Environmental Assessment of Sterilox™ Hypochlorous Acid Solution

1. **Date:** October 2, 2014

2. **Name of Applicant:** PuriCore, Inc.

3. **Address:**

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All communication regarding this food contact notification (FCN) environmental assessment (EA) should be sent to the attention of the authorized representative:

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4. Description of Proposed Action

The action requested in this submission is the food contact notification of the use of the food contact substance (FCS) hypochlorous acid solution. Hypochlorous acid is intended to provide an antimicrobial component to water designated to crisp (*i.e.*, re-hydrate) whole and fresh cut fruits and vegetables.

Maximum Use Level:
Sterilox hypochlorous acid solution is formulated to deliver up to 60 ppm available free chlorine (AFC). Sterilox hypochlorous acid solution is generated through the electrochemical oxidation of chloride from salt brine by the Sterilox Food Safety System.

Food Types:
In addition to whole fruits and vegetables, as included in FCN 692, Sterilox hypochlorous solution is intended to be used on fresh cut fruits and vegetables. The fruit or vegetable may be cut prior to submerging in the Sterilox solution or cut after the fresh fruits and vegetables have soaked in the Sterilox hypochlorous acid solution.

Conditions of Use:

The process for the use of Sterilox hypochlorous acid solution is as follows:

- Fresh produce is placed into a sink containing Sterilox hypochlorous acid solution and soaked for a minimum of 90 seconds and maximum of 10 minutes. The produce is removed from the solution and set aside to drain.
- Alternatively, Sterilox hypochlorous acid solution is introduced by spraying the solution onto the fresh produce and allowing the solution to drain from the produce.
- The Sterilox hypochlorous acid solution application process continues until all the produce requiring hydrating or crisping is complete.
- Produce may be used for display in the store or prepared for consumption (*e.g.*, made-to-order salad) after 10 minutes of draining.

Controls:

- The hypochlorous acid solution must be between 25 and 60 ppm. If AFC is below 25 ppm, the sink is drained and re-filled with fresh Sterilox hypochlorous acid solution.

5. Identification of the Food Contact Substance

Typical Physical Properties of Sterilox Hypochlorous Acid Solution
Appearance: greenish-yellow in solution
pH: weak acid
Solubility: soluble in water
Stability: the hypochlorous chemical species is unstable and decomposes to halogenated chemical species and oxygen (*e.g.*, chlorine, chlorite, chlorate and trihalomethanes (THMs) including: bromodichloromethane, dibromochloromethane and bromoform).

Hypochlorous acid (HSDB)
CAS #: 7790-92-3
Formula: HOCl
Molecular weight: 52.46 g/mol
Water solubility: soluble
Dissociation constant (pKa): 7.53
Comment: The active oxychloric species in the solution; present at not more than 60 ppm in the end-use product solutions.

Sodium chloride (HSDB)
CAS#: 7647-14-5
Formula: NaCl
Molecular weight: 58.44 g/mol
Water Solubility: highly soluble
Dissociation constant (pKa): completely dissociated

Comment: Starting material. Food grade salt supplied by Morton Salt with a specification of 99.95-99.99%% sodium chloride. It contains no additives and less than 0.05% typical impurities including calcium sulfate, calcium carbonate and heavy metals (*e.g.*, copper).

Sodium hydroxide (HSDB)
CAS#: 1310-73-2
Formula: NaOH
Molecular weight: 40.00 g/mol
Water Solubility: highly soluble
Dissociation constant (pKa): completely dissociated
Comment: By-product from Sterilox hypochlorous acid solution

Chlorine (HSDB)
CAS#: 7782-50-5
Formula: Cl_2
Molecular weight: 70.91 g/mol
Water Solubility: soluble (aqueous form)
Vapor pressure: 5.83 E10 mm Hg @ 25^{o}C (gaseous form)
Comment: By-product from Sterilox hypochlorous acid solution, minimized under controlled pH environment; interchangeable chlorine species in final solution

Hydrogen chloride (HSDB)
CAS#:7647-01-0
Formula: HCl
Molecular weight: 36.46 g/mol
Water Solubility: soluble (aqueous form)
Vapor pressure: 3.54 E4 mm Hg @ 25^{o}C (gaseous form)
Comment: By-product from Sterilox hypochlorous acid solution, minimized under controlled pH environment; interchangeable chlorine species in final solution

Chlorite (HSDB)
CAS#: 7758-19-2 (sodium chlorite)
Formula: ClO_2- (ion form) ($NaClO_2$ salt)
Molecular weight: 90.44 g/mol ($NaClO_2$)
Water Solubility: very soluble
Oxidizer: Strong; readily reduced to chloride and chlorate
Solid partition coefficient (Kd): not measured or reported (EPA, 2006c)
Bioconcentration: not expected (USEPA 2006c)
Not readily biodegradable under aerobic conditions (EPA, 2006c)
Comment: By-product from Sterilox hypochlorous acid solution, minimized under controlled pH environment

Chlorate (HSDB)
CAS#: 7775-09-9 (sodium chlorate)

Formula: ClO_3- (ion form) ($NaClO_3$ salt)
Molecular weight: 106.44 g/mol ($NaClO_3$)
Water Solubility: very soluble
Vapor pressure: 'very low' (EPA, 2006b)
Bioaccumulation: 'low potential' (EPA, 2006b)
Oxidizer: Strong; readily reduced to chloride and chlorate Comment: By-product from Sterilox hypochlorous acid solution, minimized under controlled pH environment

Bromodichloromethane (HSDB)
CAS#: 75-27-4
Formula: $CHBrCl_2$
Molecular weight: 163.83 g/mol
Octanol Water Partition Coefficient (log Kow): 2
Water Solubility: soluble
Vapor pressure: 50 mm Hg @ 20^{o}C
Solid partition coefficient (Koc): 53 to 251
Henry's Law Constant: 2.12 E-3 atm-cu m/mole
Bioconcentration factor: 7 (estimated)
Comment: By-product formed in final solution

Chlorodibromomethane (HSDB)
CAS#: 124-48-1
Formula: $CHBr_2Cl$
Molecular weight: 162.08 g/mol
Octanol Water Partition Coefficient (log Kow): 2.16
Water Solubility: soluble
Vapor pressure: 5.54 mm Hg @ 20^{o}C
Solid partition coefficient (Koc): 84
Henry's Law Constant: 7.83 E-4 atm-cu m/mole
Bioconcentration factor: 9 (estimated)
Comment: By-product formed in final solution

Bromoform (HSDB)
CAS#: 75-25-2
Formula: $CHBr_3$
Molecular weight: 252.73 g/mol
Octanol Water Partition Coefficient (log Kow): 2.40
Water Solubility: soluble
Vapor pressure: 5.4 mm Hg @ 20^{o}C
Solid partition coefficient (Koc): 116, 126
Henry's Law Constant: 5.35 E-4 atm-cu m/mole
Bioconcentration factor: 14 (estimated)
Not readily biodegradable
Comment: By-product formed in final solution

AFC levels and other by-products in Sterilox™ hypochlorous solutions were measured in the study entitled, “Measurement of Disinfectant By-product Formation During Treatment of Cut Lettuce by Submersion in Hypochlorous Acid Solution,” June 14, 2014 (PuriCore, 2014). These values are used for the environmental assessment as a worst-case estimate of environmental exposure for the residuals because cut lettuce increases cellular surface area, much of which was disrupted during cutting, thus potentially altering water chemistry, such as pH and solution activity. The hypochlorous acid solution used in the study dated June 14, 2014 was prepared from a hypochlorous acid concentration manufactured on May 27, 2014. The analysis for chlorine, chlorate, chlorite and THMs was conducted between May 28 through June 2, 2014. It should be noted that although a hypochlorous acid concentrate was used to produce the solution, the production of the concentrate was just days prior to the analysis and is representative of solution freshly generated electrochemically *in situ* as no differences in composition is expected, including residuals or by-products between a solution produced from a freshly made concentrate and a solution prepared electrochemically *in situ*. Table 1 lists the concentrations of residuals measured in the freshly prepared Sterilox solution following the treatment process described by the label and thus relevant to typical consumer use. The measured values of AFC in this study ranged from 41 to 56 ppm. To be conservative, the nominal concentration of AFC in Sterilox solution, 60 ppm, is used as a worst case estimate in the environmental exposure calculations.

Table 1. Measurements of the FCS and Residual Chemical Species in Hypochlorous Acid Solution

Chemical Species	Maximum Measured Hypochlorous Acid Solution [a]	
	ppm	%
Food Contact Substance		
Available free chlorine	60[b]	0.006
Residuals		
chlorite	<0.5[c]	0.00005
chlorate	<0.5[c]	0.00005
total trihalomethanes	0.0606	0.00000606

[a] Measurement of Disinfectant By-product Formation During Treatment of Cut Lettuce by Submersion in Hypochlorous Acid Solution, June 4, 2014. PuriCore 2014.
[b] Nominal concentration of hypochlorous acid in Sterilox solution.
[c] Less than detection limits of chlorite and chlorate.

6. **Introduction of Substances into the Environment**

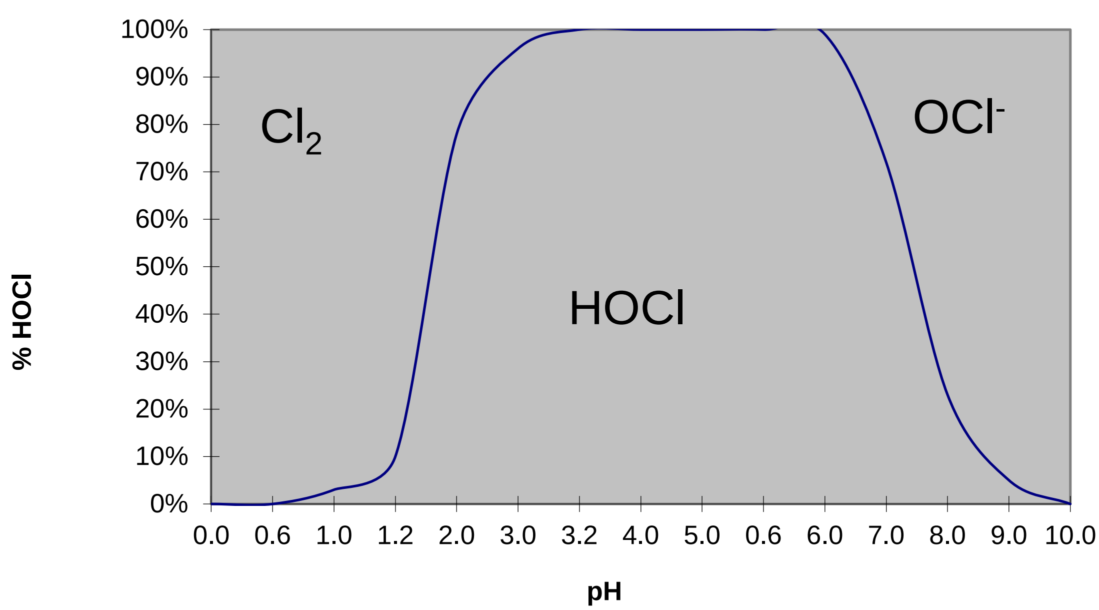
6.a. As a result of manufacture/generation at site of production

PuriCore offers Sterilox hypochlorous acid solution generated *in situ* by the customer at the point of application through an *in situ* device that utilizes an electrochemical chlor-alkali oxidation process from starting salt brine. The generation process requires sodium chloride as a starting material and generates sodium hydroxide, hydrogen and oxygen gas due to the hydrolysis of water in the electrochemical cell. Due to the control of pH during production of the solution, trace amounts of hydrogen, oxygen and diatomic chloride gas are generated during the equilibrium reaction favoring hypochlorous acid solution and therefore release of these gases into the atmosphere at the site of production is negligible. Under 21 Code of Federal Regulations (CFR) § 25.40(a), an EA should focus on relevant environmental issues relating to the use and disposal from use, rather than the production, of FDA-regulated articles. Information available suggests no extraordinary circumstances suggesting an adverse environmental impact as a result of the manufacture of the antimicrobial agent. Consequently, information on the manufacturing site and compliance with relevant emissions requirements is not provided here.

6.b. As a result of use/disposal

Using Sterilox hypochlorous acid solution in the proposed crisping procedure introduces a salt starting material and various oxychloro, chloride and THM by-products into the environment. Relative proportions of each are determined by pH control of the Sterilox solution by the Sterilox Food Safety System. The effective oxychloro species, hypochlorous acid, exists interchangeably with other chlorine species, including chlorine, hydrogen chloride (aqueous and gaseous) and chlorite (1993 Letter to Dr. Michael Rose from Dr. Andrew Laumbach, FDA). This is supported by the equilibrium chemistry of active chlorine. In a controlled pH environment, hypochlorous acid will exist as the dominant chlorine species under pH conditions ranging from 5 to 8.4 (see diagram below).

Figure 1. Equilibrium Chemistry of Active Chlorine



The table below summarizes measured available free chlorine (includes diatomic chlorine, hypochlorous acid and hypochlorite species) in Sterilox solution, which ranged from 93 to >98% depending on the pH.

Table 1. AFC in Sterilox Hypochlorous Acid Solution

Percent Concentration In Sterilox Hypochlorous Acid Solution Generated *in Situ*		
Chemical Species	At pH 5-6	At pH 8.4
Available free chlorine (includes diatomic chlorine, hypochlorous acid and hypochlorite)	93	>98

In addition to AFC (largely hypochlorous acid), residual chemicals in the final solution that may be released down the drain to publicly owned treatment works (POTWs) include the following: sodium chloride (starting material), sodium hydroxide (formed during the generation process), degradation oxycloro species (chlorate, chlorite) and THM formation by-products (bromodichloromethane, chlorodibromomethane and bromoform).

6.b.1. Maximum yearly market volume for proposed use

The maximum yearly market estimate per retail site for use of Sterilox hypochlorous acid solution is 146,657 kg. The per retail site usage is a projection based on 2012 and 2013 Sterilox sales data for all current and anticipated usage types (*i.e.*, soaking and misting of fresh whole and cut fruits and vegetables). This estimate is based on projections of large (*e.g.*, high volume) retail locations using 5 20-gallon cycles of Sterilox hypochlorous acid solution per day for 365 days per year. As the consumer consumption of fruits and vegetables is not expected to increase, the overall usage of Sterilox solution is not likely to increase but shift from usage on whole fruits and vegetables to usage on prepared or cut fruits and vegetables. The usage estimate is an overestimation as it assumes usage every day of the year and 100 gallons of solutions per day and is not adjusted for lower usage periods (*e.g.*, seasonality). Volume projections based on 2012-2013 sales data for smaller retails stores estimate less than 100 gallons per day. The anticipated use of Sterilox hypochlorous acid solution to mist fresh whole and cut fruits and vegetables is limited to traditional grocery stores and not expected to increase or expand to other grocery store formats (*e.g*., warehouse) because of the cost associated with installing and maintaining misting systems. The use of misting is included in the projections. One gallon of Sterilox solution is equivalent to 4.018 kg.

$$\begin{aligned} &Maximum\ daily\ volume\ estimate\ of\ Sterilox\ solution\ at\ one\ site \\ &= 20\ gallons\ Sterilox\ soln\ x\ 5\ cycles\ per\ day\ x\ 4.018\ kg\ per\ gallon\ Sterilox\ soln \\ &= 401.80\ kg\ per\ day\ per\ retail\ site \end{aligned}$$

$$\begin{aligned} &Maximum\ yearly\ mass\ estimate\ of\ Sterilox\ solution\ at\ one\ site \\ &\qquad = 401.80\ kg\ Sterilox\ soln\ per\ day\ per\ site\ x\ 365\ days\ per\ year \\ &\qquad = 146{,}657\ kg\ Sterilox\ soln\ per\ year\ per\ retail\ site \end{aligned}$$

6.b.2. Percent of FCS and residual chemicals entering the down-the-drain waste stream at site of production/use

To estimate the release of the FCS and residual chemicals into the environment at each retail outlet site, the percentage of each chemical species (Table 2) is multiplied by the maximum daily volume estimate of hypochlorous acid solution released down the drain to POTWs daily and annually (i.e., 146,657 kg/year/retail site). Table 2 summarizes the release estimates.

Table 2. Daily and Annual Release Estimates of Free Chlorines and the Oxychloro and THM Residual Chemical Species from a Single Retail Outlet Site that Uses Hypochlorous Acid Solution to POTWs

Chemical Species			Estimated Release Down-The-Drain	
			Daily (kg/day)[1]	Yearly (kg/yr)[2]
Chloro species	free chlorines (AFC)		2.411	879.9
	chlorite		0.02009	7.333
	chlorate		0.02009	7.333
		SUM	**2.451**	**894.6**
Trihalomethane species			**0.002435**	**0.8887**

[1] calculated by multiplying the percentage of the maximum measured chemical species in hypochlorous acid solution from Table 1 by the maximum daily volume estimate of Sterilox at one site
[2] calculated by multiplying the percentage of the maximum measured chemical species in hypochlorous acid solution from Table 1 by the maximum yearly volume estimate of Sterilox at one site

6.b.3. The mode of chemical introduction into the environment

The Sterilox hypochlorous acid solution is generated intermittently at the site of crisping in accordance with demand at each retail outlet. Solution is then disposed of down the drain to POTWs and ultimately into the environment.

6.b.4. Expected concentration of chemicals introduced into the environment

Due to the control of pH, only trace amounts of hydrogen, oxygen and hydrochloric acid gas are generated to make hypochlorous acid solution and therefore release of these substances into the atmosphere at the site of production is negligible. No solid waste is generated at the site of production.

The chemical species generated from the hypochlorous acid solution are aqueous and will be introduced into the aquatic environment via down-the-drain movement into POTWs for standard treatment processes before movement into aquatic environments. Chlorine and oxychloro species, such as hypochlorous acid, generated by the electrolysis of a brine solution are common sanitizers for potable water. Therefore, POTWs are designed to capture and minimize the impact of brines, sanitizers and their residual products on aquatic environments.

Because the pH is controlled in the Sterilox hypochlorous acid solution, the dominant oxychloro species is hypochlorous acid. Oxychloro species are strong oxidizers. Once the oxychloro species reach the POTWs, they readily react with oxidizable organic compounds (such as phenols, amino acid, proteins) and inorganic compounds (such as iron, manganese, sulfides), and progress to reduced chlorine species, *i.e.*, hypochlorite (ClO-, oxidation state I), chlorine dioxide (oxidation state IV), and the chloride anion (oxidation state -I); it is unlikely that a single reduced species exists (EPA, 2006). Therefore, we can assume 2.451 kg daily and 894.6 kg annually of the sum of the mass of the oxychloro species summarized in Table 2 are released from the POTW into the aquatic environment (Table 2). From there we may assume as a simplistic assumption that this mass is equally distributed between these reduced species. Note that this is considered a conservative approach since oxychlorine species are strong oxidizers and are expected to react readily with oxidizable compounds in the POTW before discharge to surface waters. Little is reported on the properties of the oxychloro species but it is assumed that they have low bioaccumulation potential, low volatility and do not readily biodegrade under aerobic conditions (HSDB, EPA, 2006a and 2006b). Therefore, the conservative assumption would be that the oxychloro species would not readily transition out of surface waters once introduced.

THMs are residuals formed in the final Sterilox hypochlorous acid solution as a result of halogen substitution and oxidation reactions of chlorine with naturally occurring organic matter in the presence of bromide. This same mechanism occurs in chlorinated drinking water. Upon reaching surface water, the THMs are expected to transition out of the aquatic environment within hours to days (HSDB). Based upon measured or estimated Koc values, bromodichloromethane and chlorodibromomethane are expected to have low to moderate mobility (Koc 53 and 84), while bromoform is expected to readily adsorb to suspended solids and sediment in aquatic environments (Koc 116) (HSDB). Volatilization from water surfaces is expected to be an important fate process for all three THM species based upon Henry's Law constants, which range from 5.35 E-4 to 2.12 E-3 (HSDB).

We anticipate that the expected environmental concentrations for the oxychloro and THM species will be very small and thus will be of no environmental concern. To confirm this, we elected to use the EPA screening-level exposure model, Exposure and Fate Assessment Screening Tool (E-FAST^{TM}) /Down-The-Drain to estimate aquatic ecosystem exposure release of the residual chemicals to the aquatic environment. The underlying principles, calculations and units incorporated in the E-FAST Down-the-Drain model are described in more detail in the E-FAST manual (EPA, 2007). E-FAST is a screening tool that requires minimal input data and generally provides highly conservative assessments.

Table 3. Estimated[1] Sum Concentration of Chloro Species and THM species in Aquatic Environments After Processing through POTWs

Chemical Species	E-FAST Data Input			Surface Water Concentration	
	BCF (L/kg)	WWT removal (%)	Production Volume (kg/yr)[2]	(µg/L)	(mg/L)
sum chloro species	--[3]	--[3]	894.6	2.17 E-2	2.17 E-5
sum trihalomethane species	--[3]	--[3]	0.8887	2.16 E-5	2.16 E-8

[1] E-FAST Down-The-Drain model, 10th percentile 7Q10 stream dilution descriptor
[2] Annual production volume listed in Table 2.
[3] '—' indicates a negligible contribution, thus '0' was included in the model.

7. Fate of Substances Released into the Environment

We have shown that negligible amounts of the oxychloro and trihalomethane chemical species will reach aquatic environments (<<1 ug/L) (Table 3). The majority of environmental depletion mechanisms, such as adsorption and oxidation-reduction reactions, will have occurred during processing through POTWs. These chemical species distribution assumptions are in agreement with EPA's re-registration eligibility document for chlorite and chlorate species (EPA, 2006a and 2006b, respectively).

8. Environmental Effect of Released Substances

Any number of reduced chlorine species, possibly including hypochlorite, chlorine dioxide, and the chloride anion, as well as THM species, including bromodichloromethane, chlorodibromomethane and bromoform, may be released down-the-drain through POTWs into aquatic environments during intermittent use of the Sterilox hypochlorous acid solution. The available toxicity endpoint ranges for chlorinated and THM species are summarized in Tables 4 and 5, respectively. Effects on terrestrial organisms are not expected from these residual chemicals produced by retail outlet use of hypochlorous acid as evaluated by comparing the toxicity endpoints to surface water exposure concentrations in Table 3. Additionally, negligible uptake by organisms is expected due to low estimated bioconcentration factors for all chemical species (HSDB). This demonstrates that the use of hypochlorous acid solution for crisping fruits and vegetables at retail outlets will have a negligible effect on the environment.

Table 4. Summary of Environmental Toxicity Endpoints for Available Chlorine Chemical Species.

Species	Chemical species	LC50 or EC50 (mg/L)	NOEC (mg/L)
Freshwater fish	chlorite[1]	50.6-420	32-216
	chlorate[2]	7.3-1100	600-1000
Freshwater invertebrates	chlorite	0.027-1.4	0.003-0.4
	chlorate	2100-4100	52-1000
Estuarine/marine fish	chlorite	75	13.9
Estuarine/marine invertebrates	chlorite	0.576-21.4	14.3
Aquatic plants	chlorite	1.32	<0.62
	chlorate	3.1-444	50-3137

[1]EPA, 2006a, [2]EPA, 2006c

Table 5. Summary of Environmental Toxicity Endpoints for Available THM Chemical Species.

Species	Chemical species	LC50 or EC50 (mg/L)	NOEC (mg/L)
Freshwater fish	chlorodibromomethane[1]	53-250	--[2]
	bromoform[1]	29-33	--
Freshwater invertebrates	bromoform	46-56	--
Estuarine/marine fish	bromodichloromethane[1]	67.4	--
	chlorodibromomethane	33.5	--
	bromoform	7.1-52.3	--
Estuarine/marine invertebrates	bromoform	1-24,400[2]	--

[1] data listed as summarized in HSDB, http://toxnet.nlm.nih.gov/cgi-bin/sis/search2, accessed 9/2/2014
[2] '—' indicates that no data was listed for this endpoint
[3] only approximately 30% of original concentration was still present

Additionally, discharges of chlorine to ambient waters are regulated by the National Pollutant Discharge Elimination System (NPDES) in which discharge permit limits are established to meet state water quality standards. These standards reflect federal ambient water quality criteria (WQC) established for the protection of aquatic life and human health (EPA, 2013). The WQC include the Criteria Maximum Concentration (CMC) which is an estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed briefly without resulting in an unacceptable effect and the Criterion Continuous Concentration (CCC) which is an estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed indefinitely without resulting in an unacceptable effect. The CMC and CCC for chlorine in freshwater is 19 µg/L and 11 µg/L, respectively. The CMC and CCC for chlorine in saltwater is 13 µg/L and 7.5 µg/L, respectively. The surface water concentrations of the reduced sum chlorine species as estimated by the E-FAST™ Down-the-Drain screening model (Table 3) are below these concentrations and therefore meet water quality standards.

Given that the effluent of the proposed process will be discharged to POTWs where further treatment will occur, the environmental effects of the released substances will be insignificant. EPA has considered the environmental effects of using chlorine and has stated in their R.E.D FACTS, February 1999, Chlorine Gas:

> "In receiving waters from facilities using chlorine, if acute levels of concern are exceeded, a significant risk to aquatic organisms and endangered aquatic organisms can be expected. Levels of concern (equaling one-half of the EC_{50}) are 0.009 ppm for aquatic invertebrates, 0.023 ppm for freshwater fish, and 0.013 ppm for estuarine organisms. Levels of concern for endangered species (equaling one twentieth of the EC_{50}) are 0.85 ppb for aquatic invertebrates, 2.3 ppb for freshwater fish, and 1.3 ppb for estuarine invertebrates.
>
> Uses of chlorine that are **not** regulated under the NPDES permit program, including swimming pool, aquaria and indoor use patterns (fruit and vegetable rinsing and food processing), should produce only intermittent discharges of minimal concentration into lakes or streams, resulting in minimal environmental exposure."

Direct discharge of Sterilox hypochlorous acid solution to sensitive waterways needs to be avoided to avoid these potential environmental effects. Given the location and limited volumes involved in this application, such discharges are exceedingly unlikely.

9. Use of Resources and Energy

The proposed use will have essentially no negative effect on resources or energy associated with typical fresh fruit and vegetable hydration processes. The use of Sterilox hypochlorous acid solution will remove the need for a potable water rinse but this is expected to provide a minor reduction in overall water use. All other factors of a typical fresh fruit and vegetable hydration process would remain the same. Any energy savings associated with using industrially produced chlorine as opposed to generating Sterilox hypochlorous acid solution onsite will be lost in transportation and shipping costs given the requirements for shipping the hazardous concentrated materials.

10. Mitigation Measures

No adverse environmental impacts remain to be addressed so alternatives are not required.

11. Alternatives to the Proposed Action

No adverse environmental impacts remain to be addressed so alternatives are not required.

12. List of Preparers

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13. Certification

The undersigned official certifies that the information presented is true, accurate and complete to the best of her knowledge.

10-2-2014

Date

Wendy Hillwalker, Ph.D., Authorized Representative of PuriCore, Inc.

14. References

Anderson, B.; Hetrick, J. A.; Nelson, H. Environmental Fate and Ecological Risk Assessment for the Reregistration of Sodium Chlorate as an Active Ingredient in Terrestrial Food/Feed and Non-food/Non-feed Uses. Reregistration Case Number 4049; Docket ID No. EPA-HQ-OPP-2005-0507; U.S. Environmental Protection Agency, Office of Prevention, Pesticides and Toxic Substances: Washington, D.C., Jan 31, 2005.

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U.S. EPA. Office of Water. Current National Recommended Water Quality Criteria, http://www.epa.gov/waterscience/criteria/wqcriteria.html (accessed November 8, 2013).