cause irritation to eyes.

SKIN: Prolonged and repeated contact may cause irritation to skin.

INGESTION : Toxic if swallowed.

INHALATION : Toxic by inhalation.

CARCINOGENICITY: Not listed by NTP, IARC, ACGIH, or OSHA as a carcinogen.

ROUTES OF ENTRY: Eyes, Skin, Mucous Membranes, Ingestion

TARGET ORGAN STATEMENT: Eyes, Skin

4. FIRST AID MEASURES

EYES : Flush eye(s) for 15 minutes or more; if irritation persists, consult a physician (preferably an eye specialist) and show MSDS.

SKIN: Wash area thoroughly with soap and water. Remove contaminated clothing. Seek medical attention if symptoms are present after washing.

INGESTION: Seek medical attention immediately. Do not induce vomiting.

INHALATION: Remove individual from site of exposure and place in fresh air. Seek medical attention if breathing is difficult.

NOTE AU MÉDECIN : None

ADDITIONAL INFO : None

5. FIRE FIGHTING MEASURES

FLASHPOINT AND METHOD: 226°(429°F) Closed cup

AUTOIGNITION TEMPERATURE: Not Determined



FLAMMABLE CLASS: Combustible Liquid, Class IIIB as defined by NFPA 30
EXTINGUISHING MEDIA: Foam, carbon dioxide, dry powder, and water spray.
EXPLOSION HAZARDS: This product has no explosion hazards.
FIRE FIGHTING PROCEDURES: There are no special firefighting procedures.
FIRE FIGHTING EQUIPMENT: As in any fire, wear self-contained breathing apparatus pressure-demand, (MSHA/NIOSH approved or equivalent) and full protective gear.
HAZARDOUS COMBUSTION PRODUCTS: Carbon monoxide, carbon dioxide, and tin oxides.

6. ACCIDENTAL RELEASE MEASURES

SMALL SPILL: Sweep or vacuum up spilled material and place in secure, plastic-lined container. Flush spill area with large volumes of water and contain.

RELEASE NOTES : In case of accident or road spill notify:

*CHEMTREC (U.S.) (800) 424-9300

*CHEMTREC, autres pays: (Code international) +1-202-483-7616

7. HANDLING AND STORAGE

HANDLING: Provide suitable extraction/ventilation at processing machines. Keep away from all sources of ignition – No Smoking. Cool endangered containers by water spray.

STORAGE: Keep container in cool well-ventilated place. Keep containers tightly closed.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

		EXPOSURE LIMITS					
		<u>OSHA PEL</u>		<u>ACGIH TLV</u>		<u>OEL FOURNISSEUR</u>	
		<u>ppm</u>	<u>Mg/m³</u>	<u>ppm</u>	<u>Mg/m³</u>	<u>ppm</u>	<u>Mg/m³</u>
Diocyltin	TWA		0.1				
Dilaurate							

ENGINEERING CONTROLS: Local exhaust ventilation may be necessary to control any air contaminants to within their TLVs during the use of this product. If local exhaust is not available, general (mechanical) ventilation is acceptable, if exposure is maintained below the TLV.

PERSONAL PROTECTIVE EQUIPMENT

EYES AND FACE: Safety Goggles recommended for use.

SKIN: PVC gloves are recommended for use.

RESPIRATORY: In case of insufficient ventilation, respiratory protective equipment: Cartridge for organic gases and vapors.

PROTECTIVE CLOTHING: Impermeable protective clothing is recommended.

WORK HYGIENIC PRACTICES: Avoid breathing dust or mist from solutions. Do not eat, drink, or smoke in work area. Wash hands thoroughly after use.

OTHER USE PRECAUTIONS: None

9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE : Liquid
 ODOR : Characteristic
 COLOR : Yellow
 pH : Not Determined
 PERCENT VOLATILE : Not Determined
 VAPOR DENSITY : Heavier than air
 BOILING POINT : Not Determined
 MELTING POINT : Not Determined
 SOLUBILITY IN WATER : Insoluble
 EVAPORATION RATE : Not Determined
 SPECIFIC GRAVITY : 1.03
 VISCOSITY : Not Determined
 WEIGHT PER VOLUME : 8.58 Pounds/Gallon

10. STABILITY AND REACTIVITY

STABLE – Yes

HAZARDOUS POLYMERIZATION: No

CONDITIONS TO AVOID: None

INCOMPATIBLE MATERIALS: None

11. TOXICOLOGICAL INFORMATION

ACUTE ORAL LD: LD50: >6000 milligrams/kilogram(mg/kg) [Rat]. Test Results are based on analogy with a similar material.

EYE EFFECTS: The toxic effects of this material are not known.

SKIN EFFECTS: The toxic effects of this material are not known.

INHALATION EFFECTS: The toxic effects of this material are not known.

INGESTION EFFECTS: The toxic effects of this material are not known.

12. ECOLOGICAL INFORMATION

GENERAL COMMENTS: Do not allow undiluted product or large quantities of it to reach ground water, water bodies or sewage system.

ENVIRONMENTAL DATA: No data available.

13. DISPOSAL CONSIDERATIONS

DISPOSAL METHOD: Dispose of in accordance with local, state, and federal regulations.

PRODUCT DISPOSAL: In accordance with local authority regulations, take to special waste incineration plant.

EMPTY CONTAINER DISPOSAL: If empty contaminated containers are recycled or disposed of, the receiver must be informed about possible hazards.

14. TRANSPORT INFORMATION

DOT (DEPARTMENT OF TRANSPORTATION)

PROPER SHIPPING NAME: Not Classified As Hazardous For Transport (Dioctyltin dilaurate)

TECHNICAL NAME: Dioctyltin dilaurate

PRIMARY HAZARD CLASS/DIVISION: N/A

UN/NA NUMBER: N/A

PACKING GROUP: N/A

15. REGULATORY INFORMATION

UNITED STATES:

SARA TITLE III (SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT)

311/312 HAZARD CATEGORIES:

FIRE: NO REACTIVITY: NO ACUTE: YES

313 REPORTABLE INGREDIENTS: This product contains no SARA Title III, Section 313 listed chemicals.

TSCA (TOXIC SUBSTANCE CONTROL ACT)

TSCA REGULATORY: All intentional ingredients are listed in the TSCA Inventory.

16. OTHER INFORMATION

PREPARED BY: CASTAGRA PRODUCTS, INC.

DATE: 14 MARCH 2012

MANUFACTURER DISCLAIMER: The information contained herein is based on data believed to be reliable by CASTAGRA PRODUCTS, INC. It is true and accurate to the best of our knowledge, but is not intended to be all inclusive. Users should consider this information as a supplement to other information gathered by them and must make their own determination of suitability and completeness to assure proper safe use and disposal of these materials.