CRITERIA FOR CERTIFICATION

ENVIRONMENTAL INNOVATION, GS-20 Edition 2.1

Sub-Category: Industrial Temporary Heating, Power Generation, and Lighting

APPLICANT INFORMATION:	
Company:	Thermal Intelligence
Product Name:	Basecamp and Basecamp XL Smart 3-in-1 Heater, Light Tower, and Generator
Website:	https://thermalintelligence.com

Introduction. Green Seal's Environmental Innovation Standard (GS-20) provides a framework for the certification of environmental innovations. This certification demonstrates that an independent third party has verified the innovative aspect(s) of a product results in a significant reduction of human health and environmental impacts compared to products of the same functional class, achieving innovations not previously demonstrated within a product category. Certification neither constitutes the development of a product category standard or benchmark, nor does it require competitors within a product category to use the same innovation strategies in their approach to claiming innovation.

Certification of Environmental Innovation. If the applicant can demonstrate the product conforms to all criteria within this document, Green Seal will provide a Certification of Environmental Innovation.

Innovation Claim. The applicant states that the products Basecamp and Basecamp XL Smart 3-in-1 Heater, Light Tower, and Generator achieves an estimated 50-66 percent reduction in operating fuel use than a comparable generator/generator-heater combination, to achieve the same power output. This 50-66 percent gain in fuel use efficiency is possible through a patent-pending system design to efficiently power both its generator and blower, allowing for simultaneous delivery of heating, lighting, and electric power, and results in a emissions reduction of an estimated 209 metric tons of CO_2e per year.

Disclaimer. This Certification is not intended to identify all possible negative impacts and cannot rule out any unknown negative consequences from the use of this product.

Definitions. Words and phrases described in the standard that appear in italics have a corresponding definition located in the definition section of the Green Seal Standard for Environmental Innovation, GS-20, Annex A.

Public Comment. A public comment period on the Draft Criteria was held from April 23, 2021 to May 24, 2021.

OVERVIEW

1.0 Eligibility

The products Basecamp and Basecamp XL Smart 3-in-1 Heater, Light Tower, and Generator by the company Thermal Intelligence are eligible to be certified under the Environmental Innovation Standard (GS-20, Edition 2.0) because the products:

1. Are commercially available.
2. Exist within a market that has comparable options that achieve the same function, and
3. Have lifecycle phases for which there exist published health and environmental impact information from credible sources.

Product Function

When used as intended the product provides up to 3 functions simultaneously: 1) electric power generation, 2) temporary heating, and 3) lighting. The product is typically used in construction, restoration/remediation, and equipment pre-heating/thawing. The fuel source used to power the product is diesel fuel.

Comparable Alternatives (Primary Function: Electricity Generation)

Comparable products include portable medium powered generators fueled by diesel, able to produce various electricity levels, depending on the size of the generator.[1] Portable generators similar to Basecamp and Basecamp XL produce 20-50 kW of electric power. Additional comparable products include portable generator and indirect flamed heater combinations, which provide electric power and heat.

Additional Functions: Temporary Heating and Lighting

Basecamp and Basecamp XL also provide integrated heating, comparable to standalone flameless heaters (fuel source diesel) or indirect flamed heaters (fuel source diesel or propane) and integrated lighting, comparable to standalone lighting towers (fuel source generated electricity) used on construction job sites.

Legal Compliance

Manufacturer shall not be in violation of any applicable environmental regulations or laws nor any applicable regulations under the authority of the U.S. Federal Trade Commission or the U.S. Environmental Protection Agency (or equivalent if based outside the United States).

[1] https://www.wpowerproducts.com/news/how-construction-sites-get-power/

2.0 Product Lifecycle Impact Review

This section documents the anticipated human health and environmental lifecycle impacts associated with heating, power generation and/or lighting heavy equipment for industrial use, noting the most significant (i.e., greatest in negative effect) impacts.

Summary of Lifecycle Impact Review

Lifecycle Phase	Significant Impacts Identified
Resource Extraction	Degradation of local air and water quality and soil health associated with the extraction of resources used to create typical product components such as cast iron, alloy and structural steels, aluminum alloys, brass, copper, fiberglass, etc.
Manufacturing	Local air and water quality degradation from process emissions associated with product manufacturing.
Use	Greenhouse gas and air pollutant emissions from fuel used to power equipment, creating negative human health and environmental impacts.
Waste Management and Disposal	No significant impacts identified.

Resource Extraction Phase

Heating, lighting, and power generation equipment typically requires the extraction of raw materials used to create product components such as cast iron, alloy and structural steel, aluminum, brass, copper, fiberglass and other such components. The production of each of these components results in significant impacts to the local environment.

According to the American Geosciences Institute,[2] "operations and waste products associated with metal extraction and processing are the principal causes of environmental concerns about metal mining" and are broadly categorized as:

- Physical disturbances to the land
- Soil and water contamination
- Air contamination
- Public safety

For example, aluminum is produced through the extraction of bauxite; the opencast mining process used to extract bauxite can seriously damage local ecosystems and communities and has significant residue storage needs that demand extensive land use and can create sludge spills in local communities.[3] Iron ore extraction (used to produce steel) also occurs within opencast mines, creates similar disturbances to land, creates soil, water, and air contamination.

According to the American Geosciences Institute, "as the amount of waste rock in open pit mines is commonly two to three times the amount of ore produced, tremendous volumes of waste rock are removed from the pits and deposited in areas nearby. Waste piles from processing, such as tailings impoundments, leach piles, and slag piles vary in size, but can be very large. The impoundments associated with some of the largest mills, such as at open pit copper mines, can cover thousands of acres (tens of km2) and be several hundred feet (about 100 m) thick."[4]

[2] https://www.americangeosciences.org/critical-issues/faq/how-can-metal-mining-impact-environment
[3] https://www.greenspec.co.uk/building-design/aluminium-production-environmental-impact/
[4] https://www.americangeosciences.org/critical-issues/faq/how-can-metal-mining-impact-environment

Manufacturing Phase

In general, the materials that comprise construction products such as generators, lighting equipment, and heaters require manufacturing processes that are energy and water intensive, and result in the release of hazardous emissions and effluents.

According to GreenSpec[5], "steel production has a number of impacts on the environment, including air emissions (CO, SO_x, NO_x, PM2.5), wastewater contaminants, hazardous wastes, and solid wastes" with coking and iron making contributing the largest environmental impacts from integrated steel mills. In addition, contaminants created through the coke cooling process enter the local waterways of steel production facilities, resulting in local water quality degradation and negative impacts to aquatic life. The steelmaking process is very energy intensive, with "virtually all greenhouse gas emissions" from steel production coming from "carbon dioxide emissions related to energy consumption." In fact, according to the International Energy Agency (2010), 6.5% of global CO_2 emissions come from the production process of iron and steel.

Similarly, aluminum production requires high amounts of energy use during the production phase and the smelting process requires large amounts of water. During processing, large amounts of air and water emissions occur, some of which are hazardous.[6] Similar impacts generally result from the production of other components used in generators, heaters, and powered lighting equipment.

Use Phase

Construction activities represent a significant contributor of greenhouse gas emissions. According to the U.S. EPA, the construction sector produced 6% of total U.S. industrial GHG emissions in 2002; or 131 million metric tonnes of CO_2e annually.[7] Within this figure, over 88 million metric tonnes of CO_{2e} (over 75% of the total emissions) comes from fossil fuel combustion, including emissions from on- and off-highway construction vehicle combustion of gasoline and diesel fuel, natural gas combustion for office power, heating and tools, and diesel used for generators.[8]

As is well documented by the scientific community, "greenhouse gas emissions have far-ranging environmental and health effects. They cause climate change by trapping heat, and they also contribute to respiratory disease from smog and air pollution. Extreme weather, food supply disruptions, and increased wildfires are other effects of climate change caused by greenhouse gases."[9]

In addition to greenhouse gas emissions, diesel powered equipment creates air pollutant emissions which can create a negative human health impact for on-site workers exposed to pollutant emissions. These pollutants include PM10 (which penetrates deeply into the lungs and cause a wide range of health problems including respiratory illness, asthma, bronchitis and even cancer), carbon monoxide, hydrocarbons, nitrogen oxides and carbon dioxide.[10]

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[5] https://www.greenspec.co.uk/building-design/steel-products-and-environmental-impact/
[6] https://www.greenspec.co.uk/building-design/aluminium-production-environmental-impact/
[7] Emissions calculated for Sector Strategies, based on the U.S. Department of Energy (DOE) 2002 Manufacturing Energy Consumption Survey and EPA's Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2006. U.S. Department of Energy, Energy Information Administration (EIA), 2002 Manufacturing Energy Consumption Survey, 2005. U.S. Environmental Protection Agency, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2006, 2008.
[8] U.S. Environmental Protection Agency. *Potential for Reducing Greenhouse Gas Emissions in the Construction Sector*. February 2009; page 9. https://archive.epa.gov/sectors/web/pdf/construction-sector-report.pdf
[9] https://www.nationalgeographic.com/environment/article/greenhouse-gases
[10] http://www.sustainablebuild.co.uk/pollutionfromconstruction.html

Waste Management and Disposal Phase
No significant impacts identified.

CERTIFICATION REQUIREMENTS

3.0 Environmental Innovation Review

This section details the applicant's proposed innovation claims including:

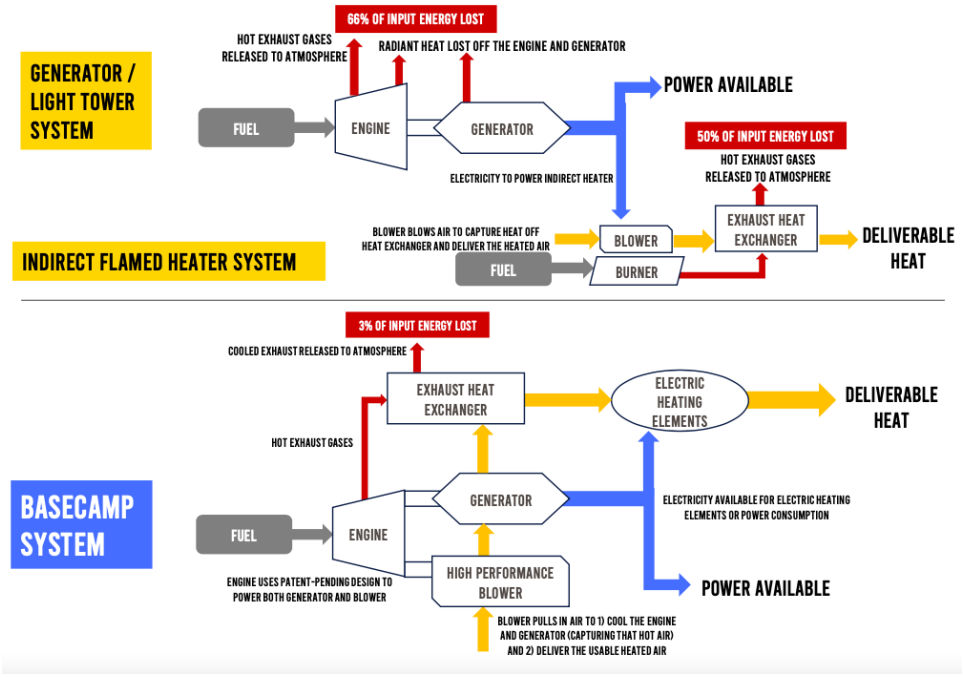
- Innovation Summary: describes how the applicant claims the product differs from comparable products on the market,
- An Impact Reduction Statement: describes how the applicant claims their product's innovation results in reductions of significant lifecycle impacts identified in the Product Lifecycle Impact Review (Section 2.0 herein),
- Market Analysis: describes the parameters for the applicant to demonstrate their claim that the product is the first product of its type to achieve this innovation during the Certification Phase, and
- Drawbacks Analysis: a summary of any potential drawbacks that Green Seal has identified and mitigations necessary.

The applicant shall demonstrate that a product is environmentally innovative via the following process: the applicant shall provide evidence that a specific new approach to the product results in reductions of significant health or environmental impacts with at least a 30% reduction in one or 20% reduction in two or more significant environmental or human health impacts, as identified in Section 2.0, as compared to available alternatives.

3.1 *Innovation Summary – How does this product differ from others on the market?*
The applicant states that the products Basecamp and Basecamp XL Smart 3-in-1 Heater, Light Tower, and Generator achieves an estimated 50-66 percent reduction in operating fuel use than a comparable generator/generator-heater combination, to achieve the same power output. This 50-66 percent gain in fuel use efficiency is possible through a patent-pending system design to efficiently power both its generator and blower, allowing for simultaneous delivery of heating, lighting, and electric power.

- Basecamp provides heat and light comparable two indirect flamed heaters and one light tower.
- Basecamp XL provides heat and light comparable to three indirect flamed heaters and one light tower.

The graphic below illustrates how Basecamp and Basecamp XL's engine design technology allows for the capture of two-thirds of the heat which is typically lost, in the case of comparable products, as exhaust or radiant heat. The captured heat is then converted back into electricity, converted into light, converted into heat, or a combination of those functions. During the Certification Phase, Green Seal will verify these claims through a technical review.



3.2 *Impact Reduction Summary – How does the innovation result in impact reduction?*
Through this innovation, the applicant states that Basecamp and Basecamp XL achieve an estimated 50-66 percent reduction in operating fuel use, which saves an estimated 209 metric tons of CO_2e per year, calculated when used at full capacity for 180 days of use.

Specifically, Basecamp and Basecamp XL's patent-pending system design produces the same energy output using 57 gallons of diesel fuel for which a comparable generator and heater combination would require 171 gallons of diesel fuel.

During the Certification Phase, Green Seal will verify these claims through a technical review.

3.3 *Market Analysis – How unique is this innovation?*
An initial market analysis conducted in February 2021 shows that there are no other products on the market that provide integrated heat, light, and power generation for use on a construction site. During the Certification Phase, applicant shall provide evidence that the product is the first combined heat, light, and power generator available on the US market and can achieve an estimated 50-66 percent reduction in operating fuel use than a comparable portable generator and indirect flamed heater combination.

3.4 *Drawbacks Analysis – Has burden shifting occurred?*
The Drawbacks Analysis explored whether the Basecamp and Basecamp XL require significantly more materials (and additional impacts to the Resource Extraction and Manufacturing Phases) in order to achieve the greenhouse gas emissions reductions associated with the Use Phase. Weight was used as the metric in this analysis.

- Basecamp (with a 27kWh generator) has a dry weight of 3,500 pounds, including the trailer
- Basecamp XL (with a 48kWh generator) has a dry weight of 7,000 pounds, including the trailer

- Three similar generators reviewed weigh between 2,600 pounds (generator only) to 4,200 pounds (including a trailer)
- Three similar indirect flame heaters reviewed weigh between 420 – 660 pounds
- Three similar light towers reviewed weigh between 970 -1,460 pounds

Based on the above information, both Basecamp and Basecamp XL are of similar weight to the comparable products they replace:

- Basecamp: one generator, two indirect flamed heaters and one light tower
- Basecamp XL: on generator, three indirect flamed heaters and one light tower

As a result of a drawbacks analysis, Green Seal has not noted any *burden shifting* resulting from this product innovation. No mitigation is necessary.

4.0 Evaluation of Functional Performance and Fitness for Purpose

This section details the requirements to demonstrate that the applicant product functionally performs as well as or better than at least one nationally recognized or market leading product of its type, to be approved by Green Seal, including test methods and test reports to submit during the Certification Phase.

Test Methods

Applicant shall meet the requirements in this section to demonstrate the product functionally performs at least as well as or better than at least one nationally recognized or market leading product of its type, to be approved by Green Seal. When industry standard data is unavailable, the applicant shall use objective, scientifically validated testing methods conducted under controlled and reproducible laboratory conditions to demonstrate functional performance along the following parameters:

- **Engine Life** in Hours compared to a portable medium powered diesel fueled electric power generator of similar kWh
- **Heat Output** in BTUs compared to two (for Basecamp) or three (for Basecamp XL) indirect flamed heaters designed to perform similar scale tasks
- **Light Output** in Lumens compared to the brightness of standalone job site light tower

5.0 Environmental and Human Health Requirements

This section describes the Environmental and Human Health requirements with which the applicant product must demonstrate compliance. Green Seal uses the following factors to determine requirements for this section:

- **Product Form**: the applicant product is assembly of parts.
- **Potential for Direct Human Exposure**: through regular handling and use of the product, the potential for inhalation, ingestion, or absorption is not present.
- **Potential for Environmental Releases:** as described in herein, when the product is used as intended, the product emits air pollutants and greenhouse gases.

See section 5.21 for additional requirements to address air pollutant emissions associated with diesel engines.

See Annex A and the GS-20 Standard for definitions and full criteria details
and Annex B for Environmental and Human Health Requirements that do not apply to this product.

5.1 Disclosure
Applicant shall disclose all product parts through a Bill of Materials, including the part name, type (e.g., raw material, assembly, sub-assembly, component), part function, and material type (e.g., steel, aluminum, resin, nylon, etc.).

5.2 Carcinogens, Mutagens, and Reproductive Toxins.
The product shall not contain any *components* that are *carcinogens, mutagens*, or *reproductive toxins.* An exemption may be made if the component is critical for product function.

5.3 Prohibited Components.
The product shall not contain the following *components*. An exemption may be made if the *component* is necessary for product function and no likely *exposure pathway* exists. Green Seal maintains the discretion to add relevant, scientifically valid prohibitions on a case-by-case basis.

- 1,2-dichlorobenzene
- 2-butoxyethanol
- Alkylphenol ethoxylates
- Formaldehyde donors
- The heavy metals lead, mercury, cadmium, hexavalent chromium, and antimony in the elemental form or compounds
- o-Phenylphenol
- Neonicotinoid pesticides
- Nitro-musks
- Phthalates
- Polycyclic musks
- Triclosan
- Triphenyl tins and tributyl tins

5.21 Product-Specific Requirements
Applicant shall demonstrate compliance with the following requirements:

5.21.1 The product shall demonstrate compliance with CARB Tier 4 Final Emissions Standard[11] by providing emissions data and Tier 4 compliance documentation.

5.21.2 The product shall demonstrate compliance with the Clean Air Act by providing a U.S. EPA Certificate of Conformity.

5.21.3 Applicant shall provide an attestation letter declaring that the product

- Is designed to have a weight consistent with other products of this type available on the market that would achieve the same output.
- Is designed only with materials consistent with other products of this type on the market.
- Use of the product does not result in detrimental effects to human health or the environment above and beyond comparable products of this type on the North American market.

[11] CARB Tier 4 compliant engines significantly reduce emissions of particulate matter (PM) and oxides of nitrogen (NOx) to near zero levels. Relative to previous emissions standards, Tier 4 compliant engines reduce emissions by over 95 percent for most agricultural and construction equipment. https://www.dieselforum.org/policy/tier-4-standards

6.0 Packaging Requirements

Basecamp and Basecamp XL are not sold in or with packaging; therefore, the requirements in this section do not apply.

7.0 Product Labeling Requirements

Not applicable for this product category. See the GS-20 Environmental Innovation Standard for reference.

8.0 Trademark Use Guidelines

Trademark Use.
Any use of the Green Seal® Certification Mark or Green Seal name, e.g., on the product, product label, packaging, secondary documents, or promotional materials, must be in accordance with Green Seal's Trademark Use Guidelines.

Misleading Claims.
The Green Seal Certification Mark shall not be used in conjunction with any modifying terms, phrases, or graphic images that might mislead the consumers as to the extent or nature of the certification.

ANNEX A (Glossary of Terms)

Note that the defined terms are italicized throughout the Environmental Innovation Standard, GS-20.

Asthmagen. A substance designated as an asthma causing agent by the Association of Occupational and Environmental Clinics (AOEC), which after review by AOEC have met the AOEC sensitization criteria.

Burden Shifting. A concept within product lifecycle review frameworks that defines an unintentional consequence of a change in the system that results in a reduction in one impact category and a significant increase in another impact category, e, g., carbon emissions.

Carcinogen. A chemical listed as a known, probable, reasonably anticipated, or possible human carcinogen by the International Agency for Research on Cancer (Groups 1, 2A, and 2B), National Toxicology Agency (Groups 1 and 2), EPA Integrated Risk Information System (weight-of-evidence classifications A, B1, B2, C, carcinogenic, likely to be carcinogenic, and suggestive evidence of carcinogenicity or carcinogen potential), or by Occupational Safety and Health Administration (as carcinogens under 29 Code of Federal Regulations (CFR) 1910.1003(a)(1)).

Colorant. A product *component*, such as a dye or pigment, whose only function is to change the product's color.

Component. A constituent that is deliberately added at any level for its continued presence in the final product to provide a specific characteristic, appearance, or quality[12] or a contaminant that was not deliberately added but is present above 0.01% by weight in the product.

Exposure Pathway. The way in which a person can be exposed to a hazardous substance. A complete exposure pathway includes (1) the source of chemical and mechanism for release, (2) the exposure point, (3) the transport medium (i.e., from source to exposure point, if different), and (4) the exposure route (e.g., ingestion, inhalation, absorption, etc.).

Fragrance. An additive, often (but not limited to) a multi-*component* additive, used in a product with the purpose of imparting a scent to the product.

Independent Laboratory. A laboratory that (1) has been recognized by a laboratory accrediting organization to test and evaluate products to a related product standard, and (2) is free from commercial, financial, and other pressures that may influence the testing and evaluation process.

Intentionally Introduced. The use of substances for their desired or deliberate presence in the *primary package* for the purpose of providing a specific characteristic or quality. It does not refer to the use of substances as processing aids or the use of an intermediate that imparts certain chemical or physical changes during manufacturing, as long as the substance or intermediate is present in the *primary package* at concentrations below 100 ppm.

Mutagen. A chemical that meets the criteria for Category 1, chemicals known to induce heritable mutations or to be regarded as if they induce heritable mutations in the germ cells of humans, under the GHS.

Natural Colorant. A *colorant* that comes from biological products, forestry or agricultural materials (including plant, animal, and marine materials), or minerals.

[12] Naturally occurring elements and chlorinated organics that may be present as a result of chlorination of the water supply are not considered intentional components if the concentrations are below the applicable maximum contaminant levels in the National Primary Drinking Water Standards found in 40 CFR Part 141.

Post-Consumer Material. Material that would otherwise be destined for solid waste disposal, having completed its intended end-use and product life cycle. Post-consumer material does not include materials and by-products generated from, and commonly reused within, an original manufacturing and fabrication process.

Primary Package. Package material that physically contains and contacts the product, not including the cap or lid.

Product As Used. The most concentrated form of the product that the manufacturer recommends for a product's intended use.

Recyclable. The package can be collected in a substantial majority of communities, separated or recovered from the solid waste stream and used again, or reused in the manufacture or assembly of another package or product through an established recycling program.

Refillable Package. A container that is routinely returned to and refilled by the product manufacturer at least five times with the original product held by the package, and demonstrated in practice. For the purpose of this standard, the product manufacturer or the product manufacturer's agent may refill a package.

Reproductive Toxin. A chemical listed as a reproductive toxin (including developmental, female, and male toxins) by the State of California under the Safe Drinking Water and Toxic Enforcement Act of 1986 (California Code of Regulations, Title 22, Division 2, Subdivision 1, Chapter 3, Sections 1200, et. Seq., also known as Proposition 65).

Respiratory Sensitizer. A substance designated as leading to hypersensitivity of the airways following inhalation of the substance and meeting the classification criteria of Category 1 respiratory sensitization (H334) in accordance with the GHS.

Secondary Packaging. Packaging used to contain *primary package*/s and typically used for merchandizing. This does not include case or shipping packaging or the *primary package*.

Serious Eye Damage. The production of tissue damage in the eye, or serious physical decay of vision, following application of a test substance to the anterior surface of the eye, which is not fully reversible within 21 days of application. Substances identified under Category 1 for Serious Eye Damage/Eye Irritation (H318) under the GHS are also considered to cause serious eye damage.

Skin Corrosion. The production of irreversible damage to the skin, namely visible necrosis through the epidermis and into the dermis, following the application of a test substance for up to 4 hours. Corrosive reactions are typified by ulcers, bleeding, bloody scabs, and, by the end of observation at 14 days, by discoloration due to blanching of the skin, complete areas of alopecia, and scars. Substances designated as Category 1A, 1B or 1C for Skin Corrosion/Irritation (H314) under the GHS are also considered to cause skin corrosion.

Skin Sensitizer. A substance that will lead to an allergic response following skin contact.

Undiluted Product. The most concentrated form of the product produced by the manufacturer for transport outside its facility.

ANNEX B (Environmental and Human Health Requirements that Do Not Apply)

5.4 Volatile Organic Compounds
No inhalation exposure pathway present; this requirement does not apply.

5.5 Animal Testing
Not relevant to applicant; this requirement does not apply.

5.6 Acute Toxicity
No inhalation or ingestion exposure pathway present; this requirement does not apply.

5.7 Skin and Eye Damage
No dermal exposure pathway present; this requirement does not apply.

5.8 Asthmagens
No inhalation exposure pathway present; this requirement does not apply.

5.9 Respiratory Sensitization
No inhalation exposure pathway present; this requirement does not apply.

5.10 Skin Sensitization
No dermal exposure pathway present; this requirement does not apply.

5.11 Skin Absorption
No dermal exposure pathway present; this requirement does not apply.

5.12 Chronic Inhalation Toxicity
No inhalation exposure pathway present; this requirement does not apply.

5.13 Combustibility
The applicant product is an article; this requirement does not apply.

5.14 Fragrances
The applicant product does not contain fragrances; this requirement does not apply.

5.15 Colorants
The applicant product does not contain colorants; this requirement does not apply.

5.16 Bioaccumulating Compounds
No environmental release exposure pathway present; this requirement does not apply.

5.17 Eutrophication
No environmental release exposure pathway present; this requirement does not apply.

5.18 Aquatic Biodegradability
No environmental release exposure pathway present; this requirement does not apply.

5.19 Toxicity to Aquatic Life
No environmental release exposure pathway present; this requirement does not apply.

5.20 Bleaching
The applicant product does not use a bleaching process; this requirement does not apply.