LightRay™ by Perma-Liner Industries LR3 UV System

Product Bid Submittal

Revised September 8, 2023

ID: 128326-Submittal
Rev: C
Date: [9-8-23]

Appendix A – LR3 Installation Procedures

Appendix B – Independent Testing

Appendix C – SDS

Appendix D – Specifications

ID: 128326-Submittal
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Appendix A

Product Bid Submittal

ITEM 1.

Manufacturer Company Name: LightRay by Perma-Liner Industries

Contact Individual(s) Michelle Arnold – Director of Sales

Street Address: 13000 Automobile Boulevard, Suite 300

City, State, Zip Code: Clearwater, Florida 33762

Telephone: (727) 300-6907

Product Submittal: INSTALLATION PRACTICE FOR THE PATCH REPAIR OF A SEWER SERVICE LATERAL USING A CURED-IN-PLACE LINER ASSEMBLY INSTALLED BY MEANS OF PULL-IN-PLACE OR PUSH-IN-PLACE (PIP)

ITEM 2.

INTENT:

This specification covers material requirements, installation practices, and test methods for the reconstruction of a sewer service lateral pipe. The lateral pipe is remotely renovated from the cleanout or access point to a specified distance up to 100 feet. The pipe renovation shall be accomplished by the pull-in-place or push-in-place (PIP) and inflation of a resin impregnated, single-piece lateral liner assembly. The liner assembly is pressed against the lateral pipe by inflation of a bladder and held under pressure and exposed to UV light until the resin has cured. When cured, the liner extends over a predetermined length of the service lateral and forms a continuous, single-piece, tight fitting, corrosion resistant and verifiable non-leaking lateral cured in-place pipe (CIPP). The Material's mechanical properties and Installation practices shall, at a minimum, adhere to the requirements of ASTM F3541-22 "Standard Practice for Sectional Repair of Existing Gravity Flow, Non-Pressure Pipelines and Conduits by Pushed or Pulled-In-Place Installation of Cured-In-Place Thermosetting Resin Pipe (CIPP)".

ITEM 3.

3.0 The Technique	The repair structurally renews the lateral. The repair consists of a one-piece, lateral lining that is vacuum impregnated with UV initiated resins and pushed or pulled from the cleanout into the lateral by the action of a packer assembly; hereby referred to as a "Packer". See Appendix D Specification Sheet
3.1 A brief description of the operation and technique; including materials and methods of installation.	The reconstruction will be accomplished using woven fiberglass fabric tube of particular length and a UV initiated vinyl ester resin with physical and chemical properties appropriate for the application. The liner is installed by cutting to length and sliding it over the packer assembly. The packer is inserted into the pipe via PIP and inflated. The resin saturated tube is UV light cured and the packer is removed. The end result is a one-piece structural lateral lining. The lateral tube length will be: 20 ft. or less The cured finished materials as described above will, upon installation inside the host pipe, exceed the minimum mechanical properties specified by the American Society for Testing Methods (ASTM) F3541-22.
3.2 Intended use: Structural Repair Crack/Joint Sealing of Root Intrusion and Water Infiltration	The system is designed for fully deteriorated pipe conditions. Typical installations are a direct result of ground water infiltration, root intrusion and structural defects such as open joints, offset joints, broken or missing pipe sections and hammer taps. The new pipe exhibits a smoothbore interior that typically increases flow rates.
3.3 Existing Sewer	The system is compatible with all pipe materials.
3.4 Diameter Ranges	Lateral: 3, 4 and 6 inch diameters.
3.5 Transitioning Diameters	The liner can transition from one pipe size to another ensuring adequate liner thickness throughout the lining.
3.6 Circular and/or Non-Circular Capability	The system can accommodate pipe ovality up to -10%.
3.7 Material Limitations	This system is designed for gravity sewers.

3.8 Lining Material Composition and Construction	Proprietary glass kitted tubes coated with a chemically resistant impervious film. The tube is air-tight and flexible in design to reduce inversion pressures. Minimum finished wall thickness: 3mm for 3 inch diameter pipe 3mm for 4 inch diameter pipe 3mm for 6 inch diameter pipe
3.9 Resin System	Ultra-Low VOC, styrene free, Vinyl Ester Resin the comes to the installers pre-wet out to the factory specification. 3-inch tube requires 0.37 lbs of resin per lineal foot. 4-inch tube requires 0.55 lbs of resin per lineal foot. 6-inch tube requires 0.85 lbs of resin per lineal foot.
3.10 Mechanical Properties	Excess resin migrates into pipe defects allowing a mechanical anchoring.
3.11 Physical Properties	Flexural Strength 4,500 - PSI “Minimum” Test Method: ASTM 790 Flexural Modulus 250,000 - PSI “Minimum” Test Method: ASTM 790
3.12 Corrosion attack	Chemical Resistance Testing. See Independent Laboratory Testing
3.13 Resin Saturation Method	The lining tube is pre-wet out at the factory. The assembly is vacuum impregnated with the UV initiated resin and weighed for accuracy as a final quality control check.
3.14 Gasket Sealed End Seals	The lateral tube may include a compression o-ring gasket attached six-inches from the terminating end of the lateral tube.
3.15 End Seal Test Data	The hydrophilic gasket seals shall include test data that supports substantial expansion properties so to form a watertight compression end seal at the terminating ends of the CIP-lateral liner. The test protocol shall simulate subterranean conditions and hydraulic loading at surface. Gasket seal submittals must include tests data simulating hydration/ dehydration conditions for a period of 10,000-hours and the test results must successfully demonstrate and document long-term performance without deterioration, loss of material, flexibility, and expansion of the gasket during repeated cycles of hydration and dehydration.
3.16 Installed at one-time	The system allows only one (1) lateral at a time to be renewed. The UV curing system allows many laterals to be renewed in a day. Conditions greatly determine the number of laterals that can be renewed in one-day, though a typical number of laterals renewed in one-day is five (5) or more.

3.17 Missing Pipe Sections	The liner can span small missing sections of pipe.
3.18 Effects of Line and Grade	There are no effects caused by grade changes since air pressure is used to inflate the liner. The liner is flexible during insertion and can accommodate and negotiate 22, 45 and 90 degree bends.
3.19 Protruding Lateral Pipes	It is recommended protrusions into the main pipe are limited to ½-inch.
3.20 Reduction in Pipe Diameter, and its Effect	The liner exhibits a slick and typically smooth interior with a co-efficient that increases flow-rate. Minor wrinkling may occur at bends of 45-degrees and greater and some wrinkling may occur based on actual inner pipe diameter, inner surface, pipe configuration and conditions.

ITEM 4.

4.0 Sewer preparation involves cleaning and a flow stoppage or diversion period.	The laterals are cleaned utilizing high-pressure water or mechanical cleaning tools removing all roots, debris and obstructions. The current condition of the pipe will be compared to the original designed condition to verify that design parameters have not changed. Normal mainline flows are plugged or by-passed during the process, depending on flow.
4.1 Installation Crew and Equipment	A typical crew consists of (2) technicians. The installation process is typically quick, efficient and non-disruptive when compared to open cut replacement methods.
4.2 Inversion/Inflation Method	Air pressure is applied to the packer. The packer extends past each terminal end of the lining assembly so the ends remain open and no cutting is necessary.
4.3 Maximum Length	Maximum length for continuous lining is 20 feet.
4.4 Curing Method	The Resin and UV curing systems are proprietary to LightRay and Perma-Liner Industries. The resin systems are capable of curing 4” diameter liners in 15 minutes and 6” diameter lateral liners in 20 minutes
4.5 Removal of Inflation Device	The packer is deflated via the control box and removed. The packer and associated hardware are designed to handle the forces experienced during the retrieval process.
4.6 Document Final Video and Testing Procedures	A final video inspection should be performed from the main or cleanout to see the termination point of the liner.
4.7 Design Life	Each product comes with a standard 10 year warranty. 50-Year Design Life based on assumption described in ASTM F1216 Appendix X1 and long-term creep as described in ASTM D2990.

Appendix B

CRT LABORATORIES, INC.
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ASTM Physical & Mechanical • Chemical-Thermal Analysis • IAPMO Cell Class
Geosynthetic Materials • Plumbing & Faucet Assemblies • Resin & Finished Product Testing

ISO 9001 IAPMO R&T Certification No. 80-09-23-12-11019

ANAB ACCREDITED

TEST REPORT

FOR: Perma-Liner Industries, LLC.
13000 Automobile Blvd., Suite-300
Clearwater, FL 33762
Tel: (727) 744-2594 / Fax: (727) 507-9849
ATTN: Mr. Rishi Vasudeva

LWR NO.: 21144 DATE: April 21, 2020

BACKGROUND: The client submitted two (2) samples of Drain Epoxy pipe for testing. The samples arrived on 03/27/2020 via customer-supplied courier. Visual inspection was performed on 03/27/2020 and no product defects were noted. Testing in accordance with customer PO #22364 and approved CRT quote received on 03/31/2020. The following additional information is provided:

CRT order entry log date: 03/31/2020 / **Report due date:** 04/30/2020

PRODUCT ID: Two (2) samples of Perma-Liner UV-LED PIPE, identified as;
1) LightRay UV-LED PIPE 3" Diameter Thickness 2.5mm
2) LightRay UV-LED PIPE 6" Diameter Thickness 3.0mm

PREPARATION: **Machining, CNC & Preparation** – ASTM D638-14 / CRT
Conditioning – ASTM D618-13, 40 h in a standard laboratory environment

SPECIFICATION: **ASTM F1743-17(Vol.: 8.04 2020) Standard Practice for Rehabilitation of Existing Pipelines and Conduits by Pulled-in-Place Installation of Cured-in-Place Thermosetting Resin Pipe (CIPP):**

TEST PROCEDURES: **Resin properties (<82.2C) via Differential Thermal Analysis (DSC), N_2** – Section 5.2.3 (ASTM D3418-15)
Workmanship, Finish & Appearance – Section 6.8
7-day Chemical Resistance – Section 7.2.1
Type-I Tensile Properties @ 23°C (Psi) – ASTM D638-14
Flexural Properties @ 23°C (Psi) – ASTM D790-17
Dimensions and Tolerances, Wall Thickness @ 23°C (") – ASTM D5813-04

TEST RESULTS: The results of testing are reported in tables 1 thru 4, attached.

CONCLUSION: Based on the test results achieved, both samples meet the minimum requirements outlined in ASTM F1743-17(Vol.: 8.04 2020)…***Complies.***

Specimen Retain Bin: BB (30-day retain only unless otherwise specified)

Signed on behalf of;

CRT LABORATORIES, INC.

IAPMO R&T ANAB ISO 9001:15 Certified – Registered / ISO/IEC 17025:05 Recognized Co.

Ken A. Le Jeune
CEO / Laboratory Director

Raul Gonzalez
Laboratory Technician

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TABLE 1

SCOPE: Compliance with ASTM F1743-17 (Vol.: 8.04 2020)
SAMPLE ID: Sample - 1 LightRay UV-LED PIPE 3" Diameter Thickness 2.5mm

5.2.3 RESIN PROPERTIES (DSC)

	Value Obtained	Requirements	Results
Onset (°C)	66.48	<82.2	Pass
Midpoint (°C)	67.58	N/A	N/A
Contamination and/or copolymers	none detected	No contamination	Pass
Tech comments	See spectra	N/A	N/A

6.8 WORKMANSHIP FINISH & APPEARANCE

The finished CIPP is homogeneous throughout the entire length and free of dry spots, lifts and delamination(s)…***Complies***

7.2 CHEMICAL RESISTANCE / ASTM D790-17 (FLEXURAL PROPERTIES)

Test specimens were machined and immersed in chemicals solutions in Table 2 at a temperature of 23°C for 7 days. Flexural properties were determined per ASTM D790-17 before/after chemical exposure. The following results were obtained:

Control specimens								
Specimen #	1	2	3	4	5	Average	% change	Results
Flexural strength (psi)	11,448	11,458	11,154	10,799	11,212	11,214	N/A	N/A
Flexural modulus (psi)	419,649	441,056	413,237	443,610	448,272	433,163	N/A	N/A
Chemical: Nitric acid 1% (immersion: 7-days @ 23°C)								
Flexural strength (psi)	10,961	9,560	8,958	11,016	9,933	10,086	N/A	N/A
Flexural modulus (psi)	361,691	359,980	429,659	461,240	356,435	393,801	-9.09	Pass
Chemical: Sulfuric acid 5% (immersion: 7-days @ 23°C)								
Flexural strength (psi)	9,689	10,681	8,738	9,932	10,909	9,991	N/A	N/A
Flexural modulus (psi)	390,116	360,730	411,888	395,484	397,737	391,191	-9.69	Pass
Chemical: ASTM Fuel C 100% (immersion: 7-days @ 23°C)								
Flexural strength (psi)	9,032	9,859	10,572	9,268	9,586	9,664	N/A	N/A
Flexural modulus (psi)	369,720	345,621	394,941	355,531	381,949	369,552	-14.70	Pass
Chemical: Vegetable oil 100% (immersion: 7-days @ 23°C)								
Flexural strength (psi)	11,932	10,937	10,994	11,068	10,915	11,169	N/A	N/A
Flexural modulus (psi)	368,174	394,195	350,067	370,350	350,092	368,375	-14.90	Pass
Chemical: Detergent 0.1% (immersion: 7-days @ 23°C)								
Flexural strength (psi)	8,828	8,155	10,294	9,874	10,064	9,443	N/A	N/A
Flexural modulus (psi)	441,364	423,051	355,009	381,956	443,793	409,034	-5.57	Pass
Chemical: Soap 0.1% (immersion. 7-days @ 23°C)								
Flexural strength (psi)	11,881	11,034	11,277	10,374	8,958	10,705	N/A	N/A
Flexural modulus (psi)	408,113	383,868	356,558	391,430	379,039	383,802	-11.40	Pass

…***Complies***

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TABLE 1 continuation

SCOPE: Compliance with ASTM F1743-17 (Vol.: 8.04 2020)

SAMPLE ID: Sample - 1 LightRay UV-LED PIPE 3" Diameter Thickness 2.5mm

ASTM D 638-14 (TENSILE STRENGTH AT PEAK)

Tensile test specimens (type-I) were CNC machined and tensile properties were determined per ASTM D638-14. The following results were obtained:

Specimen #	1	2	3	4	5	Average	Requirements	Results
Peak strength (psi)	9,854	10,162	9,960	9,491	9,608	9,815	3,000 minimum	Pass

…Complies

5.2 DIMENSIONS & TOLERANCES

Dimensions were measured in accordance with ASTM D2122-16 using a digital caliper and micrometer as applicable. The following average results were obtained:

	Outside Diameter	Wall Thickness	Results
	3.503"	0.108"	N/A
Requirements	N/A	N/A	N/A

…for client information only

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LWR NO.: 21144 DATE: April 21, 2020

TABLE 2
SCOPE: Compliance with ASTM F1743-17 (Vol.: 8.04 2020)
SAMPLE ID: Sample 2 - LightRay UV-LED PIPE 6" Diameter Thickness 3.0mm

5.2.3 RESIN PROPERTIES (DSC)

	Value Obtained	Requirements	Results
Onset (°C)	53.57	<82.2	Pass
Midpoint (°C)	59.01	N/A	N/A
Extrapolated Peak (°C)	68.27	N/A	
Contamination and/or copolymers	none detected	No contamination	Pass
Tech comments	See spectra	N/A	N/A

6.8 WORKMANSHIP FINISH & APPEARANCE

The finished CIPP is homogeneous throughout the entire length and free of dry spots, lifts and delamination(s)…***Complies***

7.2 CHEMICAL RESISTANCE / ASTM D790-17 (FLEXURAL PROPERTIES)

Test specimens were machined and immersed in chemicals solutions in Table 2 at a temperature of 23°C for 7 days. Flexural properties were determined per ASTM D790-17 before/after chemical exposure. The following results were obtained:

Control specimens								
Specimen #	1	2	3	4	5	Average	% change	Results
Flexural strength (psi)	6,900	6,829	7,012	6,311	6,464	6,703	N/A	N/A
Flexural modulus (psi)	417,523	419,129	410,733	437,347	438,221	424,589	N/A	N/A
Chemical: Nitric acid 1% (immersion: 7-days @ 23°C)								
Flexural strength (psi)	6,596	6,851	6,883	6,023	6,420	6,555	N/A	N/A
Flexural modulus (psi)	290,181	420,818	379,885	301,423	437,196	365,901	-13.8	Pass
Chemical: Sulfuric acid 5% (immersion: 7-days @ 23°C)								
Flexural strength (psi)	4,709	8,292	6,190	6,810	4,656	6,132	N/A	N/A
Flexural modulus (psi)	337,219	385,195	396,357	346,831	347,620	362,644	-14.60	Pass
Chemical: ASTM Fuel C 100% (immersion: 7-days @ 23°C)								
Flexural strength (psi)	5,748	5,899	7,753	6,817	5,373	6,318	N/A	N/A
Flexural modulus (psi)	362,806	346,203	351,547	455,791	363,533	373,976	-11.90	Pass
Chemical: Vegetable oil 100% (immersion: 7-days @ 23°C)								
Flexural strength (psi)	8,304	8,499	8,756	6,911	5,882	7,670	N/A	N/A
Flexural modulus (psi)	363,142	378,404	412,797	349,833	348,072	370,450	-12.80	Pass
Chemical: Detergent 0.1% (immersion: 7-days @ 23°C)								
Flexural strength (psi)	7,575	5,792	6,773	6,945	7,463	6,910	N/A	N/A
Flexural modulus (psi)	361,584	358,501	441,945	414,826	407,688	396,909	-6.52	Pass
Chemical: Soap 0.1% (immersion: 7-days @ 23°C)								
Flexural strength (psi)	6,684	6,251	7,284	6,160	5,584	6,393	N/A	N/A
Flexural modulus (psi)	428,629	431,744	412,155	398,042	339,255	401,965	-5.33	Pass

…***Complies***

Appendix C

SAFETY DATA SHEET

Date of issue: *04/20/2019*
Date of previous issue: *08/15/2018*

Section 1. Identification

Product name LightRay Liner/ L040-LIGHTRAY
Product type Vinyl Ester Resin
Chemical family Aromatic.
SDS No. XNA-1804:1446 (Version: 2.1)

Relevant identified uses of the substance or mixture and uses advised against
Identified uses Used in the manufacture of thermoset plastic parts.
Uses advised against No additional information.

Supplier's details United States:

Emergency telephone number

CHEMTREC Within USA and Canada	+1 (800) 424-9300	CCN1023
CHEMTREC Outside USA and Canada	+1 (703) 527-3887	
CANUTEC Within Canada	+1 (613) 996-6666	

Section 2. Hazards identification

OSHA/HCS status
This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Classification of the substance or mixture
SKIN CORROSION/IRRITATION – Category 2 – H315
SERIOUS EYE DAMAGE/ EYE IRRITATION – Category 2 – H319
SENSITIZATION (Skin) – Category 1 – H317
SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPOSURE) (Respiratory system) – Category 3 – H335

GHS label elements
Hazard pictograms

Signal word
Warning

Hazard statements
H315: Causes skin irritation.
H319: Causes serious eye irritation.
H317: May cause an allergic skin reaction.
H335: May cause respiratory irritation.

Precautionary statements
General
P101: If medical advice is needed, have product container or label at hand.
P102: Keep out of reach of children.

Prevention
P261: Do not breathe vapor or mist.
P270: Do not eat, drink or smoke when using this product.
P264: Wash hands thoroughly after handling.
P271: Use only outdoors or in a well-ventilated area.
P272: Contaminated work clothing should not be allowed out of the workplace.
P280: Wear protective gloves/protective clothing/eye protection/face protection.

ID: 128326-Submittal
Rev: C
Date: [9-8-23]

Section 2. Hazards identification

Response

P302+P352: IF ON SKIN: Wash with plenty of soap and water.
P333+P313: If skin irritation occurs, get medical advice/attention.
P362+P364: Take off contaminated clothing and wash it before reuse.
P304+P340: IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P305+P351+P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P337+P313: If eye irritation persists, get medical advice/attention.
P312: Call a POISON CENTER or doctor/physician if you feel unwell.
P391: Collect spillage.

Storage

P403 + P235: Store in a well-ventilated place. Keep cool.
P233: Keep container tightly closed.
P405: Store locked up.

Disposal

P501: Dispose of contents and container in accordance with all local, regional, national and international regulations.

Hazards not otherwise classified

None known.

Section 3. Composition/information on ingredients

Substance/mixture Mixture.

Ingredient name	CAS number	%
(1-methyl-1,2-ethanediyl)bis[oxy(methyl-2,1-ethanediyl)] diacrylate	42978-66-5	≥25 - ≤50
phenyl bis(2,4,6-trimethylbenzoyl)-phosphine oxide	162881-26-7	≤0.3

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact

Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Use of buffered baby shampoo will aid in removal. If irritation persists, get medical attention.

Inhalation

Move the victim to a safe area as soon as possible. Allow the victim to rest in a well-ventilated area. If breathing is difficult, give oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Skin contact

In case of contact, immediately flush skin with plenty of water. Remove contaminated clothing and shoes. If irritation persists, seek medical attention. Wash contaminated clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion

Wash out mouth with water. Remove dentures if any. Stop if the exposed person feels sick as vomiting may be dangerous. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Seek immediate medical attention.

Most important symptoms/effects, acute and delayed

Eye contact

Causes serious eye irritation.

Inhalation

May cause respiratory irritation.

Skin contact

May cause allergic skin reactions with repeated exposure.

Ingestion

Irritating to mouth, throat and stomach.

Over-exposure signs/symptoms

Eye contact

Adverse symptoms may include the following: pain or irritation, watering, redness.

Section 4. First aid measures

Inhalation

Adverse symptoms may include the following: respiratory tract irritation, coughing.

Skin contact

Adverse symptoms may include the following: irritation, redness.

Ingestion

Adverse symptoms may include the following: Irritating to mouth, throat and stomach..

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician

Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media

Use dry chemical, CO_2, water spray (fog) or foam.

Unsuitable extinguishing media

Do not use water jet.

Specific hazards arising from the chemical

No specific fire or explosion hazard.

Hazardous thermal decomposition products

No specific data.

Special protective actions for fire-fighters

Fire water contaminated with this material must be contained and prevented from being discharged to any waterway, sewer or drain.

Special protective equipment for fire-fighters

Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel

No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Do not touch or walk through spilled material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing vapor or mist. Provide adequate ventilation.

For emergency responders

If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment. See also the information in "For non-emergency personnel".

Environmental precautions

Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air). Water polluting material. May be harmful to the environment if released in large quantities.

Methods and materials for containment and cleaning up

Small spill

Stop leak if without risk. Move containers from spill area. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Use spark-proof tools and explosion-proof equipment. Dispose of via a licensed waste disposal contractor.

Large spill

Stop leak if without risk. Move containers from spill area. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Use spark-proof tools and explosion-proof equipment. Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures

Put on appropriate personal protective equipment (see Section 8). Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. Do not breathe vapor or mist. Do not ingest. Avoid contact with eyes, skin and clothing. Avoid release to the environment. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Store and use away from heat, sparks, open flame or any other ignition source. Use only non-sparking tools. Take precautionary measures against electrostatic discharges. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene

Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities

Store in accordance with local regulations. Store in a segregated and approved area. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink. Eliminate all ignition sources. Segregate from oxidizing materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination. Refer to the product label and/or technical data sheet for further information.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

None.

Appropriate engineering controls

Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapor or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Individual protection measures

Hygiene measures

Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection

Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists or dusts.

Hand protection

Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.

Body protection

Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection

Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection

Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Section 9. Physical and chemical properties

Appearance

Physical state	Liquid.
Color	Yellow.
Odor	Acrylate
Odor threshold	Not available.
pH	*Not applicable.*
Melting point	Not available.
Boiling point	*Not applicable.*
Flash point	>201°F / >94°C
Evaporation rate	Not available.
Flammability (solid, gas)	*Not applicable.*
Lower and upper explosive (flammable) limits	Not available.
Vapor pressure	Not available.
Vapor density	Not established.
Relative density	1.038 (Water = 1)
Solubility	Negligible.
Partition coefficient: n-octanol/water	Not available.
Auto-ignition temperature	Not available.
Decomposition temperature	Not available.
Viscosity	Not available.
Molecular weight	Not available.

Section 10. Stability and reactivity

Reactivity

No specific test data related to reactivity available for this product or its ingredients.

Chemical stability

The product is stable. Stable under recommended storage and handling conditions (see Section 7).

Possibility of hazardous reactions

Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid

Avoid all possible sources of ignition (spark or flame). Do not pressurize, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition.

Incompatible materials

Reactive or incompatible with the following materials: oxidizing materials

Hazardous decomposition products

Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Ingredient name	Result	Species	Dose	Exposure
(1-methyl-1,2-ethanediyl)bis[oxy (methyl-2,1-ethanediyl)] diacrylate	LD50 Oral	Rat	6200 mg/kg	-
phenyl bis(2,4,6-trimethylbenzoyl)-phosphine oxide	LD50 Dermal	Rat	>2000 mg/kg	-
	LD50 Oral	Rat	>2000 mg/kg	-

Irritation/Corrosion

Ingredient name	Result	Species	Score	Exposure	Observation
(1-methyl-1,2-ethanediyl)bis[oxy (methyl-2,1-ethanediyl)] diacrylate	Eyes - Severe irritant	Rabbit	-	24 hours 100 microliters	-
	Skin - Moderate irritant	Rabbit	-	500 milligrams	-

Sensitization

May cause sensitization by skin contact.

Carcinogenicity

Section 11. Toxicological information

Classification

Ingredient name	ACGIH	IARC	NTP
None of the components are listed.			

Mutagenicity

No mutagenic effect.

Reproductive toxicity

Not considered to be toxic to the reproductive system.

Teratogenicity

No known effect according to our database.

Specific target organ toxicity (single exposure)

No known effect according to our database.

Specific target organ toxicity (repeated exposure)

No known effect according to our database.

Aspiration hazard

No known effect according to our database.

Potential acute health effects

Eye contact

Causes serious eye irritation.

Inhalation

May cause respiratory irritation.

Skin contact

May cause allergic skin reactions with repeated exposure.

Ingestion

Irritating to mouth, throat and stomach.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact

Adverse symptoms may include the following: pain or irritation, watering, redness.

Inhalation

Adverse symptoms may include the following: respiratory tract irritation, coughing.

Skin contact

Adverse symptoms may include the following: irritation, redness.

Ingestion

Adverse symptoms may include the following: Irritating to mouth, throat and stomach..

Section 12. Ecological information

Toxicity

Ingredient name	Result	Species	Exposure
(1-methyl-1,2-ethanediyl)bis[oxy (methyl-2,1-ethanediyl)] diacrylate	EC50 3.68 mg/l LC50 35.96 mg/l LC50 4.9 mg/l	Algae Daphnia Fish	96 hours 48 hours 96 hours

Persistence and degradability

Not available.

Bioaccumulative potential

Ingredient name	$LogP_{ow}$	BCF	Potential
(1-methyl-1,2-ethanediyl)bis[oxy (methyl-2,1-ethanediyl)] diacrylate	2	46.83	low
phenyl bis(2,4,6-trimethylbenzoyl)-phosphine oxide	5.77	<5	low

Mobility in soil

Soil/water partition coefficient (K_{OC})

Not available.

Section 12. Ecological information

Other adverse effects

No known effect according to our database.

Section 13. Disposal considerations

The information in this section contains generic advice and guidance. The list of Identified Uses in Section 1 should be consulted for any available use-specific information provided in the Exposure Scenario(s).

Disposal methods

The generation of waste should be avoided or minimized wherever possible. Empty containers or liners may retain some product residues. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Avoid disposal. Attempt to use product completely in accordance with intended use. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible.

Special precautions

This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Empty containers or liners may retain some product residues. Do not cut, weld or grind used containers unless they have been cleaned thoroughly internally. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

DOT / TDG/ IMDG/IMO / ICAO/IATA and National regulations.

UN number	UN3082
Proper shipping name	Environmentally hazardous substance, liquid, n.o.s.(Tri(propylene glycol) diacrylate)
Transport hazard class(es)	9 
Packing group	III
Additional information	US regulations require the reporting of spills when the amount exceeds the Reportable Quantity (RQ) for specific components of this material. See CERCLA in Section 15, Regulatory Information, for the Reportable Quantities. **IMDG** No additional information. **IATA** No additional information.
Environmental hazards	Marine pollutant: Yes.
Special precautions for user	**Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Section 15. Regulatory information

International regulations lists

United States inventory (TSCA 8b)	All components are listed or exempted.
Australia (AICS)	Not determined.
Canada (DSL)	All components are listed or exempted.
China (IECSC)	Not determined.
Europe (EINECS)	Not determined.
New Zealand (NZIoC)	Not determined.
Philippines (PICCS)	Not determined.
Japan	**Japan inventory (ENCS)**: Not determined. **Japan inventory (ISHL)**: Not determined.
Malaysia (EHS Register)	Not determined.
Republic of Korea (KECI)	Not determined.
Taiwan (CSNN)	Not determined.

U.S. Federal regulations

SARA 311/312

Section 15. Regulatory information

Per the June 13, 2016 Federal Register notice, EPA harmonized the EPCRA 311/312 hazard categories with the 2012 OSHA hazard communication standard for classifying and labeling of chemicals (i.e. GHS). Please refer to Section 2 of the SDS to identify the appropriate hazard categories for reporting purposes.

SARA 313

	Ingredient name	CAS number
Form R - Reporting requirements	None.	

CERCLA RQ - None.

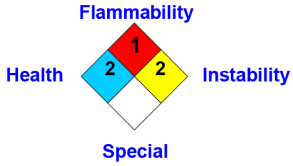
State regulations

California Prop. 65

Not available.

Section 16. Other information

National Fire Protection Association (U.S.A.)



History

Date of issue	09/20/2018
Date of previous issue	08/15/2018
Version	2.1
Prepared by	AOC Corporate Regulatory Affairs
Key to abbreviations	ATE = Acute Toxicity Estimate BCF = Bioconcentration Factor GHS = Globally Harmonized System of Classification and Labelling of Chemicals IATA = International Air Transport Association IBC = Intermediate Bulk Container IMDG = International Maritime Dangerous Goods LogPow = logarithm of the octanol/water partition coefficient MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution) UN = United Nations

Indicates information that has changed from previously issued version.

Notice to reader

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OFFICIAL LISTING

NSF certifies that the products appearing on this Listing conform to the requirements of NSF/ANSI 14 - Plastics Piping System Components and Related Materials

This is the Official Listing recorded on September 6, 2023.

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Facility: Clearwater, FL

Drain, Waste, Vent, and Sewer Rehabilitation Materials

Material Type	End Use	Trade Name	Product Standard
Rehab Systems*	1	Perma-Lateral Lining System	ASTM F1216
Rehab Systems	1	LightRay Pull In Place System	ASTM F3541

* Product meets the material requirements of ASTM F1216.

Note: Additions shall not be made to this document without prior evaluation and acceptance by NSF International.

0D470

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ID: 128326-Submittal
Rev: C
Date: [9-8-23]

Appendix D

Product Name: UV Flex Liner (Pull in Place)

Product Description: Flexible fiberglass liner for use with Light Ray technology

Typical Applications:

Use this material with WRT's Light Ray PIP technology for CIPP repairs in as little as 6 minutes. Works well in systems with multiple 45° or 90° bends as well as transitions. Materials flexibility allows for ease of inversion as well as molding to the host pipe and leaving little to no void.

Performance Limits

*** If product is utilized outside the limits defined below, warranty coverage is voided ****

Characteristic	Spec	Comments	
General			
Typical dry Thickness (mm)	4 – 5 mm		
Typical finished Thickness (mm)	2.8 – 3.5 mm	Depends on installation pressures, pipe diameter, and number of bends (45° & 90°)	
Sizes available (in.)	3, 4, 6, 8		
Coating	None		
Resins			
Light Ray UV Vinyl Ester	YES	Product comes pre-wet with this resin. ****May work with other resins but use of other resin voids warranty****	
Install Design			
** Typical Max Depth of Install (ft) for Structural Integrity DEPENDENT ON PIPE INSTALLATION CONDITIONS.	3" –> 9' 4" –>5' 6" –> 3' ≥8" –> 0'	**WORST CASE:**	- Pipe ovality = 10% - Very soft, uncompacted soil - Flood plains & High-Water Table - Pipe Condition = Fully Deteriorated
	3" –> 52' 4" –> 30' 6" –> 15' ≥8" –> 0'	**TYPICAL CASE:** *(Fully Deteriorated)*	- Pipe ovality = 5% - Moderately compacted soil - 10ft water table below surface - Pipe Condition = Fully Deteriorated
	3" –> 65' 4" –> 37' 6" –> 19' 8" –> 13' ≥10" –> 10'	**TYPICAL CASE:** *(Partially Deteriorated)*	- Pipe ovality = 5% - Moderately compacted soil - 10ft water table below surface - Pipe Condition = Partially Deteriorated
	3" – 12" –> Any Depth	**BEST CASE:**	- Pipe ovality = 2% - Highly compacted soil - No water above pipe - Pipe Condition = Partially Deteriorated
Can be used across Transitions?	YES	Stretch must be accounted for when upsizing	
Remote Start Allowed?	NO		
Install with Infiltration Allowed?	Not Recommended	High I&I situations may impact the structural integrity of any installed liner. **Contact representative to discuss specific application.**	
Resin per FT	Varies by size, resin type	**Light Ray UV Resin**: 3" – 0.37 lbs./FT, 4" – 0.55 lbs./FT, 6" – 0.83 lbs./FT, 8" – 1.1 lbs./FT *10" & 12" use upsized 8"	
Installation			
Wet Out Gap Setting	9.8 mm	When using the WRT Wet Out Roller System and proper vacuum ****DO NOT USE FLOOR ROLLER FOR RISK OF RESIN SHY FINAL PRODUCT****	
Typical Inversion Pressures (psi)	8-15	Depends on installation length, pipe diameter, and number of bends (45° & 90°)	

Maximum Inversion Pressure (psi)	25	Pressures exceeding this limit run the risk of tearing the liner or excessive “thinning” around bends
Max Curing Pressures (psi)	25	Pressures exceeding this limit run the risk of tearing the liner or excessive “thinning” around bends
Stretch Factor (Transitioning up in size)	-20%	
Suitable Host Pipe materials		Cast iron, ABS, PVC, Orangeburg, Clay
Storage Guidelines		
• Until time of use, leave liner in the UV protective film • Do not expose to direct sunlight in storage • Ideal storage temperature not to exceed 85^0F		

Please contact your representative at 1-866-336-2568 if you have any questions.