

Assessment of Alternatives to Cleaners and Sanitizers for the Brewing Industry

Supplement 1: P20ASys Raw Data Used in EHS Evaluations

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Baseline Cleaners

| Category | Units | Powder Keg | Veracity Caustic Cleaner | Liquid Metal Safe |
|----------------------------|--------------------------|--|---|-----------------------------|
| ACUTE HUMAN EFFECTS | | | | |
| Inhalation Toxicity | LC50 ppm | | | |
| Inhalation Toxicity | Vapor GHS Category Level | | | |
| Inhalation Toxicity | mg/l gas/vapor | | | |
| Inhalation Toxicity | mg/l dust/mist/fume | | | |
| Inhalation Toxicity | Key Phrases | May cause breathing difficulties if inhaled | Harmful if inhaled | Not considered harmful |
| Inhalation Toxicity | Solid GHS Category Level | 3 | | |
| Inhalation Toxicity | GHS H Phrases | H332, H305 | | |
| Oral Toxicity | LD50 mg/kg | 2800 | 2000 | |
| Oral Toxicity | Key Phrases | Harmful if swallowed | Harmful if swallowed | May be harmful if swallowed |
| Oral Toxicity | GHS H Phrases | H302 | | |
| Oral Toxicity | GHS Category Level | 4 | | |
| Dermal Toxicity | LD50 mg/kg | 1999 | 1350 | |
| Dermal Toxicity | Key Phrases | | Harmful in contact with skin | May be harmful |
| Dermal Toxicity | GHS H Phrases | | | |
| Dermal Toxicity | GHS Category Level | | | |
| Respiratory Irritation | Key Phrases | Evidence in humans and animals shows slight or minor reversible respiratory irritation effects | Evidence in humans or animals shows mild reversible respiratory irritation effects; Low to moderate frequency of occurrence | |
| Respiratory Irritation | GHS H Phrases | H335 | H335 | |

| Category | Units | Powder Keg | Veracity Caustic Cleaner | Liquid Metal Safe |
|------------------------------|---------------------------------|--|--|--|
| Respiratory Irritation | GHS Category Level | | | |
| Dermal Irritation | Key Phrases | Reversible skin irritation effects; Irritant | Existing human and animal data, in vitro data or information from structurally related compounds shows irreversible skin burns; Corrosive | Existing human and animal data, in vitro data or information from structurally related compounds shows irreversible skin burns; Corrosive |
| Dermal Irritation | GHS Category Level | 1C, 2 | 1A, 1 | 1A, 1 |
| Dermal Irritation | GHS H Phrases | H315 | H314 | H314 |
| Eye Irritation | Key Phrases | Reversible irritation effects on the eyes from single or repeated exposure; Irritating | Existing human and animal data, in vitro data or information from structurally related compounds shows irreversible eye damage; Irreversible | Existing human and animal data, in vitro data or information from structurally related compounds shows irreversible eye damage; Irreversible |
| Eye Irritation | GHS H Phrases | H319 | H318, H314 | H318, H314 |
| Eye Irritation | GHS Category Level | 2A | 1 | 1 |
| Exposure Limits | PEL/TLV ppm | | | |
| Exposure Limits | PEL/TLV (dusts/particles) mg/m3 | 2 | 2 | 2 |
| Exposure Limits | GHS Category Level | 1 | | |
| IDLH | ppm | | 10 | |
| Health | NFPA/HMIS 0,1,2,3,4 | 1 | 3 | 2 |
| CHRONIC HUMAN EFFECTS | | | | |
| Carcinogen | IARC Category | | | |
| Carcinogen | EPA CLASS Category | | | |
| Carcinogen | ACGIH Category | | | |
| Carcinogen | OSHA Category | | No components are listed as carcinogens by OSHA | No components are listed as carcinogens by OSHA |
| Carcinogen | Key Phrases | | No component present at greater than or equal to 0.1% as probable, possible or confirmed human carcinogen | No component present at greater than or equal to 0.1% as probable, possible or confirmed human carcinogen |
| Carcinogen | GHS H Phrases | | | |
| Carcinogen | GHS Category | | | |
| Carcinogen | Prop 65 Category | No; not listed on prop 65 | | No; not listed on prop 65 |
| Mutagen/ Teratogen | Key Phrases | Not expected to be mutagenic in humans | Not expected to be mutagenic in humans | Not expected to be mutagenic in humans |
| Mutagen/ Teratogen | GHS H Phrase | | | |
| Mutagen/ Teratogen | GHS Category | | | |

| Category | Units | Powder Keg | Veracity Caustic Cleaner | Liquid Metal Safe |
|-------------------------------------|---|---------------------------|--|---|
| Reproductive/ Developmental | Key Phrases | | Not expected to have reproductive effects | Not expected to have reproductive effects |
| Reproductive/ Developmental | GHS H Phrases | | | |
| Reproductive/ Developmental | GHS Category | | | |
| Reproductive/ Developmental | Prop 65 Category | No; not listed on prop 65 | | No; not listed on prop 65 |
| Neurotoxicity | GHS Category - STOT - Single Exposure | | | |
| Neurotoxicity | GHS Category - STOT - Repeated Exposure | | | |
| Neurotoxicity | Key Phrases | | | |
| Neurotoxicity | GHS H Phrase | | | |
| Respiratory Sensitivity/ Disease | Asthmagen Type (AOEC Database) | | Rs; Rr; Rrs | |
| Respiratory Sensitivity/ Disease | Key Phrases | | May cause allergy or asthma symptoms or breathing difficulties if inhaled; May cause sensitization by inhalation | |
| Respiratory Sensitivity/ Disease | GHS H Phrase | H335 | | |
| Respiratory Sensitivity/ Disease | GHS Category | | | |
| Endocrine System Effects | EU - Priority Endocrine Disruptor | | | |
| Endocrine System Effects | EU - SVHC | | | |
| Endocrine System Effects | ChemSec - SIN | | | |
| Endocrine System Effects | OSPAR | | | |
| Endocrine System Effects | TEDX | | Yes | |
| Endocrine System Effects | Key Phrases | | | |

| Category | Units | Powder Keg | Veracity Caustic Cleaner | Liquid Metal Safe |
|--|--|---------------------------------------|--|--|
| Other Chronic Organ Effects | Key Phrases | | May cause damage to organs; Possible risk of irreversible effects; May cause damage to organs through prolonged or repeated exposure | Causes damage to organs; Danger of very serious irreversible effects; Causes damage to organs through prolonged or repeated exposure; Danger of serious damage to health by prolonged exposure |
| Other Chronic Organ Effects | GHS H-Phrase - Single Exposure | | | |
| Other Chronic Organ Effects | GHS Category - STOT -Single Exposure | 3 | | |
| Other Chronic Organ Effects | GHS H-Phrase - Repeated Exposure | | | |
| Other Chronic Organ Effects | GHS Category - STOT - Repeated Exposure | | | |
| ECOLOGICAL HAZARDS | | | | |
| Acute Aquatic Toxicity | Acute Fish LC50 (mg/l) | 300 | 45 | |
| Acute Aquatic Toxicity | Acute Algae (or other aquatic plant) EC50 (mg/l) | 242 | 34.6 | |
| Acute Aquatic Toxicity | Key Phrases | No data, but some grounds for concern | Harmful to aquatic life | Not considered harmful to aquatic life |
| Acute Aquatic Toxicity | GHS H Phrases | | | |
| Acute Aquatic Toxicity | GHS Category level | Not Classified | | |
| Chronic Aquatic Toxicity (fish, crustacea or algae) - Rapidly Degradable, with Adequate Data | NOEC (NOAEC) or ECx (mg/l) | | | |
| Chronic Aquatic Toxicity (fish, crustacea or algae) - Rapidly Degradable, with Adequate Data | ChV mg/l | | | |
| Chronic Aquatic Toxicity (fish, crustacea or algae) - Rapidly Degradable, with Adequate Data | Key Phrases | | May be dangerous for the environment | Not expected to be harmful to aquatic life |

| Category | Units | Powder Keg | Veracity Caustic Cleaner | Liquid Metal Safe |
|---|--|---------------------------|--------------------------|-------------------------------|
| Chronic Aquatic Toxicity (fish, crustacea or algae) - Rapidly Degradable, with Adequate Data | GHS H Phrases | | | |
| Chronic Aquatic Toxicity (fish, crustacea or algae) - Rapidly Degradable, with Adequate Data | GHS Category | | | |
| Chronic Aquatic Toxicity (fish, crustacea or algae) - NOT Rapidly Degradable, with Adequate Data | mg/l | | | |
| Chronic Aquatic Toxicity (fish, crustacea or algae) - NOT Rapidly Degradable, with Adequate Data | Key Phrases | | | |
| Chronic Aquatic Toxicity (fish, crustacea or algae) - NOT Rapidly Degradable, with Adequate Data | GHS Category level | | | |
| ENVIRONMENTAL FATE & TRANSPORT | | | | |
| Persistence | Water t1/2 Days | | 8.7 | |
| Persistence | Water Signal Words | | | |
| Persistence | Air t1/2 Days | | 0.89 | |
| Persistence | Air Signal Words | | | |
| Persistence | Soil/Sediment t1/2 Days | | 17.6 | |
| Persistence | Soil/Sediment Signal Words | GHS "rapid degradability" | | |
| Persistence | Key Phrases | | | Not expected to be persistent |
| Rapid Degradability | 28-day Study: % Breakdown Dissolved Organic Carbon | | | |
| Rapid Degradability | 28-day Study: % Based on O2 or CO2 | | | |
| Rapid Degradability | BOD Half-life (days) | | | |
| Rapid Degradability | Hydrolysis Half-life (days) | | | |
| Rapid Degradability | Key Phrases | | Biodegradable | Not Determined |

| Category | Units | Powder Keg | Veracity Caustic Cleaner | Liquid Metal Safe |
|--------------------------------------|---|--|--|--|
| Bioconcentration/ Bioaccumulation | Log Kow / Pow | -6.9 | -0.92 | |
| Bioconcentration/ Bioaccumulation | BAF/BCF (l/kg) | | 0.9 | |
| Bioconcentration/ Bioaccumulation | On Canada EPA Domestic Substances List | | | |
| Bioconcentration/ Bioaccumulation | Key Phrases | Not likely/expected to bioaccumulate | Will bioaccumulate | Not likely/expected to bioaccumulate |
| ATMOSPHERIC HAZARDS | | | | |
| Greenhouse Gas | GWP Relative to CO2 | | 0 | 0 |
| Greenhouse Gas | Y/N | N | N | N |
| Ozone Depletor | ODP Units | | 0 | 0 |
| Ozone Depletor | GHS H Phrase | | | |
| Ozone Depletor | Ozone Classification | Not Classified | Not Classified | Not Classified |
| Acid Rain Formation | Y/N | N | N | N |
| Acid Rain Formation | Key Phrases | Does not contain SO2 or NOx | Does not contain SO2 or NOx | Does not contain SO2 or NOx |
| NESHAP | Y/N | | N | N |
| NESHAP | Key Phrases | Not listed as EPA hazardous air pollutant | Not listed as EPA hazardous air pollutant | Not listed as EPA hazardous air pollutant |
| PHYSICAL PROPERTIES | | | | |
| Vapor Pressure | mm Hg | | 0.11 | |
| Flammability: Liquid | NFPA/HMIS 0,1,2,3,4 | | 0 | 0 |
| Flammability: Liquid | GHS H Phrase | | | |
| Flammability: Liquid | GHS Category level | | | |
| Flash point: Liquid | deg C | | | |
| Flash point: Liquid | Key Phrases | | No Flash point-will not burn | No Flash point-will not burn |
| Flammability: Gas | GHS H Phrase | | | |
| Flammability: Gas | GHS Category Level | | | |
| Reactivity | NFPA/HMIS 0,1,2,3,4 | | 1 | 0 |
| Reactivity | GHS H Phrase | | | |
| Reactivity | GHS Category Level | | | |
| pH | pH Units | 2-5 or 9-11.5 | 1-2 or 11.5-14 | 1-2 or 11.5-14 |
| pH | Key Phrases | Strong acid, caustic | Highly acidic, highly caustic | Strong acid, caustic |
| Corrosivity | Key Phrases | Corrosive | Highly Corrosive | Mildly corrosive |
| Corrosivity | GHS Category Level | | | |
| Odor | Key Phrases | Slight odor | Odorless | Odorless |

| Category | Units | Powder Keg | Veracity Caustic Cleaner | Liquid Metal Safe |
|---------------------------|---|---|--|---|
| Volatile Organic Compound | g/l | | 45 | 86 |
| PROCESS FACTORS | | | | |
| Heat | WBGT, deg C | | | |
| Noise Generation | dBa/hr | | | |
| Vibration | Class 1 Small Machine (mm/s) | | | |
| Vibration | Class 2 Medium Machine (mm/s) | | | |
| Vibration | Class 3 Large Rigid Foundation (mm/s) | | | |
| Vibration | Class 4 Large Soft Foundation (mm/s) | | | |
| Ergonomic Hazard | Occurrence | Unlikely/ remote | Possible | Unlikely/ remote |
| Ergonomic Hazard | Hazard Level | Minor injury/illness, minor impact on time lost | Moderate injury, lost time | Moderate injury, lost time |
| Psychosocial Hazard | Work Overload and Pace: Work Load | | | |
| Psychosocial Hazard | Work Overload and Pace: Machine Pacing | | | |
| Psychosocial Hazard | Work Overload and Pace: Time Constraints | | | |
| Psychosocial Hazard | Work Schedule: Shift Work | | | |
| Psychosocial Hazard | Work Schedule: Work Isolation | | Process requires restricted access | Process eliminates isolation work |
| Psychosocial Hazard | Control | | Process provides worker with access to supervisor about needed changes | Process allows for minor changes in real-time by worker |
| Psychosocial Hazard | Work Environment & Equipment: Equipment Stability | | | |
| Psychosocial Hazard | Work Environment & Equipment: Work Space | | | |
| High Pressure System | Pressure (Delta % Change From Ambient) | | 0 | 0 |
| High Temperature System | Temperature (Delta % Change From Ambient) | | 0 | 25 |
| Water Use | % Water Change | | | |
| Water Use | Reuse | | | |
| Energy Use | % Energy Change | 25% reduction | | |
| Energy Use | % Renewable Energy | | | |
| Exposure Potential | Occurrence: Near Certain | | | |

| Category | Units | Powder Keg | Veracity Caustic Cleaner | Liquid Metal Safe |
|--|--|---|---|--|
| Exposure Potential | Occurrence: Highly Likely | Minor hazard | | |
| Exposure Potential | Occurrence: Likely | | Critical hazard | Marginal hazard |
| Exposure Potential | Occurrence: Unlikely | | | |
| Exposure Potential | Occurrence: Remote | | | |
| LIFE CYCLE FACTORS | | | | |
| Upstream Effects | Key Phrases | | Process reduces suppliers use of hazardous materials, energy, water and other resources | Eliminates suppliers use of hazardous materials or reduces use of energy, water, and resources |
| Consumer Hazard | Key Phrases | Product contains hazardous components with no consumer exposure potential | Product contains hazardous components with low consumer exposure potential | Product contains hazardous components with low consumer exposure potential |
| Disposal Hazard (landfill, incineration) | Key Phrases | Prevents/ reduces amount of waste material being created | Creates concern for air, water or land and disposed of as hazardous waste | Creates concern for air, water or land and disposed of as hazardous waste |
| Reportable Quantity | Pounds | | | |
| Recycling | % Recyclable at End of Life | | | |
| Recycling | Uses Products With % Recycled Material | | | |
| Renewable to Nonrenewable Resource | % Renewable Materials | | | |
| Renewable to Nonrenewable Resource | Key Words | | | |

Alternative Cleaners

| Category | Units | Neutral CIP Detergent LFE | Force of Nature | Surface Cleanse 930 | Micro A07 | Ozone |
|----------------------------|--------------------------|--|--|--|---|---|
| ACUTE HUMAN EFFECTS | | | | | | |
| Inhalation Toxicity | LC50 ppm | | | | | 12.6 |
| Inhalation Toxicity | Vapor GHS Category Level | | | | | |
| Inhalation Toxicity | mg/l gas/vapor | | | | | |
| Inhalation Toxicity | mg/l dust/mist/fume | | | | | |
| Inhalation Toxicity | Key Phrases | | May cause breathing difficulties if inhaled | Not considered harmful | Not considered harmful | May cause breathing difficulties if inhaled |
| Inhalation Toxicity | Solid GHS Category Level | | | | | |
| Inhalation Toxicity | GHS H Phrases | | | | | |
| Oral Toxicity | LD50 mg/kg | 20000 | 2000 | 2000 | 5000 | |
| Oral Toxicity | Key Phrases | Not harmful if swallowed | May be harmful if swallowed | Not harmful if swallowed | | May be harmful if swallowed |
| Oral Toxicity | GHS H Phrases | | | | | |
| Oral Toxicity | GHS Category Level | | | | | |
| Dermal Toxicity | LD50 mg/kg | 20800 | | | | |
| Dermal Toxicity | Key Phrases | Not harmful if comes in contact with skin | May be harmful | Not harmful if comes in contact with skin | Not harmful if comes in contact with skin | May be harmful |
| Dermal Toxicity | GHS H Phrases | | | | | |
| Dermal Toxicity | GHS Category Level | | | | | |
| Respiratory Irritation | Key Phrases | Evidence in humans and animals shows slight or minor reversible respiratory irritation effects | Evidence in humans and animals shows slight or minor reversible respiratory irritation effects | Non-irritating; Adequate data available, and negative studies, no structural alerts, and GHS not classified. | | |
| Respiratory Irritation | GHS H Phrases | H335 | | | | |
| Respiratory Irritation | GHS Category Level | | | | | 1 |

| Category | Units | Neutral CIP Detergent LFE | Force of Nature | Surface Cleanse 930 | Micro A07 | Ozone |
|------------------------------|---------------------------------|---|--|--|--|---|
| Dermal Irritation | Key Phrases | | Slight or minor reversible skin irritation effects | Non-irritating; Adequate data available, and negative studies, no structural alerts, and GHS not classified. | Non-irritating; Adequate data available, and negative studies, no structural alerts, and GHS not classified. | Slight or minor reversible skin irritation effects |
| Dermal Irritation | GHS Category Level | | | | | 3 |
| Dermal Irritation | GHS H Phrases | | | | | |
| Eye Irritation | Key Phrases | Mild reversible eye irritation effects; Mildly irritating | Slight or minor reversible eye irritation effects | Non-irritating; Adequate data available, and negative studies, no structural alerts, and GHS not classified. | Reversible irritation effects on the eyes from single or repeated exposure; Irritating | Mild reversible eye irritation effects; Mildly irritating |
| Eye Irritation | GHS H Phrases | | | | H319 | H320 |
| Eye Irritation | GHS Category Level | | | | 2A | 2, 2B |
| Exposure Limits | PEL/TLV ppm | | | | | 0.1 |
| Exposure Limits | PEL/TLV (dusts/particles) mg/m3 | | | | | |
| Exposure Limits | GHS Category Level | | | | | |
| IDLH | ppm | | | | | 5 |
| Health | NFPA/HMIS 0,1,2,3,4 | 1 | 0 | 1 | 2 | 2 |
| CHRONIC HUMAN EFFECTS | | | | | | |
| Carcinogen | IARC Category | | | | | |
| Carcinogen | EPA CLASS Category | | | | | |
| Carcinogen | ACGIH Category | | | | | |
| Carcinogen | OSHA Category | No components are listed as carcinogens by OSHA | No components are listed as carcinogens by OSHA | No components are listed as carcinogens by OSHA | | No components are listed as carcinogens by OSHA |

| Category | Units | Neutral CIP Detergent LFE | Force of Nature | Surface Cleanse 930 | Micro A07 | Ozone |
|----------------------------------|---|---|---|---|---|---|
| Carcinogen | Key Phrases | No component present at greater than or equal to 0.1% as probable, possible or confirmed human carcinogen | No component present at greater than or equal to 0.1% as probable, possible or confirmed human carcinogen | No component present at greater than or equal to 0.1% as probable, possible or confirmed human carcinogen | No component present at greater than or equal to 0.1% as probable, possible or confirmed human carcinogen | No component present at greater than or equal to 0.1% as probable, possible or confirmed human carcinogen |
| Carcinogen | GHS H Phrases | | | | | |
| Carcinogen | GHS Category | | | | | |
| Carcinogen | Prop 65 Category | | | | | |
| Mutagen/ Teratogen | Key Phrases | Not expected to be mutagenic in humans | Tested with no signs of mutagenicity | | Not expected to be mutagenic in humans | |
| Mutagen/ Teratogen | GHS H Phrase | | | | | |
| Mutagen/ Teratogen | GHS Category | | | | | |
| Reproductive/ Developmental | Key Phrases | Not expected to have reproductive effects | Tested with no signs of reproductive/ development toxicity | | Not expected to have reproductive effects | |
| Reproductive/ Developmental | GHS H Phrases | | | | | |
| Reproductive/ Developmental | GHS Category | | | | | |
| Reproductive/ Developmental | Prop 65 Category | | | | | |
| Neurotoxicity | GHS Category - STOT - Single Exposure | | | | | |
| Neurotoxicity | GHS Category - STOT - Repeated Exposure | | | | | |
| Neurotoxicity | Key Phrases | | | | | |
| Neurotoxicity | GHS H Phrase | | | | | |
| Respiratory Sensitivity/ Disease | Asthmagen Type (AOEC Database) | | | | | |

| Category | Units | Neutral CIP Detergent LFE | Force of Nature | Surface Cleanse 930 | Micro A07 | Ozone |
|----------------------------------|---|--|--|--|-----------|----------------------------------|
| Respiratory Sensitivity/ Disease | Key Phrases | May cause respiratory irritation | May cause respiratory irritation | Known to not cause respiratory sensitization; Only negative test results | | May cause respiratory irritation |
| Respiratory Sensitivity/ Disease | GHS H Phrase | H335 | | | | |
| Respiratory Sensitivity/ Disease | GHS Category | | | | | |
| Endocrine System Effects | EU - Priority Endocrine Disruptor | | | | | |
| Endocrine System Effects | EU - SVHC | | | | | |
| Endocrine System Effects | ChemSec - SIN | | | | | |
| Endocrine System Effects | OSPAR | | | | | |
| Endocrine System Effects | TEDX | Yes | | | | |
| Endocrine System Effects | Key Phrases | | | | | |
| Other Chronic Organ Effects | Key Phrases | | | | | |
| Other Chronic Organ Effects | GHS H-Phrase - Single Exposure | | | | | |
| Other Chronic Organ Effects | GHS Category - STOT - Single Exposure | Substance/mixture not classified as STOT, single exposure. | Substance/mixture not classified as STOT, single exposure. | Substance/mixture not classified as STOT, single exposure. | | |
| Other Chronic Organ Effects | GHS H-Phrase - Repeated Exposure | | | | | |
| Other Chronic Organ Effects | GHS Category - STOT - Repeated Exposure | Substance/mixture not classified as STOT, repeated exposure. | Substance/mixture not classified as STOT, repeated exposure. | Substance/mixture not classified as STOT, repeated exposure. | | |
| ECOLOGICAL HAZARDS | | | | | | |
| Acute Aquatic Toxicity | Acute Fish LC50 (mg/l) | 45 | 597 | | 31400 | |

| Category | Units | Neutral CIP Detergent LFE | Force of Nature | Surface Cleanse 930 | Micro A07 | Ozone |
|--|--|--------------------------------------|--|--|--|--|
| Acute Aquatic Toxicity | Acute Algae (or other aquatic plant) EC50 (mg/l) | 19000 | 126 | | 23300 | |
| Acute Aquatic Toxicity | Key Phrases | Harmful to aquatic life | Not considered harmful to aquatic life | Not considered harmful to aquatic life | Not considered harmful to aquatic life | Very toxic to aquatic life |
| Acute Aquatic Toxicity | GHS H Phrases | | | | | H400 |
| Acute Aquatic Toxicity | GHS Category level | | | | | Acute 1 |
| Chronic Aquatic Toxicity (fish, crustacea or algae) - Rapidly Degradable, with Adequate Data | NOEC (NOAEC) or ECx (mg/l) | | | | | |
| Chronic Aquatic Toxicity (fish, crustacea or algae) - Rapidly Degradable, with Adequate Data | ChV mg/l | 1.44 | 24.51 | | 28660 | 235 |
| Chronic Aquatic Toxicity (fish, crustacea or algae) - Rapidly Degradable, with Adequate Data | Key Phrases | May be dangerous for the environment | Not harmful to aquatic life | Not expected to be harmful to aquatic life | Not harmful to aquatic life | Not expected to be harmful to aquatic life |
| Chronic Aquatic Toxicity (fish, crustacea or algae) - Rapidly Degradable, with Adequate Data | GHS H Phrases | | | | | |
| Chronic Aquatic Toxicity (fish, crustacea or algae) - Rapidly Degradable, with Adequate Data | GHS Category | | | | | |
| Chronic Aquatic Toxicity (fish, crustacea or algae) - NOT Rapidly Degradable, with Adequate Data | mg/l | | | | | |
| Chronic Aquatic Toxicity (fish, crustacea or algae) - NOT Rapidly Degradable, with Adequate Data | Key Phrases | | | | | |

| Category | Units | Neutral CIP Detergent LFE | Force of Nature | Surface Cleanse 930 | Micro A07 | Ozone |
|--|--|---|----------------------------------|---|---------------|---------------------------|
| Chronic Aquatic Toxicity (fish, crustacea or algae) - NOT Rapidly Degradable, with Adequate Data | GHS Category level | | | | | |
| ENVIRONMENTAL FATE & TRANSPORT | | | | | | |
| Persistence | Water t1/2 Days | 15 | | | 8.7 | 15 |
| Persistence | Water Signal Words | | | | | |
| Persistence | Air t1/2 Days | 0.89 | | | 1.25 | 0.15 |
| Persistence | Air Signal Words | | | | | |
| Persistence | Soil/Sediment t1/2 Days | 30 | | | 17.4 | 30 |
| Persistence | Soil/Sediment Signal Words | | | | | |
| Persistence | Key Phrases | Not expected to be persistent | Not expected to be persistent | Not persistent | | Not persistent |
| Rapid Degradability | 28-day Study: % Breakdown Dissolved Organic Carbon | | | | | |
| Rapid Degradability | 28-day Study: % Based on O2 or CO2 | | | | | |
| Rapid Degradability | BOD Half-life (days) | | | | | |
| Rapid Degradability | Hydrolysis Half-life (days) | | | | | |
| Rapid Degradability | Key Phrases | Biodegradable | Biodegradable | Biodegradable | Biodegradable | Readily degradable |
| Bioconcentration/ Bioaccumulation | Log Kow / Pow | 3.01 | -0.46 | | -1.64 | -0.87 |
| Bioconcentration/ Bioaccumulation | BAF/BCF (l/kg) | 71.36 | 1.09 | | 0.89 | 0.9 |
| Bioconcentration/ Bioaccumulation | On Canada EPA Domestic Substances List | | | | | |
| Bioconcentration/ Bioaccumulation | Key Phrases | Not likely/expected to bioaccumulate | Will not bioaccumulate | Not likely/expected to bioaccumulate | | Will not bioaccumulate |
| ATMOSPHERIC HAZARD | | | | | | |
| Greenhouse Gas | GWP Relative to CO2 | 0 | 0 | 0 | 0 | 0 |
| Greenhouse Gas | Y/N | N | N | N | N | N |

| Category | Units | Neutral CIP Detergent LFE | Force of Nature | Surface Cleanse 930 | Micro A07 | Ozone |
|----------------------------|----------------------|---|---|---|---|---------------------------------------|
| Ozone Depletor | ODP Units | 0 | 0 | 0 | 0 | 0 |
| Ozone Depletor | GHS H Phrase | | | | | |
| Ozone Depletor | Ozone Classification | Not Classified | Not Classified | Not Classified | Not Classified | Not Classified |
| Acid Rain Formation | Y/N | N | N | N | | N |
| Acid Rain Formation | Key Phrases | Does not contain SO2 or NOx | Does not contain SO2 or NOx | Does not contain SO2 or NOx | Product may form SO2 or NOx upon combustion | Does not contain SO2 or NOx |
| NESHAP | Y/N | N | N | N | N | Y |
| NESHAP | Key Phrases | Not listed as EPA hazardous air pollutant | Not listed as EPA hazardous air pollutant | Not listed as EPA hazardous air pollutant | Not listed as EPA hazardous air pollutant | Listed as EPA hazardous air pollutant |
| PHYSICAL PROPERTIES | | | | | | |
| Vapor Pressure | mm Hg | 6.99 | | | 0.01 | |
| Flammability: Liquid | NFPA/HMIS 0,1,2,3,4 | 0 | 0 | 0 | 0 | 0 |
| Flammability: Liquid | GHS H Phrase | | | | | |
| Flammability: Liquid | GHS Category level | | | | | |
| Flash point: Liquid | deg C | | | | | |
| Flash point: Liquid | Key Phrases | No Flash point-will not burn | No Flash point-will not burn | No Flash point-will not burn | No Flash point-will not burn | No Flash point-will not burn |
| Flammability: Gas | GHS H Phrase | | | | | |
| Flammability: Gas | GHS Category Level | | | | | |
| Reactivity | NFPA/HMIS 0,1,2,3,4 | 0 | 0 | 0 | 0 | 3 |
| Reactivity | GHS H Phrase | | | | | |
| Reactivity | GHS Category Level | | | | | |
| pH | pH Units | 2-5 or 9-11.5 | 5-6 or 8-9 | 6-7 or 7-8 | 2-5 or 9-11.5 | 2-5 or 9-11.5 |
| pH | Key Phrases | Acidic, alkaline | Mildly acidic, mildly alkaline | Mildly acidic, mildly alkaline | Acidic, alkaline | |
| Corrosivity | Key Phrases | Not corrosive | Not corrosive | Not corrosive | Mildly corrosive | |
| Corrosivity | GHS Category Level | | | | | |
| Odor | Key Phrases | Odorless | Slight odor | Mild odor | Mild odor | Pungent or irritating odor |
| Volatile Organic Compound | g/l | 45 | 0 | | 25 | |
| PROCESS FACTORS | | | | | | |
| Heat | WBGT, deg C | | | | | |
| Noise Generation | dBA/hr | | 80/no limit | | | |

| Category | Units | Neutral CIP Detergent LFE | Force of Nature | Surface Cleanse 930 | Micro A07 | Ozone |
|-------------------------|---|---|---|---|---|--|
| Vibration | Class 1 Small Machine (mm/s) | | 1 | | | |
| Vibration | Class 2 Medium Machine (mm/s) | | | | | |
| Vibration | Class 3 Large Rigid Foundation (mm/s) | | | | | |
| Vibration | Class 4 Large Soft Foundation (mm/s) | | | | | |
| Ergonomic Hazard | Occurence | Unlikely/ remote | Possible | Unlikely/ remote | Unlikely/ remote | Possible |
| Ergonomic Hazard | Hazard Level | Minor injury/illness, minor impact on time lost | Minor injury/illness, minor impact on time lost | Insignificant, no injury, no impact on time | Minor injury/illness, minor impact on time lost | Minor injury/illness, minor impact on time lost |
| Psychosocial Hazard | Work Overload and Pace: Work Load | | | | | |
| Psychosocial Hazard | Work Overload and Pace: Machine Pacing | | | | | |
| Psychosocial Hazard | Work Overload and Pace: Time Constraints | | | | | |
| Psychosocial Hazard | Work Schedule: Shift Work | | | | | |
| Psychosocial Hazard | Work Schedule: Work Isolation | Process eliminates isolation work | Process eliminates isolation work | Process eliminates isolation work | Process eliminates isolation work | Process requires restricted access |
| Psychosocial Hazard | Control | Process allows for minor changes in real-time by worker | Process includes worker input | Process allows for minor changes in real-time by worker | Process allows for minor changes in real-time by worker | Process provides worker with access to supervisor about needed changes |
| Psychosocial Hazard | Work Environment & Equipment: Equipment Stability | | Improved equipment quality and suitability | | | |
| Psychosocial Hazard | Work Environment & Equipment: Work Space | | | | | |
| High Pressure System | Pressure (Delta % Change From Ambient) | 0 | 0 | 0 | 0 | 0 |
| High Temperature System | Temperature (Delta % Change From Ambient) | 0 | 0 | 15 | 15 | 0 |

| Category | Units | Neutral CIP Detergent LFE | Force of Nature | Surface Cleanse 930 | Micro A07 | Ozone |
|--|--|--|--|---|---|---|
| Water Use | % Water Change | | | | | |
| Water Use | Reuse | | | | | |
| Energy Use | % Energy Change | | 25% increase | | | |
| Energy Use | % Renewable Energy | | | | | |
| Exposure Potential | Occurrence: Near Certain | | | | | |
| Exposure Potential | Occurrence: Highly Likely | | | | | |
| Exposure Potential | Occurrence: Likely | Marginal hazard | Minor hazard | Minor hazard | Marginal hazard | Marginal hazard |
| Exposure Potential | Occurrence: Unlikely | | | | | |
| Exposure Potential | Occurrence: Remote | | | | | |
| LIFE CYCLE FACTORS | | | | | | |
| Upstream Effects | Key Phrases | Eliminates suppliers use of hazardous materials or reduces use of energy, water, and resources | Eliminates suppliers use of hazardous materials or reduces use of energy, water, and resources | Eliminates suppliers use of hazardous materials and reduces use of energy, water, and resources | Eliminates suppliers use of hazardous materials and reduces use of energy, water, and resources | Process reduces suppliers use of hazardous materials, energy, water and other resources |
| Consumer Hazard | Key Phrases | Product contains hazardous components with no consumer exposure potential | Product contains hazardous components with no consumer exposure potential | Product contains no hazardous components | Product contains no hazardous components | Product contains hazardous components with low consumer exposure potential |
| Disposal Hazard (landfill, incineration) | Key Phrases | Creates some concern for air, water or land | Prevents/ reduces amount of waste material being created | Creates some concern for air, water or land | Prevents/ reduces amount of waste material being created | Creates some concern for air, water or land |
| Reportable Quantity | Pounds | | | | | 100 |
| Recycling | % Recyclable at End of Life | | | | | |
| Recycling | Uses Products With % Recycled Material | | | | | |
| Renewable to Nonrenewable Resource | % Renewable Materials | | | | | |
| Renewable to Nonrenewable Resource | Key Words | | | | | |

Baseline & Alternative Sanitizers

| Category | Units | Star San | Spartan PAA SANITIZER FP | ECA Device | Lactic acid | Caprylic Acid | NaDCC Tablets | Ozone |
|----------------------------|--------------------------------|------------------------------------|-----------------------------|--|------------------------------|--|--|--|
| ACUTE HUMAN EFFECTS | | | | | | | | |
| Inhalation Toxicity | LC50 ppm | | | | | | | 12.6 |
| Inhalation Toxicity | Vapor GHS Category Level | | | | | | | |
| Inhalation Toxicity | mg/l gas/vapor | | 0.3 | | | | | |
| Inhalation Toxicity | mg/l dust/mist/fu me | | | | | | | |
| Inhalation Toxicity | Key Phrases | Harmful if inhaled | Harmful if inhaled | May cause breathing difficulties if inhaled | Not considered harmful | May cause breathing difficulties if inhaled | May cause breathing difficulties if inhaled | May cause breathing difficulties if inhaled |
| Inhalation Toxicity | Solid GHS Category Level | | | | | | | |
| Inhalation Toxicity | GHS H Phrases | | | | | | | |
| Oral Toxicity | LD50 mg/kg | | 263 | 2000 | 3730 | 10000 | | |
| Oral Toxicity | Key Phrases | Harmful if swallowed | Harmful if swallowed | May be harmful if swallowed | | Harmful if swallowed | Harmful if swallowed | May be harmful if swallowed |
| Oral Toxicity | GHS H Phrases | | | | | | H302 | |
| Oral Toxicity | GHS Category Level | | | | | | 4 | |
| Dermal Toxicity | LD50 mg/kg | | 1060 | | 2000 | 2000 | | |
| Dermal Toxicity | Key Phrases | Harmful in contact with skin | | May be harmful | | May be harmful | Harmful in contact with skin | May be harmful |
| Dermal Toxicity | GHS H Phrases | | | | | | | |
| Dermal Toxicity | GHS Category Level | | | | | | 1 | |

| Category | Units | Star San | Spartan PAA SANITIZER FP | ECA Device | Lactic acid | Caprylic Acid | NaDCC Tablets | Ozone |
|------------------------|--------------------|---|---|--|--|--|--|--|
| Respiratory Irritation | Key Phrases | Evidence in humans or animals shows mild reversible respiratory irritation effects; Low to moderate frequency of occurrence | Evidence in humans or animals shows mild reversible respiratory irritation effects; Low to moderate frequency of occurrence | Evidence in humans and animals shows slight or minor reversible respiratory irritation effects | Non-irritating; Adequate data available, and negative studies, no structural alerts, and GHS not classified. | Evidence in humans and animals shows slight or minor reversible respiratory irritation effects | Evidence in humans and animals shows slight or minor reversible respiratory irritation effects | |
| Respiratory Irritation | GHS H Phrases | H335 | | | | | | |
| Respiratory Irritation | GHS Category Level | | | | | | | 1 |
| Dermal Irritation | Key Phrases | Reversible skin irritation effects; Irritant | Existing human and animal data, in vitro data or information from structurally related compounds shows irreversible skin burns; Corrosive | Slight or minor reversible skin irritation effects | Reversible skin irritation effects; Irritant | Reversible skin irritation effects; Irritant | Reversible skin irritation effects; Irritant | Slight or minor reversible skin irritation effects |
| Dermal Irritation | GHS Category Level | | 1A, 1 | | 1C, 2 | 1B | 1A, 1 | 3 |
| Dermal Irritation | GHS H Phrases | H315 | H314 | | H315 | H315 | H314 | |

| Category | Units | Star San | Spartan PAA SANITIZER FP | ECA Device | Lactic acid | Caprylic Acid | NaDCC Tablets | Ozone |
|------------------------------|------------------------------------|--|--|---|--|--|--|---|
| Eye Irritation | Key Phrases | Reversible irritation effects on the eyes from single or repeated exposure; Irritating | Existing human and animal data, in vitro data or information from structurally related compounds shows irreversible eye damage; Irreversible | Slight or minor reversible eye irritation effects | Reversible irritation effects on the eyes from single or repeated exposure; Irritating | Reversible irritation effects on the eyes from single or repeated exposure; Irritating | Existing human and animal data, in vitro data or information from structurally related compounds shows irreversible eye damage; Irreversible | Mild reversible eye irritation effects; Mildly irritating |
| Eye Irritation | GHS H Phrases | H319 | H318, H314 | | H319 | H318, H314 | H318, H314 | H320 |
| Eye Irritation | GHS Category Level | 2A | 1 | | 1 | 1 | 1 | 2, 2B |
| Exposure Limits | PEL/TLV ppm | | 1 | | | | | 0.1 |
| Exposure Limits | PEL/TLV (dusts/particulates) mg/m3 | 1 | 1 | | | | | |
| Exposure Limits | GHS Category Level | | | | | | | |
| IDLH | ppm | | 50 | | | | | 5 |
| Health | NFPA/HMIS 0,1,2,3,4 | 3 | 3 | 0 | 3 | 3 | | 2 |
| CHRONIC HUMAN EFFECTS | | | | | | | | |
| Carcinogen | IARC Category | 4 | 4 | | | | 4 | |
| Carcinogen | EPA CLASS Category | | | | | | E | |
| Carcinogen | ACGIH Category | | A5 | | | | A5 | |
| Carcinogen | OSHA Category | No components are listed as carcinogens by OSHA | No components are listed as carcinogens by OSHA | No components are listed as carcinogens by OSHA | No components are listed as carcinogens by OSHA | No components are listed as carcinogens by OSHA | No components are listed as carcinogens by OSHA | No components are listed as carcinogens by OSHA |

| Category | Units | Star San | Spartan PAA SANITIZER FP | ECA Device | Lactic acid | Caprylic Acid | NaDCC Tablets | Ozone |
|--------------------------------|------------------|---|---|---|---|---|---|---|
| Carcinogen | Key Phrases | No component present at greater than or equal to 0.1% as probable, possible or confirmed human carcinogen | No component present at greater than or equal to 0.1% as probable, possible or confirmed human carcinogen | No component present at greater than or equal to 0.1% as probable, possible or confirmed human carcinogen | No component present at greater than or equal to 0.1% as probable, possible or confirmed human carcinogen | No component present at greater than or equal to 0.1% as probable, possible or confirmed human carcinogen | No component present at greater than or equal to 0.1% as probable, possible or confirmed human carcinogen | No component present at greater than or equal to 0.1% as probable, possible or confirmed human carcinogen |
| Carcinogen | GHS H Phrases | | | | | | | |
| Carcinogen | GHS Category | | | | | | | |
| Carcinogen | Prop 65 Category | | | | | | No; not listed on prop 65 | |
| Mutagen/ Teratogen | Key Phrases | Not expected to be mutagenic in humans | | Tested with no signs of mutagenicity | | | | |
| Mutagen/ Teratogen | GHS H Phrase | | | | | | | |
| Mutagen/ Teratogen | GHS Category | | | | | | | |
| Reproductive/ Developmental | Key Phrases | Not expected to have reproductive effects | | Tested with no signs of reproductive/development toxicity | | | | |
| Reproductive/ Developmental | GHS H Phrases | | | | | | | |
| Reproductive/ Developmental | GHS Category | | | | | | | |
| Reproductive/ Developmental | Prop 65 Category | | | | | | No; not listed on prop 65 | |

| Category | Units | Star San | Spartan PAA SANITIZER FP | ECA Device | Lactic acid | Caprylic Acid | NaDCC Tablets | Ozone |
|-------------------------------------|--|--|--|--|-------------|--|------------------|--|
| Neurotoxicity | GHS Category - STOT - Single Exposure | | | | | | | |
| Neurotoxicity | GHS Category - STOT - Repeated Exposure | | | | | | | |
| Neurotoxicity | Key Phrases | | | | | | | |
| Neurotoxicity | GHS H Phrase | | | | | | | |
| Respiratory Sensitivity/ Disease | Asthmagen Type (AOEC Database) | | Rs; Rr; Rrs | | | | | |
| Respiratory Sensitivity/ Disease | Key Phrases | May cause respiratory irritation | Sensitizer; Asthmagen; Substances showing a high frequency of occurrence in humans; probability of occurrence of a high sensitization rate in humans based on animals or other tests | May cause respiratory irritation | | May cause respiratory irritation | | May cause respiratory irritation |
| Respiratory Sensitivity/ Disease | GHS H Phrase | | | | | | | |
| Respiratory Sensitivity/ Disease | GHS Category | | | | | | | |
| Endocrine System Effects | EU - Priority Endocrine Disruptor | | | | | | | |
| Endocrine System Effects | EU - SVHC | | | | | | | |

| Category | Units | Star San | Spartan PAA SANITIZER FP | ECA Device | Lactic acid | Caprylic Acid | NaDCC Tablets | Ozone |
|-----------------------------|---|--|-----------------------------|--|-------------|---------------|------------------|-------|
| Endocrine System Effects | ChemSec - SIN | | | | | | | |
| Endocrine System Effects | OSPAR | | | | | | | |
| Endocrine System Effects | TEDX | | | | | | | |
| Endocrine System Effects | Key Phrases | | | | | | | |
| Other Chronic Organ Effects | Key Phrases | May cause damage to organs; Possible risk of irreversible effects; May cause damage to organs through prolonged or repeated exposure | | | | | | |
| Other Chronic Organ Effects | GHS H-Phrase - Single Exposure | | | | | | | |
| Other Chronic Organ Effects | GHS Category - STOT -Single Exposure | | 3 | Substance/mixture not classified as STOT, single exposure. | | | | |
| Other Chronic Organ Effects | GHS H-Phrase - Repeated Exposure | | | | | | | |
| Other Chronic Organ Effects | GHS Category - STOT - Repeated Exposure | | | Substance/mixture not classified as STOT, repeated exposure. | | | | |
| ECOLOGICAL HAZARDS | | | | | | | | |
| Acute Aquatic Toxicity | Acute Fish LC50 (mg/l) | 8.47 | 16.4 | 597 | 160 | 110 | 0.28 | |

| Category | Units | Star San | Spartan PAA SANITIZER FP | ECA Device | Lactic acid | Caprylic Acid | NaDCC Tablets | Ozone |
|--|--|--------------------------------------|-----------------------------|--|--|---|---|--|
| Acute Aquatic Toxicity | Acute Algae (or other aquatic plant) EC50 (mg/l) | 13.41 | 2.5 | 126 | 3500 | | 0.88 | |
| Acute Aquatic Toxicity | Key Phrases | Harmful to aquatic life | | Not considered harmful to aquatic life | Not considered harmful to aquatic life | Not considered harmful to aquatic life | Very toxic to aquatic life | Very toxic to aquatic life |
| Acute Aquatic Toxicity | GHS H Phrases | | | | | | H400 | H400 |
| Acute Aquatic Toxicity | GHS Category level | | | | | | Acute 1 | Acute 1 |
| Chronic Aquatic Toxicity (fish, crustacea or algae) - Rapidly Degradable, with Adequate Data | NOEC (NOAEC) or ECx (mg/l) | | | | | | | |
| Chronic Aquatic Toxicity (fish, crustacea or algae) - Rapidly Degradable, with Adequate Data | ChV mg/l | 1.12 | 493 | 24.51 | | | 48.9 | 235 |
| Chronic Aquatic Toxicity (fish, crustacea or algae) - Rapidly Degradable, with Adequate Data | Key Phrases | May be dangerous for the environment | | Not harmful to aquatic life | Not harmful to aquatic life | Toxic to aquatic life with long lasting effects | Toxic to aquatic life with long lasting effects | Not expected to be harmful to aquatic life |
| Chronic Aquatic Toxicity (fish, crustacea or algae) - Rapidly Degradable, with Adequate Data | GHS H Phrases | | | | | | H410 | |
| Chronic Aquatic Toxicity (fish, crustacea or algae) - Rapidly Degradable, with Adequate Data | GHS Category | | | | | | Chronic 1 | |

| Category | Units | Star San | Spartan PAA SANITIZER FP | ECA Device | Lactic acid | Caprylic Acid | NaDCC Tablets | Ozone |
|--|----------------------------|----------|-----------------------------|-------------------------------|-------------------------------|-------------------------------|--|----------------|
| Chronic Aquatic Toxicity (fish, crustacea or algae) - NOT Rapidly Degradable, with Adequate Data | mg/l | | | | | | | |
| Chronic Aquatic Toxicity (fish, crustacea or algae) - NOT Rapidly Degradable, with Adequate Data | Key Phrases | | | | | | | |
| Chronic Aquatic Toxicity (fish, crustacea or algae) - NOT Rapidly Degradable, with Adequate Data | GHS Category level | | | | | | | |
| ENVIRONMENTAL FATE & TRANSPORT | | | | | | | | |
| Persistence | Water t1/2 Days | 15 | 15 | | 8.7 | 8.7 | 15 | 15 |
| Persistence | Water Signal Words | | | | | | | |
| Persistence | Air t1/2 Days | 0.65 | 14.5 | | 2.7 | 1.9 | 3.55 | 0.15 |
| Persistence | Air Signal Words | | | | | | | |
| Persistence | Soil/Sediment t1/2 Days | 30 | 30 | | 17 | 17 | 30 | 30 |
| Persistence | Soil/Sediment Signal Words | | | | | | | |
| Persistence | Key Phrases | | | Not expected to be persistent | Not expected to be persistent | Not expected to be persistent | Slow environmental degradation/ hazardous degradation products form | Not persistent |

| Category | Units | Star San | Spartan PAA SANITIZER FP | ECA Device | Lactic acid | Caprylic Acid | NaDCC Tablets | Ozone |
|--------------------------------------|--|-------------------------------|-----------------------------|---------------------------|---------------------------|---|---------------------------|---------------------------|
| Rapid Degradability | 28-day Study: % Breakdown Dissolved Organic Carbon | | | | | 88 | | |
| Rapid Degradability | 28-day Study: % Based on O2 or CO2 | | | | | | | |
| Rapid Degradability | BOD Half-life (days) | | | | | | | |
| Rapid Degradability | Hydrolysis Half-life (days) | | | | | | | |
| Rapid Degradability | Key Phrases | Biodegradable | Biodegradable | Biodegradable | Readily degradable | Readily degradable | Not Determined | Readily degradable |
| Bioconcentration/ Bioaccumulation | Log Kow / Pow | 4.78 | -0.17 | -0.46 | -0.62 | 3.05 | -0.06 | -0.87 |
| Bioconcentration/ Bioaccumulation | BAF/BCF (l/kg) | 508.9 | 0.95 | 1.09 | 3.2 | 3.2 | 1.28 | 0.9 |
| Bioconcentration/ Bioaccumulation | On Canada EPA Domestic Substances List | | | | | | | |
| Bioconcentration/ Bioaccumulation | Key Phrases | Potential to bioaccumulate | | Will not bioaccumulate | Will not bioaccumulate | Not likely/expected to bioaccumulate | Will not bioaccumulate | Will not bioaccumulate |
| ATMOSPHERIC HAZARD | | | | | | | | |
| Greenhouse Gas | GWP Relative to CO2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Greenhouse Gas | Y/N | N | N | N | N | N | N | N |
| Ozone Depletor | ODP Units | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ozone Depletor | GHS H Phrase | | | | | | | |
| Ozone Depletor | Ozone Classification | Not Classified | Not Classified | Not Classified | Not Classified | Not Classified | Not Classified | Not Classified |
| Acid Rain Formation | Y/N | | N | N | N | N | N | N |

| Category | Units | Star San | Spartan PAA SANITIZER FP | ECA Device | Lactic acid | Caprylic Acid | NaDCC Tablets | Ozone |
|----------------------------|------------------------|---|---|---|---|---|---|---------------------------------------|
| Acid Rain Formation | Key Phrases | Product may form SO2 or NOx upon combustion | Does not contain SO2 or NOx | Does not contain SO2 or NOx | Does not contain SO2 or NOx | Does not contain SO2 or NOx | Does not contain SO2 or NOx | Does not contain SO2 or NOx |
| NESHAP | Y/N | N | N | N | N | N | N | Y |
| NESHAP | Key Phrases | Not listed as EPA hazardous air pollutant | Not listed as EPA hazardous air pollutant | Not listed as EPA hazardous air pollutant | Not listed as EPA hazardous air pollutant | Not listed as EPA hazardous air pollutant | Not listed as EPA hazardous air pollutant | Listed as EPA hazardous air pollutant |
| PHYSICAL PROPERTIES | | | | | | | | |
| Vapor Pressure | mm Hg | | | | 0.08 | 0 | | |
| Flammability: Liquid | NFPA/HMIS 0,1,2,3,4 | 1 | 1 | 0 | 0 | 0 | | 0 |
| Flammability: Liquid | GHS H Phrase | | | | | | | |
| Flammability: Liquid | GHS Category level | 3 | | | | | | |
| Flash point: Liquid | deg C | 49 | | | 110 | 133 | | |
| Flash point: Liquid | Key Phrases | Combustible liquid | Flammable liquid | No Flash point-will not burn | | | | No Flash point-will not burn |
| Flammability: Gas | GHS H Phrase | | | | | | | |
| Flammability: Gas | GHS Category Level | | | | | | | |
| Reactivity | NFPA/HMIS 0,1,2,3,4 | 1 | 2 | 0 | 1 | 1 | | 3 |
| Reactivity | GHS H Phrase | | H201, H202, H250, H251, H261, H270 | | | | H204, H205, H290, H252, H272 | |
| Reactivity | GHS Category Level | | | | | | | |
| pH | pH Units | 1-2 or 11.5-14 | 1-2 or 11.5-14 | 5-6 or 8-9 | 1-2 or 11.5-14 | 2-5 or 9-11.5 | 6-7 or 7-8 | 2-5 or 9-11.5 |
| pH | Key Phrases | Highly acidic, highly caustic | Highly acidic, highly caustic | Mildly acidic, mildly alkaline | Acidic, alkaline | Acidic, alkaline | Mildly acidic, mildly alkaline | |
| Corrosivity | Key Phrases | Highly Corrosive | Corrosive | Not corrosive | Not corrosive | | | |
| Corrosivity | GHS Category Level | | | | | | | |

| Category | Units | Star San | Spartan PAA SANITIZER FP | ECA Device | Lactic acid | Caprylic Acid | NaDCC Tablets | Ozone |
|------------------------------|--|--|-------------------------------|--|--|--|--|--|
| Odor | Key Phrases | Slight odor | Mild odor | Slight odor | Odorless | Pungent or irritating odor | | Pungent or irritating odor |
| Volatile Organic Compound | g/l | 0 | | 0 | | | | |
| PROCESS FACTORS | | | | | | | | |
| Heat | WBGT, deg C | | | | | | | |
| Noise Generation | dBA/hr | | | 80/no limit | | | | |
| Vibration | Class 1 Small Machine (mm/s) | | | 1 | | | | |
| Vibration | Class 2 Medium Machine (mm/s) | | | | | | | |
| Vibration | Class 3 Large Rigid Foundation (mm/s) | | | | | | | |
| Vibration | Class 4 Large Soft Foundation (mm/s) | | | | | | | |
| Ergonomic Hazard | Occurrence | Unlikely/ remote | Possible | Possible | Unlikely/ remote | Possible | Unlikely/ remote | Possible |
| Ergonomic Hazard | Hazard Level | Minor injury/illness, minor impact on time lost | Moderate injury, lost time | Minor injury/illness, minor impact on time lost | Minor injury/illness, minor impact on time lost | Minor injury/illness, minor impact on time lost | Minor injury/illness, minor impact on time lost | Minor injury/illness, minor impact on time lost |
| Psychosocial Hazard | Work Overload and Pace: Work Load | | | | | | Process improves workload | |
| Psychosocial Hazard | Work Overload and Pace: Machine Pacing | | | | | | Adequate machine pacing | |

| Category | Units | Star San | Spartan PAA SANITIZER FP | ECA Device | Lactic acid | Caprylic Acid | NaDCC Tablets | Ozone |
|----------------------------|---|--|--|--|---|---|---|--|
| Psychosocial Hazard | Work Overload and Pace: Time Constraints | | | | | | Process improves time constraints/ deadlines | |
| Psychosocial Hazard | Work Schedule: Shift Work | | | | | | Process normalizes shift work | |
| Psychosocial Hazard | Work Schedule: Work Isolation | Process requires restricted access | Process requires restricted access | Process eliminates isolation work | Process eliminates isolation work | Process requires restricted access | Process requires restricted access | Process requires restricted access |
| Psychosocial Hazard | Control | Process provides worker with access to supervisor about needed changes | Process doesn't allow for workers to participate in decision process | Process includes worker input | Process allows for minor changes in real-time by worker | Process allows for minor changes in real-time by worker | Process allows for minor changes in real-time by worker | Process provides worker with access to supervisor about needed changes |
| Psychosocial Hazard | Work Environment & Equipment: Equipment Stability | | | Improved equipment quality and suitability | | | Improved equipment quality and suitability | |
| Psychosocial Hazard | Work Environment & Equipment: Work Space | | | | | | Improves work space and surrounding conditions | |
| High Pressure System | Pressure (Delta % Change From Ambient) | 0 | 0 | 0 | 0 | 0 | | 0 |
| High Temperature System | Temperature (Delta % Change From Ambient) | 0 | 0 | 0 | 0 | 0 | | 0 |
| Water Use | % Water Change | | | | | | | |

| Category | Units | Star San | Spartan PAA SANITIZER FP | ECA Device | Lactic acid | Caprylic Acid | NaDCC Tablets | Ozone |
|---------------------------|------------------------------|--|--|--|---|--|--|--|
| Water Use | Reuse | | | | | | | |
| Energy Use | % Energy Change | | | 25% increase | | | | |
| Energy Use | % Renewable Energy | | | | | | | |
| Exposure Potential | Occurrence: Near Certain | | | | | | | |
| Exposure Potential | Occurrence: Highly Likely | | | | | | Minor hazard | |
| Exposure Potential | Occurrence: Likely | Critical hazard | Catastrophic hazard | Minor hazard | Marginal hazard | Marginal hazard | | Marginal hazard |
| Exposure Potential | Occurrence: Unlikely | | | | | | | |
| Exposure Potential | Occurrence: Remote | | | | | | Catastrophic hazard | |
| LIFE CYCLE FACTORS | | | | | | | | |
| Upstream Effects | Key Phrases | Process reduces suppliers use of hazardous materials, energy, water and other resources | Process requires suppliers to use hazardous materials or excess energy, water, and other resources | Eliminates suppliers use of hazardous materials or reduces use of energy, water, and resources | Eliminates suppliers use of hazardous materials and reduces use of energy, water, and resources | Process reduces suppliers use of hazardous materials, energy, water and other resources | Process reduces suppliers use of hazardous materials, energy, water and other resources | Process reduces suppliers use of hazardous materials, energy, water and other resources |
| Consumer Hazard | Key Phrases | Product contains hazardous components with low consumer exposure potential | Product contains hazardous components with consumer exposure potential | Product contains hazardous components with no consumer exposure potential | Product contains no hazardous components | Product contains hazardous components with low consumer exposure potential | Product contains hazardous components with no consumer exposure potential | Product contains hazardous components with low consumer exposure potential |

| Category | Units | Star San | Spartan PAA SANITIZER FP | ECA Device | Lactic acid | Caprylic Acid | NaDCC Tablets | Ozone |
|--|--|---|--|---|---|---|---|--|
| Disposal Hazard (landfill, incineration) | Key Phrases | Creates concern for air, water or land and disposed of as hazardous waste | Creates concern for air, water or land and disposed of as hazardous waste | Prevents/ reduces amount of waste material being created | Prevents/ reduces amount of waste material being created | Creates concern for air, water or land and disposed of as hazardous waste | Creates concern for air, water or land and disposed of as hazardous waste | Creates some concern for air, water or land |
| Reportable Quantity | Pounds | | | | | | | 100 |
| Recycling | % Recyclable at End of Life | | | | | | | |
| Recycling | Uses Products With % Recycled Material | | | | | | | |
| Renewable to Nonrenewable Resource | % Renewable Materials | | | | | | | |
| Renewable to Nonrenewable Resource | Key Words | | | | | | | |

The P2OASys evaluations were performed using Safety Data Sheets for each product which can be found in Supplement 2. EPA's Estimation Programs Interface, (EPI) Suite™ software was used to assess environmental fate and transport and ecological toxicity data for each product.ⁱ

ⁱ EPI Suite (2020). US EPA Estimation Programs Interface (EPI) Suite™ for Microsoft® Windows, v 4.11. United States Environmental Protection Agency, Washington, DC, USA.