CRITERIA FOR VALIDATION/CERTIFICATION

ENVIRONMENTAL INNOVATION: PRODUCTS, SERVICES, PROCESSES, AND TECHNOLOGIES, GS-20 Edition 1.0
Sub-Category: PVC Solvent Cement

APPLICANT INFORMATION:	
Company:	Weld-On
Product Name:	905ECO (Commercial and Retail Products)
Website:	www.weldon.com

Once all certification criteria listed below are met and evidence for innovation is verified, **Green Seal will be able to certify this product as Environmentally Innovative**, under the categories of

- **Unusual for the market category.** Creates increased value for better performance or environmental impacts, in ways that are different from common practice.
- **Beneficial alternative to an existing practice:** Helps to avoid, reduce, or eliminate hazards to human health and environment, reduce the use of limited resources (energy, water, land, etc.), and help to reduce or eliminate waste and pollution.

Validation of Environmental and Functional Claims: If the product can demonstrate conformance with the criteria, the following claims can be validated by Green Seal:

Weld-On's 905ECO solvent cement:

- The first solvent cement that offers the same performance as top PVC solvent cements with reduced hazards to the environment and human health
- Has a unique formulation that is the first and only solvent cement not to require the Health Hazard Warning label under OSHA labeling requirements
- Calculated VOC emissions under occupational conditions are 30% lower than equivalent products
- A low VOC product that meets California's SCAQMD (South Coast Air Quality Management District) Rule 1168 for VOC content
- Is NSF/ANSI 61 certified for use in contact with drinking and irrigation water

All claims made for these product/s shall clearly identify whether or not they were validated by Green Seal.

Statement of Basis for Certification to accompany the Certification Mark (or an alternative that is approved by Green Seal in writing)

> "This PVC solvent cement is certified by Green Seal™ for Environmental Innovation for effective performance, reduced health hazards, and use with potable water. GreenSeal.org/GS20"

Posted for public comment, August 15 - September 5, 2017

Section A: Certification Criteria

1.0 Criteria for Evaluation

1.1 Functional Performance Bond strength shall meet the following requirements when tested according to the procedures in ASTM D2564 or equivalent:

1.1.1 Lap Shear Strength

250 psi after 2 hours curing

500 psi after 16 hours curing

900 psi after 72 hours curing

1.1.2 Lap Hydrostatic Burst Strength

400 psi after 2 hours curing

1.2 Human and Environmental Health

1.2.1 The product shall not contain intentionally added substances that are classified as a GHS category 1 or 2 human carcinogen (known, presumed, or suspected, H350 or H351).

1.2.2 The total VOC evaporation rate from the product shall be at least 30% lower than that of two leading alternative products (calculation method described in Appendix A).[1]

1.2.3 The total weighted evaporation toxicity exposure of the product shall be no more than 45% of the total weighted average evaporation toxicity exposure for each of the two leading alternative products (calculation method described in Appendix A).

1.2.4 When measured under occupational conditions, exposures to the major active solvents shall be below CAL-OSHA PEL and TLV levels (methods described in Appendix A). Major active solvents are the three that have the highest concentration in the product.

1.2.5 The VOC content shall meet SCAQMD (South Coast Air Quality Management District) Rule 1168 limits for VOC content (510 g/L for PVC solvent cement[2]).

1.2.6 The product shall be rated by NSF for contact with drinking water under NSF/ANSI 61: Drinking Water System Components − Health Effects.

1.2.7 Use instructions for the product in the SDS shall include a description of engineering controls, monitoring, and personal protective measures to reduce exposure from inhalation and skin absorption (current description is included in Appendix B).

1.3 Reducing the use of limited resources (energy, water, land, etc.)

1.3.1 None identified.

1.4 Claims that do not need to be demonstrated for this application[3]

1.4.1 Is not required to carry the OSHA Health Hazard Label (since none of the ingredients carry a hazard code that would require that).

2.0 Environmental Innovation

This product shall be either unique in the market or very rare by showing it is first in the U.S. market to not require an OSHA Health Hazard warning.

[1] Criteria 1.2.2 and 1.2.3 underwent editorial corrections on 10/25/2017 to accurately describe the calculations.

[2] http://www.aqmd.gov/docs/default-source/rule-book/reg-xi/rule-1168.pdf (see table on page 11).

[3] These claims are self-evident from the other claims being validated or from the product description.

Section B: Analysis of Claims

1.0 Performance/Function/Purpose
1.1 Main function: Bonding PVC pipes in agricultural and irrigation applications.
1.2 Secondary function: None.
1.3 Alternatives for providing the same function: Standard solvent cements in the market.
1.4 Additional performance issues: None identified.
1.5 Comparison of performance parameters for the product and the alternatives; Meets or exceeds lap shear strength and hydrostatic burst strength requirements for bond strength.
1.6 Quality Management: The product is subject to the same QC test requirements as all company products:

- Pass Viscosity Specification
- Pass Specific Gravity Specification
- Pass Infra-Red footprint profile
- Pass Visual Color Standards

2.0 Environment/Health

2.1 Life cycle health and environment benefits of the product compared to alternatives

2.1.1 Resources and Manufacture Phases

The alternative PVC solvent cements use tetrahydrofuran (THF), which – unlike the other components of these products – is required to carry the Health Hazard warning and is classified as a category 2 human carcinogen according to the GHS harmonized classification according to Annex VI of Regulation (EC) No 1272/2008 (CLP Regulation).

The formulation of the applicant product uses the same major solvents as alternative products except for the absence of THF; all current PVC solvent cement in the US market uses THF. Other components in the product are also present in alternative products, essentially in similar concentrations, or are not classified as hazardous.

2.1.2 Use Phase The product is used in the same way as a regular solvent cement, with the same protective measures recommended for use with the alternative products.

The formulation of solvents in the product is less volatile than the benchmark products (calculations in appendix A). This leads to a lower calculated emission of VOCs, as well as a lower weighted toxicity profile of the major volatile substances. These calculations are supported by measurements of actual breathing-zone exposures under occupational conditions, which show that use of the applicant product leads to lower exposure to hazards.

The product is certified to comply with NSF/ANSI 61: Drinking Water System Components − Health Effects, and is therefore acceptable for use in potable and irrigation water systems.

2.1.3 Waste Management and Disposal Phases The waste management and disposal phases are the same as in current standard solvent cement manufacturing.

2.2 Life cycle health and environment drawbacks of the product compared to alternatives

2.2.1 Major concerns: None identified. The remaining solvents are the same as those used in alternative products, at concentrations that are essentially similar, and have been shown to have lower

calculated VOC content and weighted toxicity exposure than major alternatives. Any other differences in formulations are not classified with significant hazards.

2.2.2 Secondary concerns: None identified.

2.2.3 Mitigation of concerns: None are necessary.

3.0 Comments on the performance of the product vs. the alternatives: As discussed above, the product provides at least the same performance as alternatives on the market, and can also be used in potable water supply systems.

4.0 Comment on the health and environment aspects of the product relative to alternatives: As discussed above, the product is not required by OSHA to carry the same health hazard warning as other solvent cements, and does not contain tetrahydrofuran, a suspected human carcinogen. Additionally, calculated VOC content and weighted toxicity exposure are shown to be lower than other leading PVC solvent cements.

5.0 Innovation

The applicant states that this patented formulation (US Patent Application number 14/862751) is the first PVC Cement on the market to not require an OSHA Health Hazard warning, due to its unique formulation.

APPENDIX A – TEST AND CALCULATION METHODS

Occupational exposure:
The vapors were measured in the employees' breathing zone using personal air sampling pumps drawing breathing zone air through two sampling tubes in a Sensidyne Dual Variable Tube Holder Kit, (one an Anasorb747 tube for the MEK and the other, a charcoal tubes for the other solvents), in parallel, at 0.2 LPM (liters per minute). The sampling trains were calibrated prior to and after the sample collection and were checked for proper operation and flow during the sampling process. Samples were collected for two hours for each of the tests. The sampling tubes were sealed after the tests and tested at an AIHA certified Testing Laboratory.

The 8 Hr. TWA (time weighted average) results were calculated assuming they worked a full 8-hour shift at that exposure.

VOC evaporation calculation
Solvent evaporation for each major solvent was calculated by multiplying the percentage of the solvent in the product by the evaporation rate relative to ethyl ether. Total VOC evaporation was calculated as the sum for all major solvents present in the product.

VOC evaporation = % of solvent in product x evaporation rate relative to ethyl ether

Total VOC evaporation = VOC evaporation 1 + VOC evaporation 2… [for all major solvents]

Weighted toxicity exposure
Toxicity exposure for each major solvent was calculated as the amount of solvent evaporated (calculated as described above, percentage concentration x relative evaporation rate) divided by the OSHA PEL (Permitted Exposure Limit) for that substance. The total weighted toxicity exposure was calculated as the sum for all major solvents present in the product.

$$\text{Weighted toxicity exposure} = \frac{(\%\ \text{conc} \times \text{relative evaporation rate})}{\text{OSHA PEL}}$$

APPENDIX B – PROTECTIVE MEASURES LISTED IN THE SDS (as of July 2017)

Engineering Controls: Use local exhaust as needed.
Monitoring: Maintain breathing zone airborne concentrations below exposure limits.

Personal Protective Equipment (PPE):Eye Protection:
Avoid contact with eyes, wear splash-proof chemical goggles, face shield, safety glasses (spectacles) with brow guards and side shields, etc. as may be appropriate for the exposure.
Skin Protection: Prevent contact with the skin as much as possible. Butyl rubber gloves should be used for frequent immersion. Use of solvent-resistant gloves or solvent-resistant barrier cream should provide adequate protection when normal adhesive application practices and procedures are used for making structural bonds.
Respiratory Protection: Prevent inhalation of the solvents. Use in a well-ventilated room. Open doors and/or windows to ensure airflow and air changes. Use local exhaust ventilation to remove airborne contaminants from employee breathing zone and to keep contaminants below levels

listed above. With normal use, the Exposure Limit Value will not usually be reached. When limits approached, use respiratory protection equipment.