Supporting Information for Low-Priority Substance D-Gluconic Acid, Sodium Salt (1:1) (CASRN 527-07-1) (Sodium Gluconate) *Final Designation*

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1. Introduction

The Lautenberg amendments to the Toxic Substances Control Act (TSCA) require EPA to designate chemical substances as either High-Priority Substances for risk evaluation, or Low-Priority Substances for which risk evaluations are not warranted at this time (section 6(b)(1)(B) and implementing regulations (40 CFR 702.3)). A high-priority substance is defined as a chemical substance that the Administrator concludes, without consideration of costs or other non-risk factors, may present an unreasonable risk of injury to health or the environment because of a potential hazard and a potential route of exposure under the conditions of use, including an unreasonable risk to potentially exposed or susceptible subpopulations identified as relevant by the Administrator. If the Administrator concludes, based on information sufficient to establish, without consideration of costs or other non-risk factors, that the high-priority standard is not met, then the substance must be designated as a low-priority substance. D-Gluconic acid, sodium salt (1:1), referenced as sodium gluconate for the remainder of this document, is one of the 40 chemical substances initiated for prioritization as referenced in a March 21, 2019 notice (84 FR 10491)[1] and one of the 20 proposed as low-priority substances in an August 15, 2019 notice (84 FR 41712).[2]

As described under EPA's regulations at 40 CFR 702.9[3] and pursuant to section 6(b)(1)(A) of the statute, EPA generally used reasonably available information to screen the chemical substance under its conditions of use against the following criteria and considerations:

- the hazard and exposure potential of the chemical substance;
- persistence and bioaccumulation;
- potentially exposed or susceptible subpopulations;
- storage near significant sources of drinking water;
- conditions of use or significant changes in the conditions of use of the chemical substance;
- the chemical substance's production volume or significant changes in production volume; and
- other risk-based criteria that EPA determines to be relevant to the designation of the chemical substance's priority.

Designation of a low-priority substance is not a finding that the chemical substance does not present an unreasonable risk, but rather that the chemical substance does not meet the statutory criteria for a high-priority substance and that a risk evaluation is not warranted at the time. As explained in the preamble to the Prioritization Rule, "low-priority substance designations give the public notice of chemical substances for which the hazard and/or exposure potential is anticipated to be low or nonexistent and provides some insight into which chemical substances are likely not to need additional evaluation and risk management under TSCA." 82 FR 33753 at 33755. EPA is not precluded from later revising the designation based on reasonably available information, if warranted. 40 CFR 702.13; 702.15.

[1] https://www.federalregister.gov/documents/2019/03/21/2019-05404/initiation-of-prioritization-under-the-toxic-substances-control-act-tsca

[2] https://www.federalregister.gov/documents/2019/08/15/2019-17558/proposed-low-priority-substance-designation-under-the-toxic-substances-control-act-tsca-notice-of

[3] The prioritization process is explained in the *Procedures for Prioritization of Chemicals for Risk Evaluation Under the Toxic Substances Control Act* (82 FR 33753).

The screening review is not a risk evaluation, but rather a review of reasonably available information on the chemical substance that relates to the specific criteria and considerations in TSCA section 6(b)(1)(A) and 40 CFR 702.9. This paper documents the results of the screening review which supports the final designation of sodium gluconate as a low-priority substance. EPA has also prepared a general response to comments and, as applicable, chemical-specific responses to comments.

This risk-based, screening-level review is organized as follows:

- *Section 1 (Introduction):* This section explains the requirements of the Lautenberg amendments to the Toxic Substances Control Act (TSCA) and implementing regulations – including the criteria and considerations -- pertinent to prioritization and designation of low-priority substances.

- *Section 2 (Background on the Low-Priority Substance):* This section includes information on attributes of the chemical substance, including its structure, and relates them to its functionality.

- *Section 3 (Physical-Chemical Properties):* This section includes a description of the physical-chemical properties of the chemical substance and explains how these properties lead to the chemical's fate, transport, and exposure potential.

- *Section 4 (Relevant Assessment History):* This section includes an overview of the outcomes of other governing entities' assessments of the chemical substance.

- *Section 5 (Conditions of Use):* This section presents the chemical substance's known, intended, and reasonably foreseen conditions of use under TSCA.

- *Section 6 (Hazard Characterization):* This section summarizes the reasonably available hazard information and screens the information against low-concern benchmarks.

- *Section 7 (Exposure Characterization):* This section includes a qualitative summary of potential exposures to the chemical substance.

- *Section 8 (Summary of Findings):* In this section, EPA presents information pertinent to prioritization against each of the seven statutory and regulatory criteria and considerations, and makes a conclusion based on that evidence.

- *Section 9 (Final Designation):* In this section, EPA presents the final designation for this chemical substance.

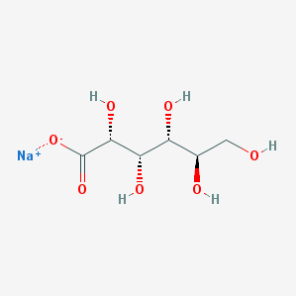
- *Appendix A (Conditions of Use Characterization):* This appendix contains a comprehensive list of TSCA and non-TSCA uses for the chemical substance from publicly available databases.

- *Appendix B (Hazard Characterization):* This appendix contains information on each of the studies used to support the hazard evaluation of the chemical substance.

- *Appendix C (Literature Search Outcomes):* This appendix includes literature search outcomes and rationales for studies that were identified in initial literature screening but were found to be off-topic or unacceptable for use in the screening-level review.

2. Background on Sodium Gluconate

Table 1 below provides the CAS number, synonyms, and other information on sodium gluconate.

Table 1: Sodium Gluconate at a Glance	
Chemical Name	Sodium Gluconate
CASRN	527-07-1
Synonyms	D-gluconate; D-gluconic acid; dextrone acid; gluconate; gluconic acid; magnerot; magnesium gluconate; maltonic acid; pentahydroxycaproic acid; D-gluconic acid, monosodium salt
Trade Name(s)	KLEEN MCT405; Glonsen
Molecular Formula	$C_6H_{11}NaO_7$
Representative Structure	

Sodium gluconate is a water-soluble organic sodium salt of gluconic acid. Gluconate salts are oxidation products of glucose and occur widely in nature. Sodium gluconate belongs to the hydroxycarboxylic acid salt family. The chemical structure of sodium gluconate consists of a six-carbon chain with five hydroxyl (-OH) groups terminating in a carboxylic acid group. The close proximity of the oxygen atoms within the chemical structure lends to its function as a highly efficient chelating agent. Chelating agents binding to positively charged metal ions in solution and prevent them from forming insoluble precipitates with other ions that may be present. Sodium gluconate functions as a chelating agent over a wide pH range. It is efficient in forming stable chelates with divalent and trivalent metal ions such as calcium, copper, iron, aluminum, and other metals, reducing the adverse effects these metals can have on systems. In addition, sodium gluconate acts as a humectant, which means that it attracts water and increases hydration in products. These properties contribute to the use of sodium gluconate as a high performing chelating agent, sequestrant, processing aid, humectant, and corrosion inhibitor in a variety of applications. Section 5 includes conditions of use for this chemical.

3. Physical-Chemical Properties

Table 2 lists physical-chemical properties for sodium gluconate. A chemical's physical-chemical properties provide a basis for understanding a chemical's behavior, including in the environment and in living organisms. These endpoints provide information generally needed to assess potential environmental release, exposure, and partitioning as well as insight into the potential for adverse toxicological effects.

Table 2: Physical-Chemical Properties for Sodium Gluconate

Source/ Model	Data Type	Endpoint	Endpoint value	Notes
Sigma-Aldrich 2019	Experimental	Physical state at room temperature (based on melting point)	Solid (170-175°C)	
ChemIDPlus 2019; OECD SIDS Initial Assessment Report, Gluconic acid and its derivatives (SIDS) (OECD SIDS 2004)	Experimental	Molecular weight	218 g/mol	
EPISuite v.4.11[4]	Calculated	Molecular weight	218.14 g/mol	
ChemIDPlus 2019	Experimental	Molar volume	190.5 cm^3/mol	
ChemIDPlus 2019	Experimental	Water solubility	590000 mg/L at 25°C	
OECD SIDS 2004	Experimental	Water solubility	590000 mg/L at 25°C; 600000 mg/L at 20 and 25°C	
EPISuite v.4.11	Estimated	Water solubility	$1.00x10^6$ mg/L	
ChemIDPlus 2019	Experimental	Water solubility	2.70 mol/L	
OECD SIDS 2004	Experimental	Water solubility	2.7 mol/L; 2.75 mol/L	
EPISuite v.4.11	Estimated	Log K_{ow}	-5.99	
EPISuite v.4.11	Estimated	Log K_{oa}	4.72	
EPISuite v.4.11	Estimated	Log K_{oc}	1 (MCI); -3.98 (K_{ow})	
EPISuite v.4.11	Estimated	Vapor pressure	<7.23E-18 mm Hg	
EPISuite v.4.11	Estimated	Henry's Law	4.76E-13 atm-m^3/mol	
EPISuite v.4.11	Estimated	Volatilization	$7.57x10^7$ days (river) $8.26x10^8$ days (lake)	

[4] EPI Suite Physical Property Inputs – Water solubility= 590000 mg/L, SMILES: [Na]OC(=O)C(O)C(O)C(O)C(O)C(O)

Table 2: Physical-Chemical Properties for Sodium Gluconate				
Source/ Model	**Data Type**	**Endpoint**	**Endpoint value**	**Notes**
EPISuite v.4.11	Estimated	Photolysis (Indirect)	3.37 hours ($T_{1/2}$)	• OH rate constant 3.81E-11 cm^3/molecules-second (12-hour day; 1.5E6 OH/cm^3) No ozone reaction estimation was available
EPISuite v.4.11	Estimated	Hydrolysis	Rate constants cannot be estimated	
EPISuite v.4.11	Estimated	Biodegradation potential	Ready prediction: Yes	
EPISuite v.4.11	Estimated	Wastewater treatment plant removal	93.5% Total Removal (93.2% biodegradation, 0.3% sludge, 0% air)	Input parameters: BIOP = 4, BioA = 1 and BioS = 1 based on 89% ThOD in 28 days
EPISuite v.4.11	Estimated	BAF	0.89	
EPISuite v.4.11	Estimated	BCF	3.16	

EPA's Sustainable Futures/P2 Framework Manual[5] was used to interpret the physical-chemical properties provided in Table 2. Based on its reported physical form and measured melting point, sodium gluconate is a solid under ambient conditions (Sigma Aldrich, 2019). In the solid form, sodium gluconate has the potential for exposure via direct dermal contact with the substance, through ingestion, and through inhalation of dust particles if they are generated. Since it is a salt, sodium gluconate is expected to be non-volatile at ambient temperatures (U.S. EPA, 2019). Based on measured solubility data (ChemIDPlus, 2018; SIDS, 2004), sodium gluconate is considered water soluble, indicating the potential for this substance to dissolve in water and form an aqueous solution. The estimated Henry's Law constant (U.S. EPA, 2019) indicates volatilization from water and aqueous solutions is not expected to occur. Therefore, exposure under ambient conditions via inhalation of vapors is expected to be minimal. Water soluble substances have an increased potential for absorption through the lungs; therefore, if exposed to the chemical in dust form, absorption through the lungs is likely. Oral exposure to this chemical could result in absorption through the gastrointestinal tract based on experimental evidence (discussed in Section 6.1.1). However, based on its estimated log K_{ow} (U.S. EPA, 2019), sodium gluconate is unlikely to cross lipid membranes and sequester in fatty tissues, as confirmed by its estimated bioconcentration factor (BCF) and bioaccumulation factor (BAF) (U.S. EPA, 2019). The estimated log K_{oc} indicates this substance is unlikely to adsorb to sediment or soil particles (U.S. EPA, 2019). Based on the log K_{oc} and water solubility, sodium gluconate is expected to be highly mobile in soils, increasing its potential for leaching into, and transport in, groundwater, including well water. Sodium gluconate is expected to have low persistence. Experimental data demonstrate sodium gluconate is aerobically readily biodegradable (discussed further in Section 6.3.1), and analog data indicate it is ultimately degradable anaerobically (discussed further in Section 6.3.1), meaning that if it were to enter groundwater, it is likely to be broken down into carbon dioxide and water.

3.1 References

ChemIDPlus (2019). Retrieved from https://chem.nlm.nih.gov/chemidplus/rn/527-07-1

OECD. (2004). OECD SIDS initial assessment report: gluconic acid and its derivatives.

Sigma-Aldrich. (2019). Sodium gluconate. Retrieved from https://www.sigmaaldrich.com/catalog/product/sial/s2054?lang=en&region=US

U.S. EPA. (2019). Estimation Programs Interface Suite, v 4.11. United States Environmental Protection Agency, Washington, DC, USA

[5] https://www.epa.gov/sites/production/files/2015-05/documents/05.pdf

4. Relevant Assessment History

EPA assessed the toxicological profile of sodium gluconate and added the chemical to the Safer Choice Program's Safer Chemical Ingredients List (SCIL) in September 2012 under the functional classes of chelating agents and processing aids and additives. The SCIL[6] is a continuously updated list of chemicals that meet low-concern Safer Choice criteria.[7]

EPA also reviewed international assessments of sodium gluconate. EPA identified assessments by the Organisation for Economic Co-operation and Development (OECD) and Australia's, Canada's and Germany's government agencies.

The OECD Screening Information Datasets (SIDS) Initial Assessment Meeting (SIAM) discussed the SIDS Initial Assessment Report (SIAR) on gluconic acid and its derivatives, including sodium gluconate, in April 2004. The SIAM determined this chemical to be "low priority for further work" for human health and the environment.[8]

The Australian Government's Department of Health National Industrial Chemicals Notification and Assessment Scheme (NICNAS) determined sodium gluconate to not pose an unreasonable risk to the health of workers and public health on the basis of their Tier I Inventory Multi-tiered Assessment and Prioritisation (IMAP) assessment.[9]

The Canadian Government, through an assessment of toxicity and exposure as part of its categorization of the Domestic Substance List, found that sodium gluconate did not meet its criteria for further attention.[10]

The German Environment Agency (UBA) designated sodium gluconate as "low hazard to waters" in August 2017 based on an assessment of ecotoxicity and environmental fate.[11]

[6] https://www.epa.gov/saferchoice/safer-ingredients
[7] https://www.epa.gov/sites/production/files/2013-12/documents/dfe_master_criteria_safer_ingredients_v2_1.pdf
[8] https://hpvchemicals.oecd.org/UI/handler.axd?id=b94cc5f7-de5c-4417-b6c2-f1eb4ffcdb72
[9] https://www.nicnas.gov.au/chemical-information/imap-assessments/imap-assessments/human-health-assessments
[10] https://canadachemicals.oecd.org/ChemicalDetails.aspx?ChemicalID=2FA737EA-C02D-4821-A170-C059BE351E32
[11] https://webrigoletto.uba.de/rigoletto/public/searchDetail.do?kennummer=5223

5. Conditions of Use

Per TSCA section 3(4), the term "conditions of use" means the circumstances, as determined by the Administrator, under which a chemical substance is intended, known, or reasonably foreseen to be manufactured, processed, distributed in commerce, used, or disposed of. EPA assembled information on all uses of sodium gluconate (Appendix A) to inform which uses would be determined conditions of use.[12] One source of information that EPA used to help determine conditions of use is 2016 Chemical Data Reporting (CDR). The CDR rule (previously known as the Inventory Update Rule, or IUR), under TSCA section 8, requires manufacturers (including importers) to report information on the chemical substances they produce domestically or import into the U.S., generally above a reporting threshold of 25,000 lb. per site per year. CDR includes information on the manufacturing, processing, and use of chemical substances with information dating to the mid-1980s. CDR may not provide information on other life-cycle phases such as the chemical substance's end-of-life after use in products (i.e., disposal).

According to CDR, sodium gluconate is manufactured domestically and imported. Based on CDR reporting, it is used in processing (incorporation into formulation, mixture or reaction) for use as a raw material in internal blending of construction materials; soap, cleaning compound, and toilet preparation manufacturing; plating agents and surface treating agents. Sodium gluconate is used in a variety of industrial, commercial, and consumer uses, such as an inert ingredient in pesticides and hard surface cleaners and deodorizers, among others. Based on the known manufacturing, processing, and uses of this chemical substance, EPA assumes distribution in commerce. According to CDR, 29 facilities reported that sodium gluconate was not recycled (e.g., not recycled, remanufactured, reprocessed, or reused). Two facilities reported recycling information as confidential business information (CBI), and one facility withheld this information. No information on disposal is found in CDR or through EPA's Toxics Release Inventory (TRI) Program[13] because sodium gluconate is not a TRI-reportable chemical. Although reasonably available information did not specify additional types of disposal, for purposes of this prioritization designation, EPA assumed end-of-life pathways that include releases to air, wastewater, surface water, and land via solid and liquid waste based on the conditions of use (e.g., incineration, landfill).

To supplement CDR, EPA conducted research through the publicly available databases listed in Appendix A (Table A.2) and performed additional internet searches to clarify conditions of use or find additional occupational[14] and consumer uses. This research improved the Agency's understanding of the conditions of use for sodium gluconate. Although EPA identified uses of sodium gluconate in personal care products, the screening review covered TSCA conditions of use for the chemical substance and personal care products were not considered in EPA's assessment. Exclusions to TSCA's regulatory scope regarding "chemical substance" can be found at TSCA section 3(2). Table 3 lists the conditions of use for sodium gluconate considered for chemical substance prioritization, per TSCA section 3(4). Table 3 reflects the TSCA uses determined as conditions of use listed in Table A.3 (Appendix A).

[12] The prioritization process, including the definition of conditions of use, is explained in the *Procedures for Prioritization of Chemicals for Risk Evaluation Under the Toxic Substances Control Act* (82 FR 33753).

[13] https://www.epa.gov/toxics-release-inventory-tri-program

[14] Occupational uses include industrial and/or commercial uses

Table 3: Conditions of Use for Sodium Gluconate			
Life Cycle Stage	**Category**	**Subcategory of Use**	**Source**
Manufacturing	Domestic manufacture	Domestic manufacture	EPA (2017b)
	Import	Import	EPA (2017b)
Processing	Processing- incorporation into formulation, mixture or reaction	Agricultural chemicals (non-pesticidal)- pesticide, fertilizer, and other agricultural chemical manufacturing;[15] Utilities	EPA (2017b); Sherlock (2019)
		Plasticizers- nonmetallic mineral product manufacturing (includes clay, glass, cement, concrete, lime, gypsum, and other nonmetallic mineral product manufacturing; construction	
		Plating agents and surface treating agents- fabricated metal product manufacturing	
		Fertilizer-pesticide, fertilizer, and other agricultural chemical manufacturing	
		Surface active agents- soap, cleaning compound, and toilet preparation manufacturing	
		Processing aids not otherwise listed- soap, cleaning compound, and toilet preparation manufacturing); nonmetallic mineral product manufacturing (includes clay, glass, cement, concrete, lime, gypsum, and other nonmetallic mineral product manufacturing; food, beverage, and tobacco product manufacturing; all other chemical product and preparation manufacturing; fabricated metal product manufacturing; nonmetallic mineral product manufacturing (includes clay, glass, cement, concrete, lime, gypsum, and other nonmetallic mineral product manufacturing; oil and gas drilling, extraction, and support activities	
		Corrosion inhibitors and anti-scaling agents- food, beverage, and tobacco product manufacturing; All other basic inorganic chemical manufacturing	
		Powdered vat cleaner, aluminum Cleaner, glass Cleaner, etc.- soap, cleaning compound, and toilet preparation manufacturing	
		Laboratory chemicals- all other chemical product and preparation manufacturing	
		Chelating agent- soap, cleaning compound, and toilet preparation manufacturing	
		Chemical distribution- wholesale and retail trade	
		Solvents (for cleaning and degreasing)- soap, cleaning compound, and toilet preparation manufacturing	
	Processing- incorporation into an article	Solvents (which become part of product formulation or mixture)- soap, cleaning compound, and toilet preparation manufacturing	
		Plasticizers- all other chemical product and preparation manufacturing	
		Functional fluids (open systems)- fabricated metal product manufacturing	

Table 3: Conditions of Use for Sodium Gluconate			
Life Cycle Stage	**Category**	**Subcategory of Use**	**Source**
		Not known or reasonably ascertainable (NKRA) - wholesale and retail trade	
	Not known or reasonably ascertainable (NKRA)	Wholesale and retail trade; NKRA	
	Wood products manufacturing	Furniture manufacturing	SPIN (2018)
	Machinery manufacturing		GoodGuide (2011); SPIN (2018)
	Transportation equipment manufacturing		SPIN (2018)
	Metal manufacturing		SPIN (2018)
	Paper manufacturing	Manufacture of pulp, paper and paper products	SPIN (2018)
	Recycling	Recycling	EPA (2017b)[16]
Distribution	Distribution	Distribution	EPA (2017b)
Industrial uses	Non-incorporative use	Plating agents and surface treating agents- paint and coating manufacturing	EPA (2017b); Synapse Information Resources, I. (n.d.); CPCat (2019); SPIN (2018); Hydrite Chemical (2018)
		Processing aids not otherwise listed- fabricated metal product manufacturing	EPA (2017b)
	Crop and animal production, hunting, fishing, and aquaculture		SPIN (2018)
	Food and beverage service activities	Oven cleaner	SPIN (2018); Diversey Inc. (2017)
	Metal surface treatment		Hydrite Chemical (2018); SPIN (2018)

[15] EPA assumes use in agricultural chemical manufacturing but not as an ingredient in a pesticidal product.

[16] In the 2016 CDR, 29 facilities reported that sodium gluconate was not recycled (e.g., not recycled, remanufactured, reprocessed, or reused). Two facilities reported recycling information as CBI, and one facility withheld this information (EPA 2017b).

Table 3: Conditions of Use for Sodium Gluconate			
Life Cycle Stage	**Category**	**Subcategory of Use**	**Source**
	Other	Sewage treatment, printing and reproduction of recorded media, electroplating	SPIN (2018), PMP (2014); Kirk-Othmer (2004)
Commercial uses	Anti-freeze and de-icing products		EPA (2017b)
	Chemical distribution		EPA (2017b)
	Industrial cleaner		EPA (2017b)
	Paints and coatings		EPA (2017b)
	Garbage disposal cleaner		DeLima Associates (2016)
	Kitchen cleaner and degreaser		DeLima Associates (2014a); CPCat (2019)
Industrial/commercial/ consumer uses	Food-contact solutions	Antimicrobial formulations approved for food-contact surface sanitizing solutions, cleaning agents for glass bottles, food-contact sanitizing solutions and as a sequestrant and chelating agent in bottle washing.	Synapse Information Resources, I. (n.d.); EPA (2018); NLM (2018); Hydrite Chemical (2018)
	Multipurpose hard surface cleaner and deodorizer		DeLima Associates (2013b)
Commercial/consumer	Agricultural products (non-pesticidal)		EPA (2017b)
	Building/construction materials not covered elsewhere		EPA (2017b)
	Cleaning and furnishing care products		EPA (2017b)
	Electrical and electronic products		EPA (2017b)
	Laundry and dishwashing products		EPA (2017b)
	Metal products not covered elsewhere		EPA (2017b)
	Plastic and rubber products not covered elsewhere		EPA (2017b)

Table 3: Conditions of Use for Sodium Gluconate			
Life Cycle Stage	**Category**	**Subcategory of Use**	**Source**
	Used in products which are used as cleaners in plating processes, as paint strippers, used as cleaners used in products for a variety of applications for surface treatments		EPA (2017b); Synapse Information Resources, I. (n.d.); GoodGuide (2011); SPIN (2018); Kirk-Othmer (2015)
	Water treatment products	Including water and process technology membrane cleaners, water treatment softeners and calcium removers	EPA (2017b); GE Betz Inc. (2010); CPCat (2019); SPIN (2018); Hydrite Chemical (2018)
Consumer	Household cleaners	All-purpose cleaner, hard surface cleaners, bathroom cleaners, carpet cleaner, coffeemaker cleaner, garbage disposal cleaner, glass cleaner, outdoor furniture cleaner, toilet bowl cleaner other cleaning and furnishing care products.	DeLima Associates (2015a); GoodGuide (2011); CPCat (2019); ACI (2018), DeLima Associates (2017a); Hillyard Industries (2012), DeLima Associates (2016); DeLima Associates (2018); GoodGuide (2011), DeLima Associates (2013a); DeLima Associates (2015b)
	Automotive care products	Automotive body polish and cleaners, radiator flush and cleaner	GoodGuide (2011); DeLima Associates (2017b); Delima Associates (2014b)

Table 3: Conditions of Use for Sodium Gluconate			
Life Cycle Stage	**Category**	**Subcategory of Use**	**Source**
Unknown		Chelating agent and sequestrant- inks and dyes, photo-chemicals, paper products	Synapse Information Resources, I. (n.d.), SPIN (2018); Synapse Information Resources (n.d.)
		Complexing agent	SPIN (2018)
		Adhesives and sealants	CPCat (2019); SPIN (2018)
		Stabilizer	SPIN (2018)
		Surfactant	CPCat (2019); Kim et al. (2016); SPIN (2018)
		Textiles	Synapse Information Resources (n.d.); NLM (2018a); SPIN (2018); Hydrite Chemical (2018)
Disposal	Releases to air, wastewater, solid and liquid wastes.		Though not explicitly identified, releases from disposal were assumed to be reasonably foreseen[17]

[17] See Section 5 for a discussion on why releases were assumed to be reasonably foreseen for purposes of this prioritization designation.

6. Human Characterization

EPA reviewed primary literature and other data sources to identify reasonably available information. This literature review approach[18] is tailored to capture the reasonably available information associated with low-hazard chemicals. EPA also used this process to verify the reasonably available information for reliability, completeness, and consistency. EPA reviewed the reasonably available information to identify relevant, quality studies to evaluate the hazard potential for sodium gluconate against the endpoints listed below. EPA's New Chemicals Program has used these endpoints for decades to evaluate chemical substances under TSCA[19] and EPA toxicologists rely on these endpoints as key indicators of potential human health and environmental effects. These endpoints also align with internationally accepted hazard characterization criteria, such as the Globally Harmonized System of Classification and Labelling of Chemicals[20] as noted above in Section 4 and form the basis of the comparative hazard assessment of chemicals.

Human health endpoints evaluated: Acute mammalian toxicity, repeated dose toxicity, carcinogenicity, mutagenicity/genotoxicity, reproductive and developmental toxicity, neurotoxicity, skin sensitization, respiratory sensitization, immunotoxicity and eye and skin irritation.

Environmental fate and effects endpoints evaluated: Aquatic toxicity, environmental persistence, and bioaccumulation.

The low-concern criteria used to evaluate both human health and environmental fate and effects are included in Table 4 below.

Table 4: Low concern Criteria for Human Health and Environmental Fate and Effects

Human Health				
Acute Mammalian Toxicity[21]	**Very High**	**High**	**Moderate**	**Low**
Oral LD50 (mg/kg)	≤ 50	> 50 – 300	> 300 - 2000	> 2000
Dermal LD50 (mg/kg)	≤ 200	> 200 – 1000	> 1000 - 2000	> 2000
Inhalation LC50 (vapor/gas) (mg/L)	≤ 2	> 2 – 10	> 10 - 20	> 20
Inhalation LC50 (dust/mist/fume) (mg/L)	≤ 0.5	> 0.5 - 1.0	> 1.0 - 5	> 5

[18] Discussed in the document "Approach Document for Screening Hazard Information for Low-Priority Substances Under TSCA," which can be found at https://www.regulations.gov/document?D=EPA-HQ-OPPT-2019-0450-0002.

[19] https://www.epa.gov/sustainable-futures/sustainable-futures-p2-framework-manual

[20] https://www.unece.org/fileadmin/DAM/trans/danger/publi/ghs/ghs_rev07/English/ST_SG_AC10_30_Rev7e.pdf

[21] Values derived from GHS criteria (*Chapter 3.1: Acute Toxicity.* 2009, United Nations).

Table 4: Low concern Criteria for Human Health and Environmental Fate and Effects				
Repeated Dose Toxicity, Neurotoxicity, and Immunotoxicity (90-day study)[22]		**High**	**Moderate**	**Low**
Oral (mg/kg-bw/day)		< 10	10 - 100	> 100
Dermal (mg/kg-bw/day)		< 20	20 - 200	> 200
Inhalation (vapor/gas) (mg/L/6h/day)		< 0.2	0.2 - 1.0	> 1.0
Inhalation (dust/mist/fume) (mg/L/6h/day)		< 0.02	0.02 - 0.2	> 0.2
Reproductive and Developmental Toxicity[23]		**High**	**Moderate**	**Low**
Oral (mg/kg/day)		< 50	50 - 250	> 250
Dermal (mg/kg/day)		< 100	100 - 500	> 500
Inhalation (vapor, gas, mg/L/day)		< 1	1 - 2.5	> 2.5
Inhalation (dust/mist/fume, mg/L/day)		< 0.1	0.1 - 0.5	> 0.5
Mutagenicity/ Genotoxicity[24]	**Very High**	**High**	**Moderate**	**Low**
Germ cell mutagenicity	GHS Category 1A or 1B: Substances known to induce heritable mutations or to be regarded as if they induce heritable mutations in the germ cells of humans.	GHS Category 2: Substances which cause concern for humans owing to the possibility that they may induce heritable mutations in the germ cells of humans.	Evidence of mutagenicity support by positive results *in vitro* OR *in vivo* somatic cells of humans or animals	Negative for chromosomal aberrations and gene mutations, or no structural alerts.
Mutagenicity and Genotoxicity in Somatic Cells		OR Evidence of mutagenicity supported by positive results in *in vitro* AND *in vivo* somatic cells and/or germ cells of humans or animals.		

[22] Values from GHS criteria for Specific Target Organ Toxicity Repeated Exposure (*Chapter 3.9: Specific Target Organ Toxicity Repeated* Exposure. 2009, United Nations).

[23] Values derived from the US EPA's Office of Pollution Prevention & Toxics criteria for HPV chemical categorizations (*Methodology for Risk-Based Prioritization Under ChAMP*), and the EU REACH criteria for Annex IV (2007).

[24] From GHS criteria (*Chapter 3.5: Germ Cells Mutagenicity.* 2009, United Nations) and supplemented with considerations for mutagenicity and genotoxicity in cells other than germs cells.

Table 4: Low concern Criteria for Human Health and Environmental Fate and Effects				
Carcinogenicity[25]	**Very High**	**High**	**Moderate**	**Low**
	Known or presumed human carcinogen (GHS Category 1A and 1B)	Suspected human carcinogen (GHS Category 2)	Limited or marginal evidence of carcinogenicity in animals (and inadequate[26] evidence in humans)	Negative studies or robust mechanism-based SAR
Sensitization[27]		**High**	**Moderate**	**Low**
Skin sensitization		High frequency of sensitization in humans and/or high potency in animals (GHS Category 1A)	Low to moderate frequency of sensitization in human and/or low to moderate potency in animals (GHS Category 1B)	Adequate data available and not GHS Category 1A or 1B
Respiratory sensitization		Occurrence in humans or evidence of sensitization in humans based on animal or other tests (equivalent to GHS Category 1A or 1B)	Limited evidence including the presence of structural alerts	Adequate data available indicating lack of respiratory sensitization
Irritation/ Corrosivity[28]	**Very High**	**High**	**Moderate**	**Low**
Eye Irritation/ Corrosivity	Irritation persists for >21 days or corrosive	Clearing in 8-21 days, severely irritating	Clearing in 7 days or less, moderately irritating	Clearing in less than 24 hours, mildly irritating
Skin Irritation/ Corrosivity	Corrosive	Severe irritation at 72 hours	Moderate irritation at 72 hours	Mild or slight irritation at 72 hours

[25] Criteria mirror classification approach used by the IARC (*Preamble to the IARC Monographs: B. Scientific Review and Evaluation: 6. Evaluation and rationale.* 2006*)* and incorporate GHS classification scheme (*Chapter 3.6: Carcinogenicity.* 2009, United Nations).

[26] EPA's approach to determining the adequacy of information is discussed in the document "Approach Document for Screening Hazard Information for Low-Priority Substances Under TSCA", also released at proposal.

[27] Incorporates GHS criteria (*Chapter 3.4: Respiratory or Skin Sensitization.* 2009, United Nations).

[28] Criteria derived from the Office of Pesticide Programs Acute Toxicity Categories (US EPA. *Label Review Manual.* 2010).

Table 4: Low concern Criteria for Human Health and Environmental Fate and Effects			
Environmental Fate and Effects			
Acute Aquatic Toxicity Value (L/E/IC50)[29]	**Chronic Aquatic Toxicity Value (L/E/IC50)**[29]	**Persistence (Measured in terms of level of biodegradation)**[30]	**Bioaccumulation Potential**[31]
May be low concern if ≤10 ppm…	…and ≤1 ppm…	…and the chemical meets the 10-day window as measured in a ready biodegradation test…	…and BCF/BAF < 1000.
Low concern if >10 ppm and <100 ppm…	…and >1 ppm and <10 ppm…	…and the chemical reaches the pass level within 28 days as measured in a ready biodegradation test	
Low concern if ≥100 ppm…	…and ≥ 10 ppm…	… and the chemical has a half-life < 60 days…	

6.1 Human Health Hazard

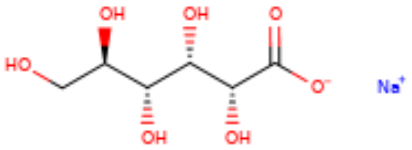
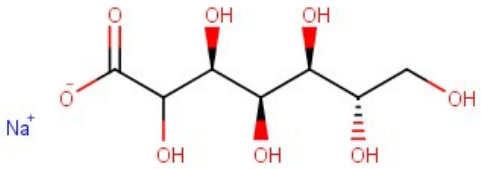
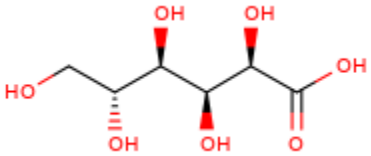
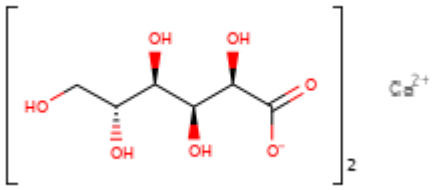
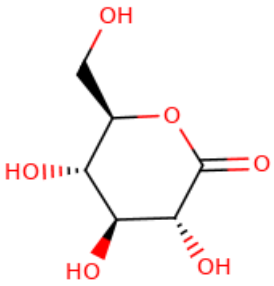
Below is a summary of the reasonably available information that EPA included in the hazard evaluation of sodium gluconate. In many cases, EPA used analogous chemicals to make findings for a given endpoint. Where this is the case, use of the analog is explained. If the chemical studied is not named, the study is for sodium gluconate. Appendix B contains more information on each study.

Sodium gluconate is the sodium salt of D-gluconic acid. D-gluconic acid is a 6-carbon aldonic acid (oxidized sugar) derived from glucose. EPA used best professional judgement to select analogs to sodium gluconate based on similarity in structure, physical-chemical properties and functionality, with the assumption that these chemicals will have similar environmental transport and persistence characteristics, and bioavailability and toxicity profiles. All analogs are aldonic acids containing 5-7 carbon atoms, or their corresponding salts or esters. Sodium glucoheptonate is used as an analog and has a chain length of 7 carbons. Analogs also include the free acid D-gluconic acid and two additional salts. Like the sodium salt, the potassium and calcium salts are expected to readily dissociate under environmentally and biologically relevant conditions to release gluconic acid and/or gluconate anion, depending on the ambient pH. As a result, the environmental and health effects of these compounds are expected to be very similar to those of sodium gluconate. In addition, glucono-delta-lactone is a cyclic ester (lactone) of D-gluconic acid. The lactone and acid are interconverted to each other and exist in equilibrium in aqueous solution. Based on these factors, the environmental and toxicological effects of glucono-delta-lactone and D-gluconic acid are expected to be very similar to each other and to sodium gluconate.

[29] Derived from GHS criteria (*Chapter 4.1: Hazards to the Aquatic Environment.* 2009, United Nations), EPA OPPT New Chemicals Program (*Pollution Prevention (P2) Framework,* 2005*)* and OPPT's criteria for HPV chemical categorization (*Methodology for Risk Based Prioritization Under ChAMP. 2009).*

[30] Derived from OPPT's New Chemicals Program and DfE Master Criteria, and reflects OPPT policy on PBTs (*Design for the Environment Program Master Criteria for Safer Chemicals, 2010)*.

[31] Derived from OPPT's New Chemicals Program and Arnot & Gobas (2006) [Arnot, J.A. and F.A. Gobas, *A review of bioconcentration factor (BCF) and bioaccumulation factor (BAF) assessments for organic chemicals* in aquatic organisms. Environmental Reviews, 2006. 14: p. 257-297.]

Table 5: Sodium Gluconate and Analog Structures		
CASRN	**Name**	**Structure**
527-07-1	Sodium gluconate	
31138-65-5	Sodium glucoheptonate	
526-95-4	D-Gluconic acid	
299-28-5	Calcium gluconate	
90-80-2	Glucono-delta-lactone	

6.1.1 Absorption, Distribution, Metabolism, and Excretion

To review absorption, distribution, metabolism and excretion (ADME) endpoints without adequate quality[32] experimental data, EPA used widely accepted new approach methodologies (NAMs), such

[32] This process is further discussed in the document "Approach Document for Screening Hazard Information for Low-Priority Substances under TSCA."

as modeling and estimation tools often based on physical-chemical properties, which provided information sufficient to fill these endpoints.

Absorption

Sodium gluconate's low vapor pressure and solid state suggests limited potential for inhalation exposure from volatilization under environmental conditions and if incorporated in a water or aqueous solution based on its low Henry's Law constant (Section 3). If sodium gluconate is present as dust and inhaled, absorption from the lungs is likely based on its water solubility (Section 3).

The potential for dermal absorption is predicted to be low when in the neat form and in a water-based product formulation based on its log K_{ow} (Section 3).

An oral gavage study on rats provided evidence that sodium gluconate is likely to be absorbed through the intestine. When rats were dosed with U-^{14}C labeled sodium gluconate via oral gavage, the chemical was present in blood and the intestine within 5 hours of exposure (discussed further in Excretion), indicating this chemical is absorbed through the gastrointestinal tract (Reported to the ECHA database, 1979a, b). Based on these results, sodium gluconate will be absorbed through the intestine.

Distribution

Sodium gluconate is considered water soluble (Section 3) and is likely to be distributed mainly in aqueous compartments in an organism. This prediction is supported by experimental evidence. Following an oral gavage dose of U-^{14}C labeled sodium-D-gluconate in rats, radioactivity was measured in blood, feces and the intestine within 5 hours of exposure, indicating rapid absorption and distribution (discussed further in Excretion) (Reported to the ECHA database, 1979a, b).

Metabolism

Gluconate is a metabolite of glucose oxidation (OECD, 2004). Because quality experimental data[32] on sodium gluconate metabolite formation were not reasonably available, the Quantitative Structure-Activity Relationship (QSAR) toolbox[33] was used to run the rat liver S9 metabolism simulator, the skin metabolism simulator, and the *in vivo* rat metabolism simulator. The predicted metabolites included various highly oxidized metabolites as well as D-gluconic acid and its derivatives, typically found in glucose metabolism pathways.

Excretion

To assess sodium gluconate's excretion pathways, EPA relied on experimental data. Rats dosed with sodium gluconate by oral gavage excreted 12.1% in the form of exhaled carbon dioxide, 19.7% remained in the whole body (excluding gastrointestinal tract), 44.9% was excreted through the intestine and feces, and 5% was excreted in urine (Reported to the ECHA database, 1979a, b). Based on this data, sodium gluconate will be primarily excreted through feces and exhaled breath.

6.1.2 Acute Toxicity

EPA assessed the potential for mammalian toxicity from acute exposure to sodium gluconate using the results of two oral rat studies and read-across from a dermal study on D-gluconic acid. A single

[33] https://www.oecd.org/chemicalsafety/risk-assessment/oecd-qsar-toolbox.htm

exposure to sodium gluconate via diet (OECD, 2004) resulted in no mortality at the highest dose tested, 2000 mg/kg. Similarly, rats exposed to sodium gluconate by oral gavage (JECFA, 1999) resulted in no mortality at the highest dose tested, 2000 mg/kg. Rats dermally exposed to D-gluconic acid for 24 hours displayed no adverse effects at the highest dose resulting in a NOAEL greater than 2000 mg/kg (Reported to the ECHA database, 2009a). These studies provide sufficient information to indicate low concern for mammalian toxicity from acute exposure with LD_{50}s above the low-concern criteria benchmark of 2000 mg/kg.

6.1.3 Repeated Dose Toxicity

EPA assessed the potential for mammalian toxicity from repeated exposure to sodium gluconate using experimental data. A 28-day study on rats exposed to sodium gluconate by oral gavage identified a no observed adverse effect level (NOAEL) of 500 mg/kg-day, with a lowest observed adverse effect level (LOAEL) of 1000 mg/kg-day based on increased relative kidney weight (OECD, 2004; JECFA, 1999). Another 28-day study on rats exposed to sodium gluconate in their diet noted effects on feed efficiency, water intake, urinary changes, and prothrombin times; however, these effects were not considered adverse effects by the study authors because they were neither significantly different from the effects observed in control animals dosed with sodium, nor displayed dose-dependent responses. The authors also noted increased relative kidney weights in males at the highest dose and females only at second highest dose; however, these effects were not considered adverse in this study because there was not a dose-response relationship. EPA determined the NOAEL to be 4100 mg/kg-day (OECD, 2004; JECFA, 1999). A 28-day study on beagle dogs exposed to sodium gluconate in their diet identified a NOAEL of 500 mg/kg-day with a LOAEL of 1000 mg/kg-day based on diarrhea and vomiting (OECD, 2004). These results provide sufficient information to indicate low concern for potential toxicity from repeated exposure because the identified NOAELs and LOAELs exceed the low-concern oral benchmark of 100 mg/kg-day for a 90-day repeated dose study (extrapolated to 300 mg/kg-day for a ~30-day study).

6.1.4 Reproductive and Developmental Toxicity

EPA assessed the potential for mammalian reproductive and developmental toxicity from sodium gluconate using read-across from sodium glucoheptonate.

An OECD Guideline 422 study exposed rats to sodium glucoheptonate by oral gavage beginning two weeks prior to mating and continued the exposure through gestation to lactation day 5 (for females). No adverse reproductive effects were noted at the highest dose, resulting in a NOAEL of 1000 mg/kg-day (Reported to the ECHA database, 2013a). The study also examined a subset of developmental endpoints, such as litter parameters and assessment of surface righting reflexes. No adverse effects were noted for these developmental endpoints.

EPA further examined the potential for developmental toxicity using data from glucono-delta-lactone. Oral gavage studies on several species, including mice (JECFA, 1986; Reported to the ECHA database, 1973b; Inc, 1973), hamsters (JECFA, 1986; Reported to the ECHA database, 1973c; Inc, 1973), rabbits (JECFA, 1986; Reported to the ECHA database, 1973d; Inc, 1973), and rats (JECFA, 1986; Reported to the ECHA database, 1973a; Inc, 1973) exposed to glucono-delta-lactone indicated no adverse effects at the highest dose tested in each study. For these studies, NOAELs range from 560 mg/kg-day to 780 mg/kg-day.

These results provide sufficient information to indicate low concern for reproductive and developmental toxicity by exceeding the oral benchmark of 250 mg/kg-day.

6.1.5 Genotoxicity

EPA assessed experimental data on genotoxicity as a potential indicator of genotoxic carcinogenicity. Two *in vitro* studies on bacteria indicated negative results for gene mutation by sodium gluconate with and without metabolic activation (OECD, 2004; Litton Bionetics, 1975). The bone marrow of mice exposed orally to sodium gluconate as either a single dose or repeated dose over four consecutive days was examined for evidence of chromosomal aberrations (OECD, 2004). The results from both the single and repeated dose exposures indicated sodium gluconate did not induce chromosomal aberrations and was considered non-genotoxic. These negative results provide sufficient information to indicate low concern for genotoxicity by sodium gluconate.

6.1.6 Carcinogenicity

Experimental data determined to be of adequate quality[34] on sodium gluconate or closely-related analogs were not reasonably available for the assessment of carcinogenicity potential. EPA used widely accepted new approach methodologies (NAMs), such as publicly available quantitative structure activity relationship (QSAR) models and structural alerts (SA) to assess carcinogenic potential for sodium gluconate, discussed further below. Sodium gluconate will dissociate into the gluconate anion and sodium salt in physiological conditions. To more accurately assess the carcinogenic potential, EPA focused on the gluconate form of the molecule (D-gluconic acid).

Structural alerts represent molecular functional groups or substructures that are known to be linked to the carcinogenic activity of chemicals. The most common structural alerts are those for electrophiles (either direct acting or following activation). Modulating factors that will impact the carcinogenic potential of a given electrophile will include its relative hardness or softness, its molecular flexibility or rigidity, and the balance between its reactivity and stability.[35] For this chemical, there is an absence of the types of reactive structural features that are present in genotoxic carcinogens. D-Gluconic acid and gluconate are not electrophiles. ISS profiler, a QSAR model,[36] identified aldehyde and dibutyl diesters as potential metabolite alerts; however, these metabolites are expected to be further transformed and excreted. Also, D-gluconic acid goes through multiple other detoxification pathways, including hydrolysis, sulfation and glucuronidation transformations that do not lead to an aldehyde or dibutyl diester metabolite (see Figure 1 (metabolic tree) in Metabolic Pathway Trees Supplemental Document[37]). With respect to the dibutyl diester metabolite alert, EPA determined that D-gluconic acid falls outside of the intended scope of the alert.[38]

[34] The literature search and review process to determine studies of adequate quality for inclusion in the screening review is further discussed in the document "The Approach Document for Screening Hazard Information for Low-Priority Substances under TSCA." https://www.regulations.gov/document?D=EPA-HQ-OPPT-2019-0450-0002

[35] "Fundamental and Guiding Principles for (Q)SAR Analysis of Chemical Carcinogens with Mechanistic Considerations: Series on Testing and Assessment, No. 229." 2015. Environment Directorate, Joint Meeting of the Chemicals Committee and the Working Party on Chemicals, Pesticides and Biotechnology.

[36] Carcinogenicity alerts by ISS 2.4 profiler as encoded in the QSAR Toolbox 4.3 (qsartoolbox.org). A summary of the results from these models is provided in Appendix B.

[37] The metabolic tree was generated using the in vivo rat metabolism simulator (v07.12) within TIMES V2.29.1.88.

[38] One of the metabolites of D-gluconic acid and its gluconate salts triggered the 'Phthalate (or butyl) diester and monoesters' structural alert for non-genotoxic carcinogenicity. This alert is characterized by 1) a structural definition which

Further, the Virtual models for property Evaluation of chemicals within a Global Architecture (VEGA) models'[39] results indicate D-gluconic acid has low potential to be carcinogenic or mutagenic with moderate reliability.

Gluconic acid is a multi-hydroxy acid that is likely to be metabolized through oxidation. Gluconic acid and its metabolites are endogenous to the body. Excess chemical is expected to be excreted from the body reducing concern for carcinogenicity.

Applying expert scientific judgement based on the reasonably available information and weight of the scientific evidence, EPA finds that sodium gluconate's endogenous nature, transformation profile, a lack of structural alerts in the parent chemical substance, and experimental genotoxicity results provide sufficient information to indicate that this chemical has low concern for carcinogenicity.

6.1.7 Neurotoxicity

EPA assessed neurotoxicity using read-across from two studies on rats exposed to calcium gluconate in drinking water. One study exposed male rats to calcium gluconate daily for 30 days and tested motor coordination, exploration, spontaneous locomotor activity and post-sacrifice brain and body weight (Godinho et al., 2014). No adverse effects were observed. Another study exposed male rats to calcium gluconate for three days and tested the rats based on open-field, social interactions, hole-board, and elevated plus-maze tests (Godinho et al., 2002). Post-sacrifice, blood and brain calcium levels were measured. An increase in motor and exploratory behavior was reported; however, parameters related to anxiety and social interactions were not affected and the evidence suggests that

identifies what structural patterns need to be matched by the target chemical of interest for this alert and 2) literature information.
This structural alert is simply defined as a chain of 4 carbons between 2 terminal carboxylate groups. Within this structural definition, two conditions were further specified 1) all 4 carbons in the butyl chain could not be in a ring and 2) the R group attached to the carboxylate group [-C(=O)-OR] could be any atom or group. There were no additional structural exclusion or inclusion rules specified. The gluconic acid metabolite met the structural definition in terms of having a chain of 4 carbons between 2 terminal carboxylates. Since the R group could be any atom or group, it did not appear that the gluconic acid metabolite could be excluded from the alert as R could also be a hydrogen, i.e. resulting in a terminal carboxylic acid. There is also nothing in the definition that stipulates that the 4 carbons between the terminal carboxylates cannot contain substituents other than hydrogen. This is relevant because the 4 carbons between the carboxylates in the gluconic acid metabolite do contain OH substituents.
The literature information for this structural alert provides a mechanistic basis underpinning the alert. In this case, the basis describes the role of peroxisome proliferator-activated receptor alpha (PPARa) as the mechanism by which phthalate (or butyl) esters can cause liver cancer in rodents. Prototypical substances found to cause liver cancer are notably di-(2-ethylhexyl) phthalate (DEHP) and di(2-isononyl) phthalte (DINP). Based on the information for this structural alert, it appears that this 'Phthalate (or butyl) diester and monoesters' structural alert is targeted towards phthalate (and butyl) esters and their transformation products, such as DEHP. DEHP is metabolized to its monoester (MEHP) and 2-ethylhexanol, both of which are PPARa activators. These metabolites are then further metabolized to its corresponding acid 2-ethylhexanoic acid (a weak activator of PPARa) or di-(2-ethylhexyl) adipate (DEHA) which also metabolizes to form 2-ethylhexanol. Therefore, it is apparent through DEHP as a prototypical example that this structural alert is intended to capture esters containing longer branched alkyl chains as part of their terminal group which would then be cleaved during enzymatic hydrolysis to result in a longer branched chain alcohol that could be PPARa activators. Based on the mechanistic justification for prototypical substances in the literature, it is reasonable to assume that the metabolite of the D-gluconic acids falls outside the intended scope of the alert as it does not follow the above metabolic pathways.

[39] There are four carcinogenicity models housed within the VEGA 1.1.4 software tool available from https://www.vegahub.eu. A summary of the results from these models is provided in Appendix B.

the motor-stimulating effect was due to high calcium levels. EPA did not consider these adverse effects. These results provide sufficient information to indicate sodium gluconate has low concern for neurotoxicity.

6.1.8 Skin Sensitization

EPA assessed the potential for sodium gluconate to cause skin sensitization based on read-across from D-gluconic acid and sodium glucoheptonate (Reported to the ECHA database, 2009d). An OECD Guideline 429 study in mice exposed to D-gluonic acid was negative for skin sensitization. The same guideline study was performed in mice exposed to sodium glucoheptonate and also resulted in negative findings for skin sensitization (Reported to the ECHA database, 2013b). These negative results indicate low concern for skin sensitization from sodium gluconate.

6.1.9 Respiratory Sensitization

Experimental data determined to be of adequate quality[40] on sodium gluconate or closely related analogs were not reasonably available for the assessment of respiratory sensitization potential. To model respiratory sensitization, EPA used NAMs, such as the QSAR Toolbox, version 4.2 models[41] for keratinocyte gene expression; protein binding potency h-CLAT; protein binding potency cysteine; protein binding potency lysine; and respiratory sensitization. No structural alerts were identified for sodium gluconate. The results from these NAMs and weight of the scientific evidence provide sufficient information to indicate low concern for respiratory sensitization.

6.1.10 Immunotoxicity

EPA reviewed the literature for immunotoxicity endpoints such as lymphoid organ weight, histopathology, and immune function. Specific endpoints included immune system function (e.g., T-cell dependent antibody response), immunophenotyping (e.g., changes in cell types), natural killer cell activity, host resistance assays, macrophage neutrophil function, and cell-mediated immunity assays. Experimental data determined to be of adequate quality[42] on sodium gluconate or closely related analogs were not reasonably available for the assessment of immunotoxicity potential.

Repeated dose testing is designed to be comprehensive in nature, and is intended to address a wide range of possible impacts, including, but not limited to immunotoxicity. The testing required to address repeated dose toxicity typically includes routine clinical observations, hematology and clinical biochemistry, body weight/food and water consumption, as well as both gross necropsy and histopathology involving organs and organ systems. For example, repeated dose studies can evaluate changes to the spleen or thymus, which with accompanying histological changes or changes in hematological parameters can indicate potential for immunological toxicity. Where immune system-related endpoints were measured in repeated dose studies, any adverse effects would be incorporated

[40] The literature search and review process to determine studies of adequate quality for inclusion in the screening review is further discussed in the document "Approach Document for Screening Hazard Information for Low-Priority Substances under TSCA." https://www.regulations.gov/document?D=EPA-HQ-OPPT-2019-0450-0002.

[41] The OECD QSAR Toolbox is one of EPA's listed new approach methodologies under TSCA 4(h)(2), available at https://www.epa.gov/sites/production/files/2019-12/documents/alternative_testing_nams_list_first_update_final.pdf

[42] The literature search and review process to determine studies of adequate quality for inclusion in the screening review is further discussed in the document "Approach Document for Screening Hazard Information for Low-Priority Substances under TSCA." https://www.regulations.gov/document?D=EPA-HQ-OPPT-2019-0450-0002.

into the lowest observed adverse effect level used against the low-concern benchmarks. Therefore, EPA relied on this information from repeated dose studies when it was reasonably available. For sodium gluconate, the included repeated dose studies did not report changes in lymphoid organ weights (thymus, spleen, lymph nodes), with accompanying histopathology, or hematological changes due to exposure to this chemical substance in mammals. These results provide sufficient information to indicate low concern for immunotoxicity potential from sodium gluconate.

6.1.11 Skin Irritation

EPA assessed dermal irritation effects using read-across from D-gluconic acid. Two studies in rabbits demonstrated D-gluconic acid was negative for dermal irritation (Reported to the ECHA database, 2009c; OECD, 2004). Using read-across from this analog, the negative results provide sufficient information to indicate low concern for skin irritation from sodium gluconate.

6.1.12 Eye Irritation

To assess potential for eye irritation, EPA used read-across from glucono-delta-lactone and D-gluconic acid. An *in vitro* bovine corneal opacity and permeability assay found glucono-delta-lactone to be a severe irritant (Gautheron et al., 1994). *In vivo* studies on D-gluconic acid reported moderate results for eye irritation. One *in vivo* study in rabbits indicated D-gluconic acid was mildly irritating to the eyes with all effects fully reversible in 72 hours (OECD, 2004), while another *in vivo* study in rabbits concluded D-gluconic acid was irritating with most effects reversed by the study's end at 72 hours (Reported to the ECHA database, 2009b). Slight chemosis and conjunctival redness remained in one test animal at 72 hours. While the *in vitro* study provided evidence of irritation, EPA weighed the outcome of the *in vivo* effects to determine that the reversible results indicate moderate concern for eye irritation from sodium gluconate. The weight of the scientific evidence for these results is discussed in Section 8.1.

6.1.13 Hazards to Potentially Exposed or Susceptible Subpopulations

The above information supports a low human health hazard finding for sodium gluconate based on low concern criteria. This finding includes considerations such as the potential for developmental toxicity, reproductive toxicity, and acute or repeated dose toxicity that may impact potentially exposed or susceptible subpopulations. Based on the hazard information discussed in Section 6, EPA did not identify populations with greater susceptibility to sodium gluconate.

6.2 Environmental Hazard

To review environmental hazard endpoints without adequate quality[32] experimental data, EPA used widely accepted new approach methodologies (NAMs), such as modeling and estimation tools often based on physical-chemical properties, which provided information sufficient to fill these endpoints and form the basis for designation. EPA assessed environmental hazard for sodium gluconate based on available acute experimental data and estimated chronic toxicity values using the Ecological Structure Active Relationships (ECOSAR) Predictive Model.[43] Appendix B contains a summary of the reasonably available environmental hazard data.

[43] https://www.epa.gov/tsca-screening-tools/ecological-structure-activity-relationships-ecosar-predictive-model

6.2.1 Acute Aquatic Toxicity

EPA assessed environmental hazard from acute exposures to sodium gluconate. No adverse effects were observed in aquatic invertebrates and aquatic vertebrates exposed to sodium gluconate at the highest doses tested (100 mg/L and 1000 mg/L, respectively), resulting in no effects expected at concentrations less than 100 mg/L for aquatic vertebrates (OECD, 2004; Reported to the ECHA database, 2002) and 1000 mg/L for invertebrates (OECD, 2004; Reported to the ECHA database, 2001a). Two studies evaluated the effects of acute exposures of sodium gluconate to algae. *S. subspicatus* exposed to sodium gluconate resulted in 70% biomass inhibition at 100 mg/L (Reported to the ECHA database, 2001b), while *S. capricornutum* exposed to sodium gluconate resulted in a no observed effect concentration (NOEC) of 560 mg/L based on growth rate (OECD, 2004). These results provide sufficient information to indicate sodium gluconate has low environmental hazard for aquatic vertebrates, aquatic invertebrates and algae, based on the low-concern criteria acute aquatic toxicity benchmark of 100 mg/L.

6.2.2 Chronic Aquatic Toxicity

Toxicity from chronic exposures were estimated by ECOSAR using the neutral organics chemical class to occur at 38,000 mg/L for aquatic vertebrates, 69,000 mg/L for aquatic invertebrates, and 300,000 mg/L for algae. These predicted toxicity values provide sufficient information to indicate sodium gluconate has low environmental hazard based on the low-concern criteria chronic aquatic toxicity benchmark of 10 mg/L.

6.3 Persistence and Bioaccumulation Potential

6.3.1 Persistence

EPA assessed environmental persistence for sodium gluconate. An experimental OECD Guideline 301D biodegradation study demonstrated this substance biodegraded by greater than 60 percent in 10 days, confirming it is aerobically readily biodegradable in a sludge inoculum (OECD, 2004). Further, this chemical anaerobically biodegrades completely after 35 days (OECD, 2004). No degradation products of concern were identified for this chemical substance. The available biodegradation results meet the low-concern benchmark by readily biodegrading within 28 days under aerobic conditions and provide sufficient information to indicate this chemical has low potential for persistence.

6.3.2 Bioaccumulation Potential

Based on the estimated bioaccumulation factor (BAF) value of 0.89 using the Estimation Programs Interface (EPI) Suite models,[44] EPA has sufficient information that sodium gluconate has low potential for bioaccumulation in the environment based on the low-concern benchmark of less than 1000.

[44] https://www.epa.gov/tsca-screening-tools/epi-suitetm-estimation-program-interface

7. Exposure Characterization

EPA considered reasonably available information on exposure for sodium gluconate. In general, there is limited information on exposure for low-hazard chemicals. EPA consulted sources of use information that include CDR database and other databases and public sources. Of these sources, EPA determined that the CDR database contained the primary source of information on the conditions of use for this exposure characterization. EPA used these other databases and public sources (described in Table A.2) only where they augmented information from the CDR database to inform intended, known, or reasonably foreseen uses.

As shown in Tables 3 and A.3, sodium gluconate is used as a processing aid for agricultural chemicals, detergent/degreasers, cleaning compound, and toilet preparation manufacturing, laboratory chemicals, and other applications, as well as in various industrial, commercial, and consumer uses. Non-TSCA uses, including those excluded under TSCA section 3(2), are beyond the scope of this assessment (See Table A.3).

Under the conditions of use identified in Table 3, EPA assessed the potential exposure to the following categories: the environment, the general population, and potentially exposed or susceptible subpopulations including workers and consumers.

7.1 Production Volume Information

Production volume information for sodium gluconate is based on an analysis of CDR data reported from 1986 to 2015.[45] The CDR database indicates that, for reporting year 2015, 24 companies manufactured or imported sodium gluconate at 32 sites. Since the early 2000s, production volume remained mostly in the 10,000,000 lbs. to 50,000,000 lbs. range with an increase in 2012 to the 50,000,000 lbs. to 100,000,000 lbs. range. Since 2015, production volume has remained in the 50,000,000 lbs. to 100,000,000 lbs range. While volume fluctuated throughout the 2000s, these fluctuations don't indicate a production volume trend.

7.2 Exposures to the Environment

EPA expects most exposures to the environment to occur during the manufacture, import, processing, and commercial and consumer use of sodium gluconate. Exposure is also possible from other uses, distribution and disposal. These activities could result in releases of sodium gluconate to media including surface water, landfills, and air.

EPA expects high levels of removal of sodium gluconate during wastewater treatment (either directly from the facility or indirectly via discharge to a municipal treatment facility or Publicly Owned Treatment Works (POTW), see Table 2). Further, sodium gluconate is expected to have low persistence (aerobic and anaerobic biodegradation are discussed in Section 6.3.1) and has the potential to be broken down in the environment into carbon dioxide and water. Therefore, any release of the chemical to surface water is expected to break down, reducing exposure to aquatic organisms in

[45] The CDR requires manufacturers (including importers) to report information on the chemical substances they produce domestically or import into the U.S above 25,000 lb. per site per year.

the water column, benthic organisms, and groundwater sources of drinking water, including well water.

If disposed of in a landfill, this chemical is expected to degrade under aerobic and anaerobic conditions (aerobic and anaerobic biodegradation are discussed in Section 6.3.1).

If incineration releases during manufacturing and processing occur, EPA expects significant degradation of sodium gluconate to the point that it will not be present in air.

7.3 Exposures to the General Population

EPA expects the general population is unlikely to be exposed to sodium gluconate from the environmental releases described above. The general population is unlikely to be exposed to sodium gluconate via inhalation of ambient air because sodium gluconate is a solid, has a low vapor pressure, and will break down if incinerated. If released into the air as dust particles, sodium gluconate will settle out and biodegrade. Sodium gluconate is also unlikely to be present in surface water because it will degrade (aerobic and anaerobic biodegradation are discussed in Section 6.3.1), reducing the potential for the general population to be exposed by oral ingestion or dermal exposure. Given the low bioconcentration and bioaccumulation potential of sodium gluconate, oral exposure to sodium gluconate via fish ingestion is unlikely.

7.4 Exposures to Potentially Exposed or Susceptible Subpopulations

EPA identified workers and consumers as a potentially exposed or susceptible subpopulation based on greater exposure to sodium gluconate than the general population during manufacturing, processing, distribution, use, or disposal. EPA also identified consumers as a population that may experience greater exposure to sodium gluconate than the general population through use of cleaning and furnishing care products, laundry and dishwashing products, and automotive care products, for example. EPA did not identify populations with greater susceptibility to sodium gluconate.

7.4.1 Exposures to Workers

Based on its reported physical form and measured melting point, sodium gluconate is a solid under ambient conditions. Based on sodium gluconate's conditions of use (Table 3), workers may be exposed to solids through direct dermal contact with the substance and inhalation of dust if it is generated. Sodium gluconate is a salt and therefore not expected to be a volatile substance, meaning workers are unlikely to be exposed through inhalation of vapors. Workers may be exposed to sodium gluconate in manufacturing, processing, distribution, industrial uses, and disposal.

7.4.2 Exposures to Consumers

Consumers could be exposed to sodium gluconate through the use of cleaning and furnishing care products, laundry and dishwashing products, automotive care products, or others as specified in Table 3. For all these uses, if dermal contact does occur, sodium gluconate is expected to be minimally absorbed through the skin. If the chemical is in an aerosol product and inhalation exposure occurs, sodium gluconate's absorption from the lungs is reasonably foreseen. Consumer exposure could also occur through inhalation or incidental ingestion of dust if using consumer products in a powdered form, such as powdered laundry and dishwashing products and automotive care products. EPA does not include intentional misuse, such as people drinking products containing this chemical, as part of

the known, intended or reasonably foreseen conditions of use that could lead to an exposure (82 FR 33726). Thus, oral exposures will be incidental (meaning inadvertent and low in volume). Sodium gluconate is expected to be metabolized and excreted, further reducing duration of exposure.

8. Summary of Findings

EPA has used reasonably available information on the following statutory and regulatory criteria and considerations to screen sodium gluconate against each of the priority designation considerations in 40 CFR 702.9(a), listed below and discussed individually in this section, under its conditions of use:

- the hazard and exposure potential of the chemical substance (See Sections 6 and 7);
- persistence and bioaccumulation (See Section 6.3);
- potentially exposed or susceptible subpopulations (See Section 7.4);
- storage near significant sources of drinking water (See Section 8.4);
- conditions of use or significant changes in the conditions of use of the chemical substance (See Section 5);
- the chemical substance's production volume or significant changes in production volume (See Section 7.1); and
- other risk-based criteria that EPA determines to be relevant to the designation of the chemical substance's priority.

EPA conducted a risk-based, screening-level review based on the criteria and other considerations above and other relevant information described in 40 CFR 702.9(c) to inform the determination of whether the chemical substance meets the standard of a high-priority substance. High-priority substance means a chemical substance that EPA determines, without consideration of costs or other non-risk factors, may present an unreasonable risk of injury to the health of the environment because of a potential hazard and a potential route of exposure under the conditions of use, including an unreasonable risk to potentially exposed or susceptible subpopulations identified as relevant by EPA (40 CFR 702.3). Designation of a low-priority substance is not a finding that the chemical substance does not present an unreasonable risk, but rather that the chemical does not meet the statutory criteria for a high-priority substance and that a risk evaluation is not warranted at the time. This section explains the basis for the final designation and how EPA applied statutory and regulatory requirements, addressed issues and reached conclusions.

8.1 Hazard and Exposure Potential of the Chemical Substance

Approach: EPA evaluated the hazard and exposure potential of sodium gluconate. EPA used this information to inform its determination of whether sodium gluconate meets the statutory criteria and considerations for final designation as a low-priority substance.

- **Hazard potential:**

For sodium gluconate's hazard potential, EPA gathered information for a broad set of human health and environmental endpoints described in detail in Section 6 of this document. EPA screened this information against low-concern benchmarks. EPA found that sodium gluconate is of low concern for human health and environmental hazard across the range of endpoints in these low-concern criteria.

- **Exposure potential:**

To understand exposure potential, EPA gathered information on physical-chemical properties, production volumes, and the types of exposures likely to be faced by workers, the general population, children, and consumers (discussed in Sections 3 and 7). EPA also gathered information on environmental releases. EPA identified workers, the general population, consumers, and the

environment as most likely to experience exposures. EPA determined that while the general population, consumers and workers may be exposed to sodium gluconate, exposure by dermal, inhalation, and ingestion pathways are limited by sodium gluconate's physical-chemical properties. If sodium gluconate is released into the environment, its exposure potential will be reduced through biodegradation under aerobic and anaerobic conditions.

Rationale: Although sodium gluconate may have potential to cause moderate eye irritation, the effects are reversible, thereby reducing concern for longer-term effects. TSCA conditions of use would be unlikely to result in frequent eye exposure because the use patterns do not involve intentional eye exposure. Workers could be exposed during processing, manufacturing, distribution, use, and disposal, splashing of solutions, or hand-to-face and eye contact. Other uses covered under TSCA, especially consumer uses in cleaning and furnishing care products, would be unlikely to result in more than incidental eye exposure. Eye irritation resulting from exposure in an occupational and consumer setting is mitigated by the reversible nature of the effect and furthermore by the strong likelihood that any exposures would be self-limiting, especially by those who experience eye irritation from eye exposure.

Conclusion: Based on an initial analysis of reasonably available hazard and exposure information, EPA concludes that the risk-based, screening-level review under 40 CFR 702.9(a)(1) does not support a finding that sodium gluconate meets the standard for a high-priority substance. The reasonably available hazard and exposure information described above provides sufficient information to support this finding. EPA does not find that unlikely, infrequent, and temporary occurrence of potential moderate eye irritation meets the standard for a high-priority substance (i.e., that the substance "may present an unreasonable risk of injury to health").

8.2 Persistence and Bioaccumulation

Approach: EPA has evaluated both the persistence and bioaccumulation potential of sodium gluconate based on a set of EPA and internationally accepted measurement tools and benchmarks that are sound indicators of persistence and bioaccumulation potential (described in Section 6). These endpoints are key components in evaluating a chemical's persistence and bioaccumulation potential.

Rationale: EPA's review of experimental data indicates sodium gluconate is readily biodegradable under aerobic conditions, with greater than 60 percent aerobic biodegradation expected within 10 days and expected to completely biodegrade within 35 days under anaerobic conditions (Section 6.3.1). EPA's EPI Suite models indicate a low potential for bioaccumulation (Section 6.3.2).

Conclusion: Based on an initial screen of reasonably available information on persistence and bioaccumulation, EPA concludes that the screening-level review under 40 CFR 702.9(a)(2) does not support a finding that sodium gluconate meets the standard for a high-priority substance. The reasonably available persistence and bioaccumulation information described above provides sufficient information to support this finding.

8.3 Potentially Exposed or Susceptible Subpopulations

Approach: TSCA Section 3(12) states that the "term 'potentially exposed or susceptible subpopulation' means a group of individuals within the general population identified by the Administrator who, due to either greater susceptibility or greater exposure, may be at greater risk than

the general population of adverse health effects from exposure to a chemical substance or mixture, such as infants, children, pregnant women, workers or the elderly." EPA identified workers engaged in the manufacturing, processing, distribution, use and disposal of sodium gluconate as a potentially exposed or susceptible subpopulation (described in more detail in Section 7). Consumers are also a potentially exposed subpopulation because of their use of cleaning and furnishing care products, laundry and dishwashing products, automotive care products, and other uses, as shown in Table 3.

Rationale: EPA did not identify hazard effects for this chemical that would make any population susceptible. EPA expects workers and consumers to have a higher exposure to sodium gluconate than the general population. Because of the chemical's low-concern hazard properties and reversibility of effects, this exposure does not pose a significant increase in risk for consumers or workers.

Conclusion: Based on the Agency's understanding of the conditions of use and expected users such as potentially exposed or susceptible subpopulations, EPA concludes that the screening-level review under 40 CFR 702.9(a)(3) does not support a finding that sodium gluconate meets the standard for a high-priority substance. The conditions of use could result in increased exposures to certain populations. Even in light of this finding, the consistently low-hazard profile and reversible effects of sodium gluconate provides sufficient evidence to support a finding of low concern. The reasonably available information on conditions of use, hazard, and exposure described above provides sufficient information to support this finding.

8.4 Storage near Significant Sources of Drinking Water

Approach: In Sections 6 and 7, EPA explains its evaluation of the elements of risk relevant to the storage of sodium gluconate near significant sources of drinking water. For this criterion, EPA focused primarily on the chemical substance's potential human health hazards, including to potentially exposed or susceptible subpopulations, and environmental fate properties, and explored a scenario of a release to a drinking water source. EPA also investigated whether the chemical was monitored for and detected in a range of environmental media. This requirement to consider storage near significant sources of drinking water is unique to prioritization under TSCA Section 6(b)(1)(A) and 40 CFR 702.9(a)(4).

Rationale: In terms of health hazards, sodium gluconate is expected to present low concern to the general population, including potentially exposed or susceptible subpopulations, across a spectrum of health endpoints.

In the event of an accidental release into a surface water drinking water source, though sodium gluconate is water soluble (see Section 3), it is not expected to persist (see Section 6.3.1) in the drinking water supply. In the event of an accidental release to land, its biodegradability (aerobic and anaerobic biodegradation are discussed in Section 6.3.1) reduces its potential for transport to surface water drinking water sources and leaching into groundwater, including well water. Fate and transport evaluations indicate sodium gluconate is unlikely to partition into sediment, predicted to biodegrade under aerobic and anaerobic conditions (see Section 3), and unlikely to bioaccumulate (see Section 6.3.2), minimizing the likelihood that the chemical would be present in sediment or groundwater to pose a longer-term drinking water contamination threat.

A sudden release of large quantities of the chemical near a drinking water source could have immediate effects on the usability of a surface drinking water source. If such a release were to occur, two primary factors would operate together to reduce concern. First, the chemical would be expected to present low concern to the general population, including susceptible subpopulations, across a spectrum of health endpoints (see Section 6). Second, sodium gluconate would degrade in aerobic and anaerobic environments (see Section 6). Together, these factors mean that any exposures to this chemical through drinking water sources would be short-lived, and that if ingestion were to take place, concern for adverse health effects would be low.

EPA also explored whether the chemical had been identified as a concern under U.S. environmental statutes in the past. EPA searched lists of chemicals and confirmed that sodium gluconate does not appear on these lists. The lists reviewed include EPA's List of Lists (https://www.epa.gov/sites/production/files/2015-03/documents/list_of_lists.pdf). EPA also searched the lists of chemicals included in the National Primary Drinking Water Regulations and the Unregulated Contaminant Monitoring Rule (UCMR) under the Safe Drinking Water Act (SDWA).

Conclusion: Based on a qualitative review of a potential release near a significant source of drinking water, EPA concludes that the screening-level review of sodium gluconate under 40 CFR 702.9(a)(4) does not support a finding that sodium gluconate meets the standard for a high-priority substance. The reasonably available information on storage near significant sources of drinking water described above provides sufficient information to support these findings.

8.5 Conditions of Use or Significant Changes in Conditions of Use of the Chemical Substance

Approach: EPA evaluated the conditions of use for sodium gluconate and related potential exposures and hazards.

Rationale: EPA evaluated the conditions of use of sodium gluconate (see Section 5 and Appendix A) and found it to have a broad range of conditions of use. EPA expects that even if the conditions of use were to expand beyond activities that are known, intended, or reasonably foreseen, the outcome of the screening review would likely not change and would not alter the Agency's conclusion of low concern. EPA bases this expectation on sodium gluconate's consistently low-concern hazard characteristics across the spectrum of hazard endpoints and regardless of a change in the nature or extent of its use and resultant increased exposures.

Conclusion: EPA's qualitative evaluation of potential risk does not support a finding that sodium gluconate meets the standard for a high-priority substance based on its low-hazard profile under the current conditions of use. EPA concludes that even if conditions of use broaden, resulting in an increase in the frequency or amount of exposures, the analysis conducted to support the screening-level review under 40 CFR 702.9(a)(5) would not change significantly. In particular, the analysis of concern for hazard, which forms an important basis for EPA's findings, would not be impacted by a change in condition of use. Therefore, such changes would not support a finding that sodium gluconate meets the standard for a high-priority substance. The reasonably available information on conditions of use, or significant changes in conditions of use, described above provides sufficient information to support this finding.

8.6. The Volume or Significant Changes in Volume of the Chemical Substance Manufactured or Processed

Approach: EPA evaluated the current production volumes of sodium gluconate (Section 7.1) and related potential exposures (Sections 7.2 and 7.4).

Rationale: EPA used reasonably available information on production volume (see Appendix A) in considering potential risk. It is possible that designation of sodium gluconate as a low-priority substance could result in increased use and higher production volumes. EPA expects, however, that any changes in sodium gluconate's production volume would not alter the Agency's assessment of low concern given the chemical's low-concern hazard profile of the chemical. EPA bases this expectation on sodium gluconate's consistently low-concern hazard characteristics, across the spectrum of hazard endpoints. This expectation would apply, even with a significant change in the volume of the chemical manufactured or processed and resultant increased exposures.

Conclusion: Based on the screening criteria under 40 CFR 702.9(a)(6), EPA concludes that even if production volumes increase, resulting in an increase in the frequency or level of exposures, sodium gluconate does not meet the standard for a high-priority substance. The reasonably available information on production volume, or significant changes in production volume described above provides sufficient information to support this finding.

8.7 Other Considerations

EPA did not identify other considerations for the screening review to support the final designation of sodium gluconate as a low-priority substance.

9. Final Designation

Based on a risk-based screening-level review of the chemical substance and, when applicable, relevant information received from the public and other information as appropriate and consistent with TSCA section 26(h), (i) and (j), EPA concludes that sodium gluconate does not meet the standard for a high-priority substance. The reasonably available information described above provides sufficient information to support this finding. Accordingly, EPA is designating sodium gluconate as a low-priority substance.

Appendix A: Conditions of Use Characterization

EPA gathered information on and related to conditions of use including uses of the chemical, products in which the chemical is used, types of users, and status (e.g., known, regulated).

A.1 CDR Manufacturers and Production Volume

The Chemical Data Reporting (CDR) rule (previously known as the Inventory Update Rule, or IUR), under TSCA section 8, requires manufacturers (including importers) to report information on the chemical substances they produce domestically or import into the U.S., generally above a reporting threshold of 25,000 lb. per site per year. According to the 2016 CDR database, 24 companies manufactured or imported sodium gluconate at 32 sites for reporting year 2015. Individual production volumes were withheld, but may be available in later releases of the 2016 CDR.

Table presents the historic production volume of sodium gluconate from the CDR (previously known as the Inventory Update Rule, or IUR) from 1986-2015. Since the early 2000s, production volume remained mostly in the 10,000,000 lbs. to 50,000,000 lbs. range with a slight bump in 2012 to the 50,000,000 lbs. to 100,000,000 lbs. range. Since 2015, production volume has remained in the 50,000,000 lbs. to 100,000,000 lbs range. While volume has fluctuated up and down throughout the 2000s there seems to be no clear trend in either decreasing or increasing production volume. ‘

Table A.1: 1986-2015 National Production Volume Data for Sodium Gluconate (Non-Confidential Production Volume in Pounds)

1986	1990	1994	1998	2002	2006	2011	2012	2013	2014	2015
>1 M – 10 M	>10 M – 50 M	>10 M – 50 M	>1 M – 10 M	>10 M – 50 M	10 M - <50 M	48,087,574	50 M – 100 M	10 M – 50 M	50 M – 100 M	50 M – 100 M

Source(s):
EPA (2018a; 2017b; 2006; 2002)

Note(s):
K = Thousand; M = Million; NDR = No data reported

A.2 Uses

A.2.1 Methods for Uses

Section A.2 provides a list of known uses of sodium gluconate, organized by category of use. To compile the uses, EPA searched publicly available databases listed in Table A.2 and conducted additional internet searches to clarify uses. Search terms differed among databases because of different search term requirements for each database (i.e., some databases search by CASRN while others search by chemical name).

Table A.2: Sources Searched for Uses of Sodium Gluconate

Title	Author and Year	Search Term(s)	Found Use Information? [1]
Sources searched for all use reports			
California Links to Pesticides Data	California Dept of Pesticide Regulation (2013)	527-07-1	No
Canada Chemicals Management Plan information sheets	Government of Canada (2018)	527-07-1	No
Chemical and Product Categories (CPCat)	CPCat (2019)	527-07-1	Yes
ChemView [2]	EPA (2018a)	527-07-1	Yes
Children's Safe Product Act Reported Data	Washington State Dept. of Ecology (2018)	527-07-1	No
Consumer Product Information Database (CPID)	DeLima Associates (2018a)	527-07-1	Yes
Danish surveys on chemicals in consumer products	Danish EPA (2018)	N/A, There is no search but report titles were checked for possible information on the chemical	No
Datamyne	Descartes Datamyne (2018)	Sodium gluconate	No
DrugBank	DrugBank (2018)	Sodium gluconate; 527-07-1	Yes
European Chemicals Agency (ECHA) Registration Dossier	ECHA (2018)	Sodium gluconate; 527-07-1	No
eChemPortal [2]	OECD (2018)	527-07-1	Yes
Envirofacts [2]	EPA (2018b)	527-07-1	No
Functional Use Database (FUse)	EPA (2017a)	527-07-1	Yes
Kirk-Othmer Encyclopedia of Chemical Technology	Kirk-Othmer (2006)	Sodium gluconate; 527-07-1	Yes
Non-Confidential 2016 Chemical Data Reporting (CDR)	EPA (2017b)	527-07-1	Yes
PubChem Compound	Kim et al. (2016)	527-07-1	Yes
Safer Chemical Ingredients List (SCIL)	EPA (2018e)	527-07-1	Yes

Table A.2: Sources Searched for Uses of Sodium Gluconate			
Title	**Author and Year**	**Search Term(s)**	**Found Use Information?** [1]
Synapse Information Resources [2]	Synapse Information Resources (n.d.)	Sodium gluconate	Yes
Resource Conservation and Recovery Act (RCRA)	EPA (2018d)	Sodium gluconate	No
Scorecard: The Pollution Information Site	GoodGuide (2011)	527-07-1	Yes
Skin Deep Cosmetics Database	EWG (2018)	527-07-1	Yes
Toxics Release Inventory (TRI)	EPA (2018f)	527-07-1	No
TOXNET [2]	NLM (2018b)	527-07-1	Yes
Ullmann's Encyclopedia of Industrial Chemistry	Ullmann's (2000)	Sodium gluconate	Yes
Additional sources identified from reasonably available information			
American Cleaning Institute (ACI)	ACI (2018)	Incidentally identified while researching details of this chemical's uses and products.	Yes
Diversey Inc.	Diversey Inc. (2017)		
GE Betz Inc.	GE Betz Inc. (2010)		
Health Products Express Inc.	Health Products Express Inc. (2018)		
Hillyard Industries	Hillyard Industries (2012)		
Hydrite Chemical Co.	Hydrite Chemical (2018)		
Med-Plus Inc.	Med-Plus Inc. (2018)		
PMP Fermentation Products Inc. (PMP)	PMP (2014)		
Sigma-Aldrich	Sigma-Aldrich (2018)		
Substances in Preparations in Nordic Countries (SPIN)	SPIN (2018)		
State Agency for Nature, Environment and Consumer Protection (LANUV)	LANUV (2018)		
Note(s): 1. If use information was found in the resource, it will appear in Table unless otherwise noted. 2. This source is a group of databases; thus, the exact resource(s) it led to will be cited instead of the database as whole.			

The U.S. Patent and Trademark Office has an online database that shows 3,079 patents referencing "sodium gluconate" (USPTO 2018). Although patents could be useful in determining reasonably foreseen uses, it is difficult to confirm whether any of the patented technologies are currently in use. Uses inferred from patents containing sodium gluconate were not included in Table A.3.
Note that the uses in Table A.2.2 that are covered under TSCA are included in Section 5, Table 3 of this document.

A.2.2 Uses of Sodium Gluconate

Table A.3: Uses of Sodium Gluconate		
Use	**Expected Users**	**Description of Use and References**
TSCA Conditions of Use: Agriculture and Food Products CDR reports use of liquid and dry powder sodium gluconate in consumer and commercial, non-pesticide agricultural products. CDR identifies concentrations of at least 1 percent but less than 30 percent, as well as at least 90 percent, by weight in reported products (EPA 2017b). Synapse Information Resources and CPCat also identify use of sodium gluconate in agricultural use (Dionisio et al. 2015; Synapse Information Resources n.d.). SPIN identifies use of sodium gluconate in agriculture and horticulture in Nordic countries (SPIN 2018)		
Crop and animal production, hunting, fishing, and aquaculture[1]	Industrial	SPIN (2018) SPIN identifies use of sodium gluconate in crop and animal production as well as hunting, fishing, aquaculture, and related service activities in Nordic countries. No further information about this use could be found and it is unknown whether this is an ongoing use in the United States. Expected users are industrial based on inclusion in SPIN's industrial uses database.
Food and beverage service activities[2]	Industrial	SPIN (2018) SPIN identifies use of sodium gluconate in restaurants, cafeterias, canteens, and community centers in Nordic countries. No further information about this use could be found and it is unknown whether this is an ongoing use in the United States. Expected users are industrial based on inclusion in SPIN's industrial uses database.

Table A.3: Uses of Sodium Gluconate		
Use	**Expected Users**	**Description of Use and References**
Food, beverage, and tobacco product manufacturing[2]	Industrial	EPA (2017b); CPCat (2019); SPIN (2018) CDR reports use of liquid sodium gluconate as a corrosion inhibitor, anti-scaling agent, and processing aid in food, beverage, and tobacco manufacturing processing (incorporation into formulation, mixture, or reaction product). SPIN identifies use of sodium gluconate in food, beverage, and tobacco manufacturing in Nordic countries, including the manufacture of beer, vegetable and animal oils and fats, dairy products, meat and meat products, as well as processing and preserving of fruits, vegetables, meat, meat products, fish, and fish products. Expected users are industrial based on CDR's Industrial Processing and Use report.
Pesticide, fertilizer, and other agricultural chemical manufacturing	Industrial	EPA (2017b); CPCat (2019) CDR reports use of dry powder sodium gluconate as a fertilizer, processing aid, and non-pesticide agricultural chemical in agricultural chemical manufacturing. Expected users are industrial based on CDR's Industrial Processing and Use report.

Table A.3: Uses of Sodium Gluconate		
Use	**Expected Users**	**Description of Use and References**
TSCA Conditions of Use: Building and Construction		
Construction	Consumer, commercial	EPA (2017b); Synapse Information Resources (n.d.); CPCat (2019); PMP (2014); NLM (2018a); SPIN (2018); Ullmann's (2010) CDR reports use of liquid, dry powder, and other solid sodium gluconate in consumer and commercial building/construction materials. CDR identifies concentrations of up to 60 percent by weight in reported products. Synapse Information Resources identifies use of sodium gluconate as a retarder and water reducer in concrete, and PMP identifies use in concrete admixtures. HazMap reports use of sodium gluconate in cement set retarding and in sequestering for concrete and mortar, and Ullmann's identifies use in dry mortars as a retarder. SPIN identifies use in construction materials, civil engineering work, bricklaying, floor and wall covering and materials, cement, concrete (hardeners), mortar, and fillers (insulation) in Nordic countries. Expected users are consumer and commercial based on CDR's consumer/commercial classification.
Construction processing	Industrial	EPA (2017b); SPIN (2018) CDR reports use of liquid sodium gluconate as a plasticizer during construction processing (incorporation into formulation, mixture, or reaction product). SPIN identifies use in the manufacture of concrete, cement, plaster, and lime, in Nordic countries. Expected users are industrial based on CDR's Industrial Processing and Use report.
TSCA Conditions of Use: Chemicals		
All other basic inorganic chemical manufacturing	Industrial	EPA (2017b) CDR reports use of sodium gluconate as a corrosion inhibitor and anti-scaling agent in basic inorganic chemical manufacturing. Expected users are industrial based on CDR's Industrial Processing and Use report.

Table A.3: Uses of Sodium Gluconate		
Use	**Expected Users**	**Description of Use and References**
All other chemical product and preparation manufacturing	Industrial	EPA (2017b); Synapse Information Resources (n.d.); Sigma-Aldrich (2018); CPCat (2019); SPIN (2018) CDR reports use of liquid and dry powder sodium gluconate as a laboratory chemical, plasticizer, and processing aid in chemical product and preparation manufacturing. Synapse Information Resources identifies unspecified use of sodium gluconate as a plasticizer. Sigma-Aldrich identifies use of sodium gluconate in laboratory chemicals and in the synthesis of substances. SPIN identifies use in the manufacture of chemicals and chemical products in Nordic countries. Expected users are industrial based on CDR's Industrial Processing and Use report.
Chemical distribution	Commercial, industrial	EPA (2017b) CDR reports use of solid sodium gluconate in the wholesale and retail trade of chemicals. CDR identifies concentrations of at least 60 percent but less than 90 percent by weight in reported commercial products. Expected users are commercial based on CDR's consumer/commercial classification and industrial based on CDR's Industrial Processing and Use report.

Table A.3: Uses of Sodium Gluconate		
Use	**Expected Users**	**Description of Use and References**
TSCA Conditions of Use: Cleaning and Furnishing Care Products CDR reports use of liquid, dry powder, and other solid sodium gluconate in consumer and commercial cleaning and furnishing care products. CDR identifies concentrations of at least one percent by weight in reported products (EPA 2017b). Pollution Scorecard identifies use of sodium gluconate in surface cleaners, detergents, other specialty cleaning and sanitation products (GoodGuide 2011). CPCat and PMP also identify use in cleaning products and applications, and PubChem identifies use in solvents for cleaning and degreasing (Dionisio et al. 2015; Kim et al. 2016; PMP 2014). SPIN identifies use of sodium gluconate in cleaning/washing agents in Nordic countries (Dionisio et al. 2015; PMP 2014; SPIN 2018)		
All-purpose cleaner	Consumer	DeLima Associates (2015e); GoodGuide (2011); CPCat (2019); ACI (2018) ACI identifies use of sodium gluconate in powdered, gel, liquid, and aerosol all-purpose cleaners. Pollution scorecard identifies use of liquid sodium gluconate in household hard surface cleaners. CPCat reports use of sodium gluconate in bathroom cleaners and other cleaning and furnishing care products. CPID generally includes consumer products; therefore, the expected users are consumer.
Automotive body polish and cleaners	Consumer	GoodGuide (2011); DeLima Associates (2017a) Pollution Scorecard identifies use of sodium gluconate in consumer automotive body polish and cleaners. CPID lists one degreaser that contains sodium gluconate under automotive use, however the product is not specific to automotive use. Expected users are consumer based on inclusion in GoodGuide's Consumer Uses.
Carpet cleaner	Consumer	DeLima Associates (2017b); Hillyard Industries (2012) Hillyard Industries identifies a carpet pre-spray that contains sodium gluconate. CPID identifies at least one carpet cleaning product currently for sale that contains sodium gluconate. CPID generally includes consumer products; therefore, the expected users are consumer.

Table A.3: Uses of Sodium Gluconate		
Use	**Expected Users**	**Description of Use and References**
Coffeemaker cleaner	Consumer	DeLima Associates (2015a) CPID generally includes consumer products; therefore, the expected users are consumer.
Garbage disposal cleaner	Professional	DeLima Associates (2016) CPID identifies this product for professional use.
Glass cleaner	Consumer	DeLima Associates (2018b); GoodGuide (2011) Pollution Scorecard identifies use of sodium gluconate in consumer glass window cleaning preparations. CPID generally includes consumer products; therefore, the expected users are consumer.
Industrial cleaner	Commercial, industrial	EPA (2017b) CDR reports use of liquid sodium gluconate in industrial cleaners at concentrations of up to 30 percent by weight. Expected users are commercial based on CDR's consumer/commercial classification, and industrial based on the fact that it is an industrial cleaner.
Kitchen cleaner and degreaser	Commercial	DeLima Associates (2014a); CPCat (2019) CPCat identifies use of sodium gluconate in kitchen cleaners. CPID identifies this product for professional use.

Table A.3: Uses of Sodium Gluconate		
Use	**Expected Users**	**Description of Use and References**
Laundry and dishwashing products	Consumer, commercial	EPA (2017b); DeLima Associates (2015b); DeLima Associates (2015f); DeLima Associates (2017b); Synapse Information Resources (n.d.); GoodGuide (2011); CPCat (2019); ACI (2018); CDR reports use of dry powder sodium gluconate in laundry and dishwashing products. CDR identifies concentrations (by weight) of at least 1 percent but less than 30 percent, as well as at least 90 percent, in reported products. Synapse Information Resources identifies use of sodium gluconate as a chelating agent and sequestrant in detergents, and Pollution Scorecard identifies use in household machine dishwashing and other alkaline non-household detergents. ACI identifies use of sodium gluconate in liquid and gel dishwashing detergents as well as liquid and aerosol laundry detergents and pre-treatment laundry products. CPID identifies multiple dishwashing products that contain sodium gluconate. Expected users are consumer and commercial based on CDR's consumer/commercial classification.
Multipurpose hard surface cleaner and deodorizer	Commercial, institutional	DeLima Associates (2013b) CPID identifies this product for commercial/institutional applications.
Outdoor furniture cleaner	Consumer	DeLima Associates (2013a) CPID generally includes consumer products; therefore, the expected users are consumer.
Oven cleaner	Industrial	Diversey Inc. (2017) Diversey Inc. identifies use of sodium gluconate in industrial/institutional oven cleaners. Diversey Inc.'s SDS identifies industrial and institutional users of oven cleaners.

Table A.3: Uses of Sodium Gluconate		
Use	**Expected Users**	**Description of Use and References**
Plating process and surface cleaners	Consumer, commercial, industrial	EPA (2017b); GoodGuide (2011); Kim et al. (2016); CPCat (2019); SPIN (2018) CDR reports use of liquid and solid sodium gluconate in cleaners used in plating and other surface treatment processes. CDR identifies concentrations of at least 30 percent but less than 60 percent by weight in reported products. Pollution Scorecard identifies use of liquid sodium gluconate in consumer acid non-household metal cleaners. PubChem identifies further use of sodium gluconate in powdered vat and aluminum cleaners, as well as in unspecified surface-active agents. SPIN reports use of sodium gluconate in surface active agents in Nordic countries. Expected users are consumer and commercial based on CDR's consumer/commercial classification, and industrial based on CPCat's user classification.
Radiator flush and cleaner	Consumer	Delima Associates (2014b) CPID generally includes consumer products; therefore, the expected users are consumer.
Soap, cleaning compound, and toilet preparation manufacturing	Industrial	EPA (2017b); CPCat (2019); SPIN (2018) CDR reports use of liquid, pellet, large crystal, dry powder and other solid sodium gluconate in soap, cleaning compound, and toilet preparation manufacturing. CDR identifies sodium gluconate as a processing aid, surface active agent, solvent, cleaner, degreaser, and chelating agent during processing (incorporation into article, formulation, mixture, or reaction product). SPIN identifies use of sodium gluconate in the manufacture of soap, detergents, and cleaning and polishing products in Nordic countries. Expected users are industrial based on CDR's Industrial Processing and Use report.
Toilet bowl cleaner	Consumer	DeLima Associates (2015h) CPID generally includes consumer products; therefore, the expected users are consumer.

Table A.3: Uses of Sodium Gluconate		
Use	**Expected Users**	**Description of Use and References**
TSCA Conditions of Use: Electrical and Electronic Products		
Electrical and electronic products	Consumer, commercial, industrial	EPA (2017b); SPIN (2018) CDR reports use of liquid and solid sodium gluconate in electrical and electronic products at concentrations of at least 90 percent by weight. CDR also reports use of liquid and solid sodium gluconate as a plating and surface treatment agent in the manufacture of electrical equipment, appliances, and components. SPIN identifies use of sodium gluconate in the manufacture of computer, electronic, and optical products in Nordic countries. Expected users are consumer and commercial based on CDR's consumer/commercial classification and industrial based on CDR's Industrial Processing and use report.
TSCA Conditions of Use: Energy and Utility Uses		
Oil and gas drilling, extraction, and support activities	Industrial	EPA (2017b); SPIN (2018) CDR reports use of sodium gluconate as a petroleum production processing aid in upstream fossil fuel activities. SPIN identifies use of sodium gluconate in the extraction of crude petroleum and natural gas in Nordic countries. Expected users are industrial based on CDR's Industrial Processing and Use report.
Sewage treatment	Industrial	SPIN (2018) SPIN identifies use of sodium gluconate in sewage and refuse disposal, sanitation, and similar activities in Nordic countries. No further information about this use could be found and it is unknown whether this is an ongoing use in the United States. Expected users are industrial based on inclusion in SPIN's industrial uses database.

Table A.3: Uses of Sodium Gluconate		
Use	**Expected Users**	**Description of Use and References**
Utilities	Industrial	EPA (2017b) CDR reports utility use of dry powder sodium gluconate as a non-pesticide agricultural chemical. Expected users are industrial based on CDR's Industrial Processing and Use report.
Water treatment products	Consumer, commercial	EPA (2017b); GE Betz Inc. (2010); CPCat (2019); SPIN (2018); Hydrite Chemical (2018) CDR reports use of dry powder, pellet, and large crystal sodium gluconate in water treatment products. CDR identifies concentrations of at least 90 percent by weight in commercial, dry powder water treatment products. GE Betz identifies use of sodium gluconate in water and process technology membrane cleaners, and Hydrite Chemical identifies use in water treatment products. SPIN reports use of sodium gluconate in water treatment softeners and calcium removers in Nordic countries. Expected users are consumer and commercial based on CDR's consumer/commercial classification.
TSCA Conditions of Use: Manufacturing		
Furniture manufacturing	Industrial	SPIN (2018) SPIN identifies use of sodium gluconate in the manufacture of furniture in Nordic countries. No further information about this use could be found and it is unknown whether this is an ongoing use in the United States. Expected users are industrial based on inclusion in SPIN's industrial uses database.

Table A.3: Uses of Sodium Gluconate		
Use	**Expected Users**	**Description of Use and References**
Machinery manufacturing and repair	Industrial	GoodGuide (2011); SPIN (2018) Pollution Scorecard identifies use of sodium gluconate as a corrosion inhibitor in machinery manufacturing and repair. SPIN identifies use of sodium gluconate in the manufacture of machinery and equipment in Nordic countries. No further information about this use could be found and it is unknown whether this is an ongoing use in the United States. Expected users are industrial based on inclusion in GoodGuide's Industrial Uses and ECHA's industrial uses database.
Manufacture of pulp, paper and paper products	Industrial	SPIN (2018) SPIN identifies use of sodium gluconate in the industry for and the manufacture of pulp, paper, and paper products in Nordic countries. No further information about this use could be found and it is unknown whether this is an ongoing use in the United States. Expected users are industrial based on inclusion in SPIN's industrial uses database.
Manufacture of transport equipment	Industrial	SPIN (2018) SPIN identifies use of sodium gluconate in the industry for and manufacture of motor vehicles, trailers, semi-trailers, and other transport equipment, as well as the maintenance and repair of motor vehicles, in Nordic countries. No further information about this use could be found and it is unknown whether this is an ongoing use in the United States. Expected users are industrial based on inclusion in SPIN's industrial uses database.

Table A.3: Uses of Sodium Gluconate		
Use	**Expected Users**	**Description of Use and References**
Miscellaneous manufacturing	Industrial	EPA (2017b); Hydrite Chemical (2018) CDR reports use of liquid and solid sodium gluconate as a plating and surface treatment agent in miscellaneous manufacturing. Hydrite Chemical identifies use in plating. Expected users are industrial based on CDR's Industrial Processing and Use report.
Nonmetallic mineral product manufacturing	Industrial	EPA (2017b); CPCat (2019); SPIN (2018) CDR reports use of liquid and solid sodium gluconate as a plasticizer and processing aid in clay, glass, cement, concrete, lime, gypsum, and other nonmetallic mineral product manufacturing. SPIN identifies use of sodium gluconate in the manufacture of other non-metallic mineral products in Nordic countries Expected users are industrial based on CDR's Industrial Processing and Use report.
TSCA Conditions of Use: Media and Printing		
Inks and dyes	Unknown	Synapse Information Resources (n.d.) Synapse Information Resources identifies use of sodium gluconate as a chelating agent and sequestrant in inks and dyes. Expected users are unknown, due to the limited availability of information.

Table A.3: Uses of Sodium Gluconate		
Use	**Expected Users**	**Description of Use and References**
Photo-chemicals	Unknown	Synapse Information Resources (n.d.); SPIN (2018) Synapse Information Resources identifies use of sodium gluconate as a chelating agent and sequestrant in photo-chemicals and lithographic plate cleaning. SPIN reports use of sodium gluconate in photo-chemicals, developers, and reprographic agents in Nordic countries. No further information about this use could be found and it is unknown whether this is an ongoing use in the United States. Expected users are unknown, due to the limited availability of information.
Printing and reproduction of recorded media	Industrial	SPIN (2018) SPIN reports use of sodium gluconate in media printing and reproduction in Nordic countries. No further information about this use could be found and it is unknown whether this is an ongoing use in the United States. Expected users are industrial based on inclusion in SPIN's industrial use database.
TSCA Conditions of Use: Metal Products		
Complexing agent	Unknown	SPIN (2018) SPIN identifies use of sodium gluconate in complexing agents in Nordic countries. Complexing agents are typically compounds that are used during metal treatment processes. No further information about this use could be found and it is unknown whether this is an ongoing use in the United States. Expected users are unknown, due to the limited availability of information.

Table A.3: Uses of Sodium Gluconate		
Use	**Expected Users**	**Description of Use and References**
Electroplating	Industrial	PMP (2014); SPIN (2018); Kirk-Othmer (2004) PMP identifies use of sodium gluconate in electroplating, and Ullman's identifies use in soak cleaning during electroplating. SPIN identifies use in electroplating agents in Nordic countries. No further information about this use could be found and it is unknown whether this is an ongoing use in the United States. Expected users are not defined in the source, but likely to be industrial.
Fabricated metal product manufacturing	Industrial	EPA (2017b); Synapse Information Resources (n.d.); CPCat (2019); SPIN (2018); Hydrite Chemical (2018) CDR reports use of liquid, dry powder, and other solid sodium gluconate as a plating agent, surface treatment agent, and processing aid in fabricated metal manufacturing, for processing and use. Synapse Information Resources identifies use of sodium gluconate as a sequestrant and chelating agent in metal plating/cleaning, de-rusting, and in chrome tanning and aluminum de-oxidation. Hydrite Chemical identifies use in alumina dyeing. SPIN reports use of sodium gluconate in the manufacture of fabricated metal products in Nordic countries. Expected users are industrial based on CDR's Industrial Processing and Use report.
Metal degreasing	Industrial	GoodGuide (2011); Ullmann's (2014) Pollution Scorecard identifies use of sodium gluconate as an aqueous cleaner in metal degreasing. Ullmann's identifies use of sodium gluconate in alkaline metal cleaners. No further information about this use could be found and it is unknown whether this is an ongoing use in the United States. Expected users are industrial based on inclusion in GoodGuide's Industrial Uses.

Table A.3: Uses of Sodium Gluconate		
Use	**Expected Users**	**Description of Use and References**
Metal manufacturing	Industrial	SPIN (2018) SPIN reports the use of sodium gluconate in the industry for and manufacture of basic metals and iron and metal products, and in the treatment and coating of metals in Nordic countries. No further information about this use could be found and it is unknown whether this is an ongoing use in the United States. Expected users are industrial based on inclusion in ECHA's industrial use database.
Metal products	Consumer, commercial	EPA (2017b); CPCat (2019) CDR reports use of liquid, dry powder, and solid sodium gluconate in metal products not covered elsewhere, at concentrations of at least 90 percent by weight. Expected users are consumer and commercial based on CDR's consumer/commercial classification.
Metal surface treatment	Industrial	Hydrite Chemical (2018); SPIN (2018) Hydrite Chemical identifies use of sodium gluconate in steel surface cleaning agents. SPIN identifies use of sodium gluconate in metal surface treatment, coating, pickling, galvano-technical, and metal staining agents as well as rust removers in Nordic countries. Hydrite Chemical lists steel surface cleaning as an industrial application.

Table A.3: Uses of Sodium Gluconate		
Use	**Expected Users**	**Description of Use and References**
TSCA Conditions of Use: Paints and Coatings		
Paints and coatings	Commercial, industrial	EPA (2017b); Synapse Information Resources (n.d.); SPIN (2018) CDR reports use of dry powder sodium gluconate in commercial paints and coatings and as a plating and surface treatment agent in industrial paint and coating manufacturing. Synapse Information Resources identifies use of sodium gluconate as a chelating agent and sequestrant in paints, and SPIN reports use in paints in Nordic countries. Expected users are commercial based on CDR's consumer/commercial classification and industrial based on CDR's Industrial Processing and Use report.
Paint strippers	Consumer, commercial	EPA (2017b); Synapse Information Resources (n.d.); GoodGuide (2011); SPIN (2018); Kirk-Othmer (2015) CDR reports use of liquid and solid sodium gluconate in paint strippers. CDR identifies concentrations of at least 30 percent but less than 60 percent by weight in reported products. Synapse Information Resources identifies use of sodium gluconate in paint stripping, and Pollution Scorecard identifies use in paint and varnish removers. Kirk-Othmer identifies use of sodium gluconate in liquid alkaline paint and finish removers. SPIN reports use of sodium gluconate in paint and varnish removers and strippers Expected users are consumer and commercial based on CDR's consumer/commercial classification.

Table A.3: Uses of Sodium Gluconate		
Use	**Expected Users**	**Description of Use and References**
TSCA Conditions of Use: Miscellaneous		
Adhesives and sealants	Industrial, unknown	CPCat (2019); SPIN (2018) CPCat identifies use of sodium gluconate in adhesive and sealant chemicals. SPIN reports use of sodium gluconate in adhesives and binding agents in Nordic countries. No further information about this use could be found and it is unknown whether this is an ongoing use in the United States. Expected users are industrial based on CPCat's user classification, and unknown due to the limited availability of information on SPIN use.
Anti-freeze and de-icing products	Consumer, commercial	EPA (2017b); CPCat (2019) CDR reports use of sodium gluconate in commercial anti-freeze and de-icing products at concentrations of at least 1 percent but less than 30 percent by weight. CPCat identifies sodium gluconate in consumer anti-freeze and de-icing products. Expected users are commercial based on CDR's consumer/commercial classification and consumer based on CPCat's user classification.
Paper products	Unknown	Synapse Information Resources (n.d.) Synapse Information Resources identifies use of sodium gluconate as a sequestrant and chelating agent in paper. No further information about this use could be found and it is unknown whether this is an ongoing use in the United States. Expected users are unknown, due to the limited availability of information.

Table A.3: Uses of Sodium Gluconate		
Use	**Expected Users**	**Description of Use and References**
Plastic and rubber products	Consumer, commercial	EPA (2017b) CDR reports use of liquid and solid sodium gluconate in plastic and rubber products not covered elsewhere, at concentrations of at least 1 percent but less than 30 percent by weight. Expected users are consumer and commercial based on CDR's consumer/commercial classification.
Processing aid	Industrial	CPCat (2019); CPCat identifies use in unspecified industrial processing aids. Expected users are industrial based on CPCat's user classification.
Stabilizers	Unknown	SPIN (2018) SPIN identifies use of sodium gluconate in stabilizers in Nordic countries. Stabilizers are typically used to prevent degradation through heat and light. No further information about this use could be found and it is unknown whether this is an ongoing use in the United States. Expected users are unknown, due to the limited availability of information.
Surfactant	Industrial	CPCat (2019); Kim et al. (2016); SPIN (2018) CPCat and PubChem identify use in unspecified industrial surface-active agents. SPIN reports use of sodium gluconate in surface active agents in Nordic countries. No further information about this use could be found and it is unknown whether this is an ongoing use in the United States. Expected users are industrial based on CPCat's user classification.

Table A.3: Uses of Sodium Gluconate		
Use	**Expected Users**	**Description of Use and References**
Textiles	Unknown	Synapse Information Resources (n.d.); NLM (2018a); SPIN (2018); Hydrite Chemical (2018) Synapse Information Resources identifies use of sodium gluconate in hide tanning, as a sequestrant and chelating agent in textiles and leather, and as a mordant for fabrics. Hydrite Chemical identifies use as a textile dye. HazMap identifies use of sodium gluconate in textile bleach stabilization and generally in the tanning and textile industries. SPIN reports use of sodium gluconate in textile finishing and manufacturing, as well as washing and cleaning of textile and fur products, in Nordic countries. No further information about this use could be found and it is unknown whether this is an ongoing use in the United States. Expected users are unknown, due to the limited availability of information.
Non-TSCA Uses		
Baby shampoo	Consumer	EWG (2018) EWG generally includes consumer products; therefore, the expected users are consumer.
Bar soap	Consumer	EWG (2018) EWG generally includes consumer products; therefore, the expected users are consumer.
Body wash/cleanser	Consumer	EWG (2018) EWG generally includes consumer products; therefore, the expected users are consumer.
Bubble bath	Consumer	EWG (2018) SkinDeep identifies one bubble bath product that contains sodium gluconate, however this product is not currently for sale. EWG generally includes consumer products; therefore, the expected users are consumer.

Table A.3: Uses of Sodium Gluconate		
Use	**Expected Users**	**Description of Use and References**
Dental care	Unknown	Synapse Information Resources (n.d.) Synapse Information Resources identifies unspecified use of sodium gluconate in dental care. No further information about this use could be found and it is unknown whether this is an ongoing use in the United States. Expected users are unknown, due to the limited availability of information.
Electrolyte supplement	Unknown	DrugBank (2018); Med-Plus Inc. (2018) DrugBank identifies use of sodium gluconate in intravenous electrolyte nutrient supplements. Expected users are unknown, due to the limited availability of information.
Eye cream	Consumer	EWG (2018) EWG generally includes consumer products; therefore, the expected users are consumer.
Face wash	Consumer	EWG (2018) EWG generally includes consumer products; therefore, the expected users are consumer.
Facial moisturizer	Consumer	EWG (2018) EWG generally includes consumer products; therefore, the expected users are consumer.

Table A.3: Uses of Sodium Gluconate		
Use	**Expected Users**	**Description of Use and References**
Food additive	Unknown	FDA (2018); PMP (2014); Synapse Information Resources (n.d.); LANUV (2018); Ullmann's (2016); Hydrite Chemical (2018) FDA identifies sodium gluconate as a flavoring agent or adjuvant, flavor enhancer, nutrient supplement, and sequestrant in its Substances Added to Food inventory. Synapse Information Resources identifies use of sodium gluconate as a sequestrant, chelating agent, nutrient, mineral source, and bitterness inhibitor in dairy, diet foods, and meat products. Hydrite Chemical, PMP and Ullmann's also identify use of sodium gluconate in foods. LANUV reports use of sodium gluconate as an antioxidant and emulsifying salt in foods in Germany. No further information about this use could be found and it is unknown whether this is an ongoing use in the United States. Expected users are unknown, due to the limited availability of information.
Food-contact solutions	Unknown	Synapse Information Resources (n.d.); EPA (2018c); CPCat (2019); NLM (2018a); Hydrite Chemical (2018) EPA identifies use of sodium gluconate in antimicrobial formulations approved for food-contact surface sanitizing solutions. Hydrite Chemical identifies use in cleaning agents for glass bottles. Synapse Information Resources identifies use of sodium gluconate in food-contact sanitizing solutions and as a sequestrant and chelating agent in bottle washing. No further information about this use could be found and it is unknown whether this is an ongoing use in the United States. Expected users are unknown, due to the limited availability of information.
Hair conditioner	Consumer	EWG (2018) EWG generally includes consumer products; therefore, the expected users are consumer.

Table A.3: Uses of Sodium Gluconate		
Use	**Expected Users**	**Description of Use and References**
Hair removal cream	Consumer	EWG (2018); DeLima Associates (2018c) EWG and CPID generally include consumer products; therefore, the expected users are consumer.
Hair removal spray	Consumer	EWG (2018); DeLima Associates (2015g) EWG and CPID generally include consumer products; therefore, the expected users are consumer.DeLima Associates 2018c
Hair shampoo	Consumer	EWG (2018); DeLima Associates (2011) EWG and CPID generally include consumer products; therefore, the expected users are consumer.
Hair styling gel	Consumer	EWG (2018) EWG generally includes consumer products; therefore, the expected users are consumer.
Hair treatment	Consumer	EWG (2018) EWG generally includes consumer products; therefore, the expected users are consumer.
Hand soap	Consumer	EWG (2018) EWG generally includes consumer products; therefore, the expected users are consumer.
Pesticides (inert)	Unknown	CPCat (2019); EPA (2018c); SPIN (2018) EPA approves use of sodium gluconate in non-food use and as a sequestrant in pre-harvest pesticides. Neither NPIRS nor Cal DPR list sodium gluconate as an active ingredient in pesticides used in the U.S. or California, respectively. Expected users are unknown, due to the limited availability of information.

Table A.3: Uses of Sodium Gluconate		
Use	**Expected Users**	**Description of Use and References**
Makeup primer	Consumer	EWG (2018) EWG generally includes consumer products; therefore, the expected users are consumer.
Makeup remover	Consumer	EWG (2018) EWG generally includes consumer products; therefore, the expected users are consumer.
Mascara	Consumer	EWG (2018) EWG generally includes consumer products; therefore, the expected users are consumer.
Masque	Consumer	EWG (2018) SkinDeep identifies one masque product that contains sodium gluconate, however this product is not currently for sale. EWG generally includes consumer products; therefore, the expected users are consumer.
Moisturizer	Consumer	DeLima Associates (2015c) CPID generally includes consumer products; therefore, the expected users are consumer.
Moisturizer with SPF	Consumer	EWG (2018) EWG generally includes consumer products; therefore, the expected users are consumer.
Plasma injection	Unknown	DrugBank (2018); Health Products Express Inc. (2018) DrugBank identifies use of sodium gluconate in plasma injections. Expected users are unknown, due to the limited availability of information.

Table A.3: Uses of Sodium Gluconate		
Use	**Expected Users**	**Description of Use and References**
Sunscreen	Consumer	EWG (2018); EWG generally includes consumer products; therefore, the expected users are consumer.
Toothpaste	Consumer	EWG (2018); DeLima Associates (2015d) EWG and CPID generally include consumer products; therefore, the expected users are consumer.
Children's Products CDR reports did not include any uses in children's products; however, uses in baby shampoo are found in this table.		
Recycling and Disposal In the 2016 CDR, 29 facilities reported that sodium gluconate was not recycled (e.g., not recycled, remanufactured, reprocessed, or reused). Two facilities reported recycling information as CBI, and one facility withheld this information (EPA 2017b).		
Note(s): 1. Assumed to be a mix of TSCA and non-TSCA products. It is expected that more specifically defined uses in the table are representative of the uses that fall into this category. 2. TSCA product based on the assumption that the chemical is used in the manufacturing of products and not intended to be a component of food.		

A.3 References

American Cleaning Institute (ACI). (2018). CPISI Database. Retrieved from https://www.cleaninginstitute.org/science/ingredients_and_assessments.aspx

California Dept of Pesticide Regulation. (2013). DPR Databases. Retrieved from https://www.cdpr.ca.gov/dprdatabase.htm

Danish EPA. (2018). Danish surveys on chemicals in consumer products. Retrieved from https://eng.mst.dk/chemicals/chemicals-in-products/consumers-consumer-products/danish-surveys-on-consumer-products/

DeLima Associates. (2011). Aveda Smooth Infusion Shampoo. Retrieved from https://www.whatsinproducts.com/types/type_detail/1/11151/standard/Aveda%20Smooth%20Infusion%20Shampoo/01-032-004

DeLima Associates. (2013a). CLR Outdoor Furniture Cleaner, Pump Spray. Retrieved from https://www.whatsinproducts.com/types/type_detail/1/15721/standard/p%3ECLR%20Outdoor%20Furniture%20Cleaner,%20Pump%20Spray-12/12/2013/p%3E/10-006-019

DeLima Associates. (2013b). Focus MP 11 Multi-Purpose Cleaner, Professional Use. Retrieved from https://www.whatsinproducts.com/types/type_detail/1/13839/standard/Focus%20MP%2011%20Multi-Purpose%20Cleaner,%20Professional%20Use/01-038-004

DeLima Associates. (2014a). Easy-Off Professional Heavy Duty Cleaner-Degreaser, Professional Use. Retrieved from https://www.whatsinproducts.com/types/type_detail/1/15937/standard/p%20class=%22p1%22%3Espan%20style=%22color:#008000;%22%3EEasy-Off%20Professional%20Heavy%20Duty%20Cleaner-Degreaser,%20Professional%20Use-12/03/2014/span%3E/p%3E/18-001-677

Delima Associates. (2014b). Zerex Radiator Super Cleaner. Retrieved from https://www.whatsinproducts.com/types/type_detail/1/14543/standard/Zerex%20Radiator%20Super%20Cleaner/22-001-080

DeLima Associates. (2015a). Affresh Coffeemaker Cleaner. Retrieved from https://www.whatsinproducts.com/types/type_detail/1/18765/standard/p%3EAffresh%20Coffeemaker%20Cleaner-08/26/15/p%3E/23-025-001

DeLima Associates. (2015b). Affresh Dishwasher Cleaner. Retrieved from https://www.whatsinproducts.com/types/type_detail/1/18767/standard/p%3EAffresh%20Dishwasher%20Cleaner-08/26/2015/p%3E/23-025-003

DeLima Associates. (2015c). Amore Pedi Perfect Daily Moisturizer. Retrieved from https://www.whatsinproducts.com/types/type_detail/1/16325/standard/p%20class=%22p1%22%3Espan%20class=%22s1%22%3EAmore%20Pedi%20Perfect%20Daily%20Moisturizer-04/01/2015/span%3E/p%3E/18-030-008

DeLima Associates. (2015d). Crest Sensi Repair & Prevent Toothpaste. Retrieved from https://www.whatsinproducts.com/types/type_detail/1/18017/standard/p%20class=%22p1%22%3ECrest%20Sensi%20Repair%20&%20Prevent%20Toothpaste-04/08/2015/p%3E/16-033-376

DeLima Associates. (2015e). Method All-Purpose Cleaner, Clementine, Pump Spray. Retrieved from https://www.whatsinproducts.com/types/type_detail/1/19386/standard/p%3EMethod%20All-Purpose%20Cleaner,%20Clementine,%20Pump%20Spray-05/11/2015/p%3E/13-036-114

DeLima Associates. (2015f). Method Power Dish, Dishwasher Detergent Packs, Free & Clear. Retrieved from https://www.whatsinproducts.com/types/type_detail/1/19373/standard/p%3EMethod%20Power%20Dish,%20Dishwasher%20Detergent%20Packs,%20Free%20&%20Clear-05/26/2015/p%3E/13-036-101

DeLima Associates. (2015g). Nair Men Hair Remover Spray, Aerosol. Retrieved from https://www.whatsinproducts.com/types/type_detail/1/17237/standard/p%20class=%22p1%22%3ENair%20Men%20Hair%20Remover%20Spray,%20Aerosol-12/01/2015/p%3E/03-005-228

DeLima Associates. (2015h). Scrubbing Bubbles Vanish Drop-Ins Toilet Bowl Cleaner. Retrieved from https://www.whatsinproducts.com/types/type_detail/1/16608/standard/p%20class=%22p1%22%3EScrubbing%20Bubbles%20Vanish%20Drop-Ins%20Toilet%20Bowl%20Cleaner-02/24/2015/p%3E/19-001-628

DeLima Associates. (2016). Zep Foaming Garbage Disposal Cleaner-ZUGDF19, Aerosol, Professional Use. Retrieved from https://www.whatsinproducts.com/types/type_detail/1/20332/standard/p%20class=%22p1%22%3EZep%20Foaming%20Garbage%20Disposal%20Cleaner-ZUGDF19,%20Aerosol,%20Professional%20Use-08/03/2016/p%3E/26-006-010

DeLima Associates. (2017a). Method Heavy Duty Degreaser, Lemongrass, Pump Spray. Retrieved from https://www.whatsinproducts.com/types/type_detail/1/19404/standard/p%3EMethod%20Heavy%20Duty%20Degreaser,%20Lemongrass,%20Pump%20Spray-04/13/2017/p%3E/13-036-138

DeLima Associates. (2017b). Simple Green Laundry, Sunshine Fresh. Retrieved from https://www.whatsinproducts.com/types/type_detail/1/19140/standard/p%3ESimple%20Green%20Laundry,%20Sunshine%20Fresh-02/15/2017/p%3E/19-006-112

DeLima Associates. (2018a). Consumer Product Information Database. Retrieved from https://www.whatsinproducts.com/

DeLima Associates. (2018b). Seventh Generation Glass & Surface Natural Cleaner, Free & Clear, Pump Spray. Retrieved from https://www.whatsinproducts.com/types/type_detail/1/20434/standard/p%20class=%22p1%22%3ESeventh%20Generation%20Glass%20&%20Surface%20Natural%20Cleaner,%20Free%20&%20Clear,%20Pump%20Spray-01/22/2018/p%3E/19-039-094

DeLima Associates. (2018c). Veet 3-In-1 Facial Hair Cream Kit, Hair Removal Cream. Retrieved from https://www.whatsinproducts.com/types/type_detail/1/21150/standard/p%20class=%22p1%22%3EVeet%203-In-1%20Facial%20Hair%20Cream%20Kit,%20Hair%20Removal%20Cream-06/13/2018/p%3E/18-030-051

Descartes Datamyne. (2018). Descartes Datamyne Import-Export Database.

Dionisio, K. L., Frame, A. M., Goldsmith, M.-R., Wambaugh, J. F., Liddell, A., Cathey, T., . . . Judson, R. S. (2015). Exploring consumer exposure pathways and patterns of use for chemicals in the environment. *Toxicology Reports, 2*, 228-237. doi:http://dx.doi.org/10.1016/j.toxrep.2014.12.009

Diversey Inc. (2017). Safety Data Sheet. Retrieved from https://sds.diversey.com/private/document.aspx?prd=MS0800391~~PDF~~MTR~~ANGH~~EN~~

DrugBank. (2018). Gluconic Acid. Retrieved from https://www.drugbank.ca/drugs/DB13180

European Chemicals Agency (ECHA). (2018). Registered substances. Retrieved from https://echa.europa.eu/information-on-chemicals/registered-substances?p_p_id=dissregisteredsubstances_WAR_dissregsubsportlet&p_p_lifecycle=1&p_p_state=normal&p_p_mode=view&p_p_col_id=column-1&p_p_col_pos=1&p_p_col_count=2&_dissregisteredsubstances_WAR_dissregsubsportlet_javax.portlet.action=dissRegisteredSubstancesAction

EWG. (2018). Sodium Gluconate. Retrieved from https://www.ewg.org/skindeep/ingredient/706067/SODIUM_GLUCONATE/#.W6Avs3tKhhE

GE Betz Inc. (2010). Material Safety Data Sheet. Retrieved from http://files.dep.state.pa.us/Water/Wastewater%20Management/EDMRPortalFiles/Chemical_Additives/MSDS/795.pdf

GoodGuide. (2011). Scorecard: The Pollution Information Site. Retrieved from http://scorecard.goodguide.com/chemical-profiles/summary.tcl?edf_substance_id=+527-07-1#use_profile

Government of Canada. (2018). Chemical Substances: Services and Information. Retrieved from https://www.canada.ca/en/health-canada/services/chemical-substances.html

Health Products Express Inc. (2018). Plasma-Lyte 148 Injection Solution. Retrieved from https://www.healthproductsexpress.com/plasma-lyte-148-injection-solution-by-baxter-healthcare?BHL2B2534XH&gclid=Cj0KCQjwuafdBRDmARIsAPpBmVVW6a3kzD1scIzBVa1NOr_FSLK1omsfeYSQIO87XhKxlocji6UU-lwaAqD-EALw_wcB

Hillyard Industries. (2012). Material Safety Data Sheet. Retrieved from http://www.doraziocleaningsupply.com/v/vspfiles/files/msds/Hillyard%20Carpet%20Pre-Spray%20Extraction%20MSDS.pdf

Hydrite Chemical. (2018). SODIUM GLUCONATE. Retrieved from https://www.hydrite.com/Product/industrial/Sodium-Gluconate.htm

Kim, S., Thiessen, P. A., Bolton, E. E., Chen, J., Fu, G., Gindulyte, A., . . . Bryant, S. H. (2016). PubChem Substance and Compound databases. *Nucleic Acids Research, 44*(Database issue), D1202-D1213. doi:10.1093/nar/gkv951

Kirk-Othmer. (2004). Electroplating. Retrieved from https://onlinelibrary.wiley.com/doi/10.1002/0471238961.0512050308151814.a01.pub2

Kirk-Othmer. (2006). Kirk-Othmer Encyclopedia of Chemical Technology.

Kirk-Othmer. (2015). Paint and Finish Removers. Retrieved from https://onlinelibrary.wiley.com/doi/10.1002/0471238961.1601091423080920.a01.pub3

Med-Plus Inc. (2018). Hyperlyte CR Multi-Electrolyte Concentrate. Retrieved from https://www.medpluspro.com/additives-for-parenteral-nutrition.html?gclid=Cj0KCQjwuafdBRDmARIsAPpBmVWRVhNgEZRFERSGgjAM_kl5T2HbGn4hWod1eYVgqsg-4OWm3MSAFOsaAquOEALw_wcB

Organisation for Economic Cooperation and Development (OECD). (2018). eChemPortal: Global Portal to Information on Chemical Substances. Retrieved from https://www.echemportal.org/echemportal/index.action

PMP Fermentation Products Inc. (PMP). (2014). Safety Data Sheet. Retrieved from http://www.pmpinc.com/Documents/Sodium%20Gluconate%20FCC%20GHS.PDF

Sherlock, Scott. (2019). Email. 527-07-1 FW_TSCA Low Priority Chemical Review Processes CBI Review. July 9.

Sigma-Aldrich. (2018). Safety Data Sheet. Retrieved from https://www.sigmaaldrich.com/MSDS/MSDS/DisplayMSDSPage.do?country=US&language=en&productNumber=G9005&brand=SIGMA&PageToGoToURL=https%3A%2F%2Fwww.sigmaaldrich.com%2Fcatalog%2Fsearch%3Fterm%3D527-07-1%26interface%3DCAS%2520No.%26N%3D0%2B%26mode%3Dpartialmax%26lang%3Den%26region%3DUS%26focus%3Dproduct

State Agency for Nature Environment and Consumer Protection (LANUV). (2018). Sodium Gluconate. Retrieved from https://www.google.com/search?q=landesamt+fuer+natur+umwelt+und+verbraucherschutz+nrw&rlz=1C1GGRV_enUS751US751&oq=lan&aqs=chrome.0.69i59j69i57j69i61j69i60l2j35i39.4294j0j7&sourceid=chrome&ie=UTF-8

Substances in Preparations in Nordic Countries (SPIN). (2018). NATRIUMSALT AF D-GLUCONSYRE. Retrieved from http://www.spin2000.net/spinmyphp/

Synapse Information Resources. (n.d.). *Synapse Information Resources*. Retrieved from: Excel file.

U.S. Environmental Protection Agency (EPA). (2002). 1986-2002 Historical IUR Data. Retrieved from Excel File

U.S. Environmental Protection Agency (EPA). (2006). 2006 IUR Public Database.

U.S. Environmental Protection Agency (EPA). (2017a). *Functional Use Database (FUse)*. Retrieved from: https://catalog.data.gov/dataset/functional-use-database-fuse

U.S. Environmental Protection Agency (EPA). (2017b). Non-Confidential 2016 Chemical Data Reporting (CDR). Retrieved from https://www.epa.gov/chemical-data-reporting

U.S. Environmental Protection Agency (EPA). (2018a). ChemView. Retrieved from https://chemview.epa.gov/chemview

U.S. Environmental Protection Agency (EPA). (2018b). Envirofacts Multisystem Search. Retrieved from https://www3.epa.gov/enviro/facts/multisystem.html

U.S. Environmental Protection Agency (EPA). (2018c). InertFinder. Retrieved from https://iaspub.epa.gov/apex/pesticides/f?p=INERTFINDER:3:::NO::P3_ID:6597

U.S. Environmental Protection Agency (EPA). (2018d). Look up table for BR Waste Code (National Biennial RCRA Hazardous Waste Report). Retrieved from https://iaspub.epa.gov/enviro/brs_codes_v2.waste_lookup

U.S. Environmental Protection Agency (EPA). (2018e). Safer Chemical Ingredients List. Retrieved from https://www.epa.gov/saferchoice/safer-ingredients

U.S. Environmental Protection Agency (EPA). (2018f). TRI-Listed Chemicals. Retrieved from https://www.epa.gov/toxics-release-inventory-tri-program/tri-listed-chemicals

U.S. Food and Drug Administration (FDA). (2018). Substances Added to Food. Retrieved from https://www.accessdata.fda.gov/scripts/fdcc/index.cfm?set=FoodSubstances&id=SODIUMGLUCONATE

U.S. National Library of Medicine (NLM). (2018a). Haz-Map®: Information on Hazardous Chemicals and Occupational Diseases. Retrieved from https://hazmap.nlm.nih.gov/category-details?table=copytblagents&id=17569

U.S. National Library of Medicine (NLM). (2018b). TOXNET Hazardous Substances Data Bank. Retrieved from https://toxnet.nlm.nih.gov/cgi-bin/sis/search2

U.S. Patent and Trademark Office (USPTO). (2018). USPTO Patent Full-Text and Image Database. Retrieved from http://patft.uspto.gov/netacgi/nph-Parser?Sect1=PTO2&Sect2=HITOFF&p=1&u=%2Fnetahtml%2FPTO%2Fsearch-bool.html&r=0&f=S&l=50&TERM1=sodium+gluconate&FIELD1=&co1=AND&TERM2=&FIELD2=&d=PTXT

Ullmann's. (2000). ULLMANN'S Encyclopedia of Industrial Chemistry.

Ullmann's. (2010). Dry Mortars. Retrieved from https://onlinelibrary.wiley.com/doi/10.1002/14356007.f16_f01.pub2

Ullmann's. (2014). Thin Films. Retrieved from https://onlinelibrary.wiley.com/doi/10.1002/14356007.a26_681.pub2

Ullmann's. (2016). Foods, 3. Food Additives. Retrieved from https://onlinelibrary.wiley.com/doi/10.1002/14356007.a11_561.pub2

Washington State Dept. of Ecology. (2018). Children's Safe Product Act Reported Data. Retrieved from https://fortress.wa.gov/ecy/cspareporting/

Appendix B: Hazard Characterization

Table B.1: Human Health Hazard

ADME						
Source	**Exposure Route**	**Species & strain (if available)**	**Duration**	**Doses and replicate number**	**Effect**	**Study Details**
4940231, 4940243	Oral (gavage)	Wistar rats	Single dose	**Dose:** 800 mg/kg **Replicates:** 9-23 fasted male rats	After 5 hours, radioactivity was reported to be 12.1% (exhaled carbon dioxide) 19.7% (whole body), 44.9% (intestine and feces) and 5.0% (urine)	• Test substance reported as CASRN 527-07-1 • Purity not reported • OECD Guideline 417 • GLP compliance not reported
Acute Mammalian Toxicity						
Source	**Exposure Route**	**Species & strain (if available)**	**Duration**	**Doses and replicate number**	**Effect**	**Study Details**
4947904	Oral (gavage)	Sprague-Dawley rats	Single exposure, 14-day observation	**Doses:** 500, 1000, and 2000 mg/kg **Replicates:** 5 per sex per dose	**LD_{50}** > 2000 mg/kg No mortality	**Methods**: • Test substance reported as CASRN 527-07-1 • Purity not reported • GLP compliance not reported
2072857	Oral	Sprague-Dawley rats	Single exposure	**Doses**: 500, 1000, and 2000 mg/kg **Replicates**: 10 animals (# per dose unspecified)	**LD_{50}** > 2000 mg/kg No mortality	**Methods**: • Test substance identified as CASRN 527-07-1 • Purity not reported • GLP compliance not reported
4940240	Dermal	Sprague-Dawley rats	24 hours observed for 14 days	**Dose:** 2000 mg/kg **Replicates:** 5 per sex	**LD_{50}** > 2000 mg/kg	**Methods**: • Test substance reported as CASRN 526-95-4 • Purity reported 54.4% • OECD Guideline 402 • GLP compliant

Table B.1: Human Health Hazard						
Repeated Dose Toxicity						
Source	**Exposure Route**	**Species & strain (if available)**	**Duration**	**Doses and replicate number**	**Effect**	**Study Details**
4947904, 2072857	Oral (gavage)	Sprague-Dawley rats	28 days	**Doses:** 0, 500, 1000, and 2000 mg/kg-day **Replicates:** 12 per sex per dose	**NOAEL**: 500 mg/kg-day **LOAEL**: 1000 mg/kg-day based on increased relative kidney weight	**Methods**: • Test substance reported as CASRN 527-07-1 • Purity not reported • Method and GLP not reported **Results:** • Urinalysis showed increased sodium excretion at 2000mg/kg-day (both sexes) • Increased relative kidney weight was observed in males ≥ 1000 mg/kg-day • Increased absolute adrenal weight was seen in males at 1000 mg/kg-day but not 2000mg/kg-da • Increased thickening of the limiting ridge of the stomach was observed in 5/12 males at 2000 mg/kg-day • Study authors considered lesions to not to be toxicologically significant for humans because the limiting ridge is tissue specific to rodents.
4947904, 2072857	Oral	Sprague-Dawley rats	28 days	**Doses**: 0, 1000, 2000 and 4100 (M) and 4400 (F) mg/kg-day **Replicates**: 10 per sex per dose	**NOAEL**: 4100 mg/kg-day	**Methods**: • Test substance reported as CASRN 527-07-1 • Purity not reported • GLP compliance not reported **Results:** • A transient decrease in feed efficiency (males 4100 mg/kg-day) was observed at week 4 but was not different overall, so it was not considered an adverse effect • Water intake increased (26%) in 4100 mg/kg-day males, but not females. This was not considered an adverse effect

Table B.1: Human Health Hazard						
						• Decreased prothrombin times were observed in males at 2000 and 4100 mg/kg-day. The study authors did not consider this an adverse effect • Urinary changes were observed in both treated and control groups and was attributed to sodium. Increased urinary ketone bodies were observed in 2000 mg/kg-day, but not 4100 mg/kg-day males • Increased relative kidney weights were observed in males at 4100 mg/kg/d and in females at 2000 mg/kg/d, but not 4400 mg/kg-day. Given the above effects and non-dose dependent nature, this was not considered an adverse effect for this study
2072857	Oral	Beagle dogs	4 weeks	**Doses:** 0, 500, 1000, and 2000 mg/kg-day **Replicates:** 4 per sex per dose	**NOAEL**: 500 mg/kg-day **LOAEL**: 1000 mg/kg-day based on watery stools and vomiting	**Methods**: • Test substance reported as CASRN 527-07-1 • Purity not reported • GLP compliance not reported **Results:** • No animals died. • Significant increases in the frequency of vomiting and passage of loose or watery stools was observed in the 1,000 and 2,000 mg/kg-day groups

Table B.1: Human Health Hazard						
Reproductive Toxicity						
Source	**Exposure Route**	**Species & Strain (if available)**	**Duration**	**Doses and replicate number**	**Effect**	**Study Details**
4864285	Oral (gavage)	Wistar rats	8 weeks • Dosing began 2 weeks prior to mating • Dosing continued, through gestation to lactation day 5 (for females)	**Doses:** 0, 30, 300, and 1000 mg/kg-day **Replicates**: 12 per sex per group	**NOAEL**: 1000 mg/kg-day	**Methods:** • Test substance reported as CASRN 31138-65-5 • Purity: 49.5% • OECD Guideline 422 • GLP compliant
Developmental Toxicity						
Source	**Exposure Route**	**Species & Strain (if available)**	**Duration**	**Doses and replicate number**	**Effect**	**Study Details**
4947912, 4940251, 4947704	Oral (gavage)	Albino CD-1 mice	GD 6-15	**Doses:** 0, 6.95, 32.5, 150 and 695 mg/kg-day **Replicates:** 21-25 per dose	**NOAEL:** 695 mg/kg-day	**Methods** • Test substance reported as CASRN 90-80-2 • Purity not reported • OECD Guideline 414 • Pre-dates GLP
4947912, 4940249, 4947704	Oral (gavage)	Golden outbred hamsters	GD 6-10	**Doses:** 0, 5.6, 26, 121, and 560 mg/kg-day **Replicates:** 20-25 per dose	**NOAEL:** 560 mg/kg-day	**Methods** • Test substance reported as CASRN 90-80-2 • Purity not reported • Equivalent or similar to OECD Guideline 414 • Pre-dates GLP

Table B.1: Human Health Hazard						
4947912, 4940230, 4947704	Oral (gavage)	Dutch rabbits	GD 6-18	**Doses:** 0, 7.8, 32.2, 168 and 780 mg/kg-day **Replicates:** 10-13 per dose	**NOAEL:** 780 mg/kg-day	**Methods** • Test substance reported as CASRN 90-80-2 • Purity not reported • OECD Guideline 414 • Pre-dates GLP
4947912, 4940250, 4947704	Oral (gavage)	Wister rat	GD 6-15	**Doses:** 0, 5.94, 27.6, 128 and 594 mg/kg-day **Replicates:** 21-25 per dose	**NOAEL:** 594 mg/kg-day	**Methods** • Test substance reported as CASRN 90-80-2 • Purity not reported • GLP not reported
4864283	Oral (gavage)	Wistar Han rats	8 weeks • Dosing began 2 weeks prior to mating • Dosing continued, through gestation to lactation day 5 (for females)	**Doses:** 0, 30, 300, and 1000 mg/kg-day **Replicates**: 12 per sex per group	**NOAEL:** 1000 mg/kg-day	**Methods:** • Test substance reported as CASRN 31138-65-5. • Purity: 50.5% • OECD Guideline 422 • GLP compliant **Endpoints:** • Developmental endpoints evaluated included litter parameters (live birth and viability indices, sex ratio, offspring weight, and assessment of surface righting reflex. No fetal visceral or skeletal exams performed
Cancer						
Source	**Effect**					**Study Details**
OncoLogic v8.0	OncoLogic currently has no assessment criteria regarding sugar derivatives.					Structure could not be evaluated by Oncologic.
ISS v2.4[46]	Negative (Estimated)					**Methods:**

[46] Carcinogenicity alerts by ISS profiler comprises 55 structural alerts for genotoxic and non-genotoxic carcinogenicity. The alerts have been compiled upon existing knowledge of the mechanism of action of carcinogenic chemicals that have been published elsewhere (Benigni and Bossa (2011) *Chem Rev* 111: 2507-2536 and Benigni R et al. (2013) *Chem Rev.* 113: 2940-2957).

Table B.1: Human Health Hazard		
	D-Gluconic acid is a multi-hydroxy acid which does not contain any structural features indicative of electrophilic potential.	Carcinogenicity alerts (genotoxic and non-genotoxic) by ISS profiler as available within the OECD Toolbox v4.3 **Results:** No alerts were identified for the parent structure (an aldehyde and a butyl diester alert are flagged for its metabolites)
VEGA 1.1.4[47]	D-Gluconic acid was processed through all 4 models. ISS 1.0.2 and IRFMN/ISSCAN-GX 1.0.0 predicted the acid to be non-carcinogenic with moderate reliability.	**Methods:** VEGA 1.1.4 contains 4 models for carcinogenicity – CAESAR 2.1.9, ISS 1.0.2, IRFMN/Antares 1.0.0, IRFMN/ISSCAN-GX 1.0.0 **Results:** • CAESAR 2.1.9: Low reliability (D-Gluconic acid lies outside of the applicability domain (AD) of the model) • ISS 1.0.2: Moderate reliability (D-Gluconic acid could be outside of the AD) • IRFMN/Antares 1.0.0: Low reliability (D-Gluconic acid lies outside of the AD) • IRFMN/ISSCAN-GX 1.0.0: Moderate reliability (D-Gluconic acid could be outside of the AD)

[47] VEGA 1.1.4 contains 4 different models to facilitate an *in silico* assessment of carcinogenicity potential. The models are summarized in Golbamaki et al. (2016) J Environ Sci and Health Part C http://dx.doi.org/10.1080/10590501.2016.1166879 as well as in documentation that is downloadable from within the VEGA tool itself (https://www.vegahub.eu/).

- CAESAR 2.1.9 is a classification model for carcinogenicity based on a neural network.
- ISS 1.0.2 is a classification model based on the ISS ruleset (as described above for the OECD Toolbox).
- IRFMN/Antares 1.0.0 and IRFMN/ISSCAN-GX 1.0.0 are classification models based on a set of rules built with SARpy software (part of the same suite of VEGA tools https://www.vegahub.eu/) extracted from the Antares and ISSCAN-CGX datasets respectively.

Table B.1: Human Health Hazard						
Genotoxicity						
Source	**Exposure Route**	**Species & Strain (if available)**	**Duration**	**Doses and replicate number**	**Effect**	**Study Details**
4947765, 2072857	Gene mutation (*in vitro*)	*Salmonella typhimurium* strains TA1535, TA1537, and TA1538	With and without	**Doses:** 0.0006, 0.0012, and 0.0024% substance	Negative	**Methods**: • Test substance reported as CASRN 527-07-1 • Purity not reported • OECD 472 • Non-GLP compliant **Results:** • Cytotoxicity was observed at 0.0024%
4947765, 2072857	Gene mutation (*in vitro*)	*Saccharomyces cerevisiae* strain D4	With and without	**Doses:** 1.25%, 2.5%, and 5% substance	Negative	**Methods**: • Test substance reported as CASRN 527-07-1 • Purity not reported • OECD Guideline 472 • Non- GLP compliant **Results:** • Cytotoxicity was observed at 5%
2072857	Chromosomal aberrations (*in vivo)*	C57BL mice	With	**Doses:** 0, 2500, 5000, and 1000 mg/kg-day for 1 day, and 1250 and 2500 mg/kg-day for 4 consecutive days	Negative	**Methods**: • Test substance reported as CASRN 527-07-1 • Purity not reported • GLP not reported **Results:** • In the single dose groups, all mice in the 5,000 and 10,000 mg/kg groups died. Only two mice in the 2,500 mg/kg dose could be evaluated due to technical issues. Sodium gluconate induced chromosomal aberrations at a rate of 0.5% which was comparable to controls

Table B.1: Human Health Hazard						
						• In the 1250 mg/kg-day and 2500 mg/kg-day animals, one mouse in each treatment group died. Chromosomal aberrations in surviving animals were similar to the negative controls. The test substance was considered non-genotoxic
Sensitization						
Source	**Exposure Route**	**Species & Strain (if available)**	**Duration**	**Doses and replicate number**	**Effect**	**Study Details**
4940232	Dermal	CBA/CaOlaHsd mice	5 days	**Doses:** 25 µL of 25, 50, and 100% concentration in dimethyl formamide **Replicates:** 4 per dose	Negative	**Methods**: • Test substance reported as CASRN 526-95-4 • Purity reported as 54.4% • OECD Guideline 429 • GLP compliant
4864280	Dermal	CBA mice	3 day	**Doses**: 25 µL of 25%, 50%, and 100% substance **Replicates**: 4 per group	Not sensitizing	**Methods:** • Test substance reported as CASRN 31138-65-5 • Purity not reported • OECD Guideline 429 • GLP compliant **Results:** • Stimulation index was 0.93, 0.86, and 0.61 at 25%, 50% or 100% substance, respectively
Irritation						
Source	**Exposure Route**	**Species & Strain (if available)**	**Duration**	**Doses**	**Effect**	**Study Details**
4940239	Dermal	New Zealand White rabbits	Exposures after 3 minutes, 1 hour, and 4 hours; observed for 72 hours	**Dose:** 0.5 mL undiluted test substance **Replicates:** 3 rabbits	Negative	**Methods**: • Test substance reported as CASRN 526-95-4 • Purity reported as 54.4% • Based on EU Method B.4 • GLP compliant

Table B.1: Human Health Hazard						
				• 2/3 rabbits were exposed for 4 hours (single dose) • 1/3 rabbits were exposed after 3 minutes, 1 hour, and 4 hours (three doses)		
2072857	Dermal	Albino rabbits	4-hour exposure observed for 72 hours	**Dose:** 0.5 mL undiluted test substance **Replicates:** 12 rabbits	Negative	**Methods**: • Test substance reported as CASRN 526-95-4 • Purity not reported • Test method: 'Directive 79/831/EEC, B.4. "Acute toxicity" (skin irritation)' • GLP compliance not reported **Endpoints:** • Erythema was observed in 3/6 animals 1-hour post exposure and in 1/6 animals through 48 hours post exposure
4940242	Ocular	New Zealand White rabbits	Single exposure observed for 72 hours	**Dose:** 0.1 mL test material **Replicates:** 3 rabbits	Positive	**Methods**: • Test substance reported as CASRN 526-95-4 • Purity 54.4% • OECD Guideline 405 • GLP compliance not reported **Endpoints:** • At 1 hour, chemosis and conjunctival redness were mild-moderate or moderate to severe in all animals. 2 animals exhibited lacrimation, iris lesions, and 1 animal had corneal lesion

Table B.1: Human Health Hazard						
						• At 24 hours, one animal had severe chemosis, lacrimation and conjunctival redness with lesions of iris and cornea whereas the other 2 animals had slight to minimal effects • At 48 hours, 1 animal had chemosis, lacrimation, conjunctival redness, iris lesions, and corneal lesions • At 72 hours, slight chemosis and conjunctival redness persisted in one animal • All effects were fully reversible • D-gluconic acid was considered mildly irritating
2072857	Ocular	New Zealand White albino rabbits	Single exposure observed for up to 7 days	**Dose:** 0.1 mL of 50% test substance **Replicates**: 9 rabbits	Negative	**Methods**: • Test substance reported as CASRN 526-95-4 • Purity not reported • Test method: Draize Test • GLP compliance not reported **Endpoints:** • Some redness and chemosis of the conjunctivae, irritation of the iris and discharge were observed 1-hour post exposure • Conjunctivae redness and chemosis were also observed at 24 and 48 hours post exposure • All effects were reversed by 72 hours • D-gluconic acid was considered non-irritating
2077994	Ocular	Bovine	4 hours	**Dose:** 0.75 mL of 20% suspension of test material **Replicates:** 6	Severely irritating	**Methods**: • Test substance reported as CASRN 90-80-2 • Purity not reported • According to bovine corneal opacity and permeability assay based on the method of Muir (1984)

Table B.1: Human Health Hazard						
						• GLP not reported **Endpoints:** • Corneal opacity scores were evaluated before and after treatment. • Scores from each laboratory were: 63, 81, 90, 62, 108, 66, 90, 57, 88, 75, 63 and an average score of 76.6. Therefore, the in vitro classification of this test material is a severe irritant. • Note: Scoring classification: score 0-25= mild irritant; 25.1-55 = moderate irritant; ≥55.1 = severe irritant.
Neurotoxicity						
Source	**Exposure Route**	**Species & Strain (if available)**	**Duration**	**Doses**	**Effect**	**Study Details**
2540871	Oral (drinking water)	Wistar rats	30 days	**Doses:** 0 or 1% of substance **Replicates**: 10 males per group	Negative	**Methods**: • Test substance reported as CASRN 299-28-5 • Purity not reported • GLP not reported
4941088	Oral (drinking water)	Wistar rats	3 days	**Doses:** 0 or 1% of substance **Replicates:** 50 males per group	Negative	**Methods**: • Test substance reported as CASRN 299-28-5 • Purity not reported • GLP not reported

Table B.2: Environmental Hazard					
Aquatic Toxicity: Experimental					
Source	**Species & strain (if available)**	**Duration**	**Doses and replicate number**	**Effect**	**Study Details**
4940263, 2072857	*Oryzias latipes*	96 hours	**Dose:** 100 mg/L (nominal)	**LC_{50} >** 100 mg/L	**Methods**: • Test substance reported as CASRN 527-07-1 • Purity: 99.6% • OECD Guideline 203 • GLP compliant **Results:**

Table B.2: Environmental Hazard					
					• No deaths, no behavioral abnormalities, no symptoms of toxicity observed
4940259, 2072857	*Daphnia magna*	48 hours	**Dose:** 1000 mg/L (nominal)	**EC_{50}** > 1000 mg/L	**Methods**: • Test substance reported as CASRN 527-07-1 • Purity: 99-101% • OECD Guideline 202 • GLP compliant **Results:** • No immobility or mortality in test vessels
2072857	*Daphnia magna*	48 hours	**Dose**: 1000 mg/L (nominal)	**EC_{50}** > 1000 mg/L	**Methods**: • Test substance reported as CASRN 527-07- • Purity: 99.6% • OECD Guideline 202 • GLP compliant **Results:** • No immobility or mortality
4940257	*Scenedesmus subspicatus*	72 hours	**Dose:** 100 mg/L (nominal)	**EC_{50}** < 100 mg/L	**Methods:** • Test substance reported as CASRN 527-07-1 • Purity: 99-101% • OECD Guideline 201 • GLP compliant **Results:** • 70% inhibition at 100 mg/L (nominal, biomass) and 42% inhibition at 100 mg/L (nominal, growth rate)
2072857	*Selenastrum capricornutum*	72 hours	**Doses:** 0, 100, 180, 320, 560, and 1000 mg/L (nominal)	**EC_{50}** > 1000 mg/L	**Methods:** • Test substance reported as CASRN 527-07-1 • Purity: 99.6% • OECD Guideline 201 • GLP compliant **Results:** • NOEC: 560 mg/L (nominal, growth rate)
Aquatic Toxicity: Estimated					
Model	**Endpoint**	**Species**	**Predicted Effect Level**	**Notes**	
ECOSAR (Class; Neutral Organics)	ChV	Algae	3.8E+4 mg/L	Input SMILES: O=C(O)C(O)C(O)C(O)C(O)CO. Experimental input values: Water Solubility = 316000 mg/L; MP = 131 C.	
ECOSAR (Class: Neutral Organics)	ChV	Invertebrates	6.9E+4 mg/L	Input SMILES: O=C(O)C(O)C(O)C(O)C(O)CO. Experimental input values: Water Solubility = 316000 mg/L; MP = 131 C.	

Table B.2: Environmental Hazard				
ECOSAR (Class: Neutral Organics)	ChV	Aquatic vertebrates	3E+5 mg/L	Input SMILES: O=C(O)C(O)C(O)C(O)C(O)CO. Experimental input values: Water Solubility = 316000 mg/L; MP = 131 C.

Table B.3: Fate					
Environmental Fate: Experimental					
Source	**Endpoint**	**Duration**	**Doses and number of replicates**	**Results**	**Study Details**
2072857	ThOD	28 day	**Dose:** 3 mg/L	Readily biodegradable, 10-day window met	**Methods**: • Test substance reported as CASRN 527-07-1 • Purity: 99-101% • Test method: Directive 92/69/EEC, C.4-E and OECD Guideline 301D • GLP compliant **Results:** • Degradation kinetics: 3 days (61.13%); 7 days (74.35%); 14 days, (66.09%), 21 days (71.94%), 28 days, (88.88%)
2072857	Anaerobic mineralization	35 days	**Dose:** 303 mg/L	100% degradation after 35 days (based on net-mass carbon)	**Methods**: • Test substance reported as CASRN 527-07-1 • Purity not reported • Test method: DIN EN ISO 11734 • GLP compliant **Results:** • Degradation kinetics: 1 days (8%); 8 days (51%); 15 days (57%), 22 days (61%), 35 days (100%), when accounting for biogas production and dissolved inorganic carbon (DIC)
2072857	Other: absorption mechanisms (sorption to gibbsite mineral)	NA	**Doses**: 1 and 100 mmol/L	Results indicate that electrostatic interaction is the primary mechanism at low pH, hydrophilic interactions at intermediate pH and inner sphere complex	**Methods**: • Test substance CASRN 527-07-1 • Purity: 99.4%, • Method: Batch sorption experiment **Notes:** • Sorption kinetics best described as two-site Langmuir isotherm based on experimental equilibration ○ Sorption constants: K_f = 9.33±0.78. 7.48±0.77, 1.2±0.25, and 2.91±0.36 mmol-L/Kg at pH 4, 7, 9, and 12, respectively; ○ Distribution constant K_d = 41.8 L/Kg at pH 13.3

Table B.3: Fate					
				formation at high pH.	
Experimental Fate: Modelled					
Model	**Data Type**	**Endpoint**	**Predicted Endpoint**	**Notes**	
EPI Suite v4.11	Estimation	BCF	3.16	EPI Suite Physical Property Inputs - WS = 590000 mg/L, SMILES: [Na]OC(=O)C(O)C(O)C(O)C(O)C(O)C(O)	
EPI Suite v4.11	Estimation	BAF	0.89	EPI Suite Physical Property Inputs - WS = 590000 mg/L, SMILES: [Na]OC(=O)C(O)C(O)C(O)C(O)C(O)C(O)	

B.1 References

A. F. Godinho, T. V. Trombini, E. C. Oliveira (2002). Effects of elevated calcium on motor and exploratory activities of rats Brazilian Journal of Medical and Biological Research, 35 (4,4), 451-457. https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/4941088

A. F. Godinho, S. L. Stanzani, F. C. Ferreira, T. C. Braga, M. C. Silva, J. L. Chaguri, C. A. Dias-Júnior (2014). Permethrin chronic exposure alters motor coordination in rats: effect of calcium supplementation and amlodipine; Environmental Toxicology and Pharmacology, 37(2,2), 878-884. https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/2540871

Anonymous (1999). Safety evaluation of certain food additives. Glucono-delta-lactone and the calcium, magnesium, potassium, and sodium salts of gluconic acid, 42 (1999,1999), 203-212. HERO ID: https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/4947904

FAO and WHO working groups (1986). Glucono delta-lactone 21(1986,1986), 165-172. https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/4947912

Food AND DRUG RESEARCH LABS. I (1973). TERATOLOGIC EVALUATION OF FDA 71-72 (GLUCONO DELTA LACTONE) 56 PP. https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/4947704

Reported to the ECHA (European Chemicals Agency) database. (1973). D-glucono-1,5-lactone: developmental toxicity/teratogenicity: in vitro: 003 supporting https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/4940249

Reported to the ECHA (European Chemicals Agency) database. (1973). D-glucono-1,5-lactone: developmental toxicity/teratogenicity: in vitro: 004 supporting https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/4940230

Reported to the ECHA (European Chemicals Agency) database. (1973). D-glucono-1,5-lactone: developmental toxicity/teratogenicity: in vitro: 001 key https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/4940250

Reported to the ECHA (European Chemicals Agency) database. (1973). D-glucono-1,5-lactone: developmental toxicity/teratogenicity: in vitro: 002 key https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/4940251

Reported to the ECHA (European Chemicals Agency) database. (1979). D-glucono-1,5-lactone: basic toxicokinetics https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/4940243

Reported to the ECHA (European Chemicals Agency) database. (1979). Potassium gluconate: basic toxicokinetics https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/4940231

Reported to the ECHA (European Chemicals Agency) database. (2001). Potassium gluconate: short-term toxicity to aquatic invertebrates https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/4940259

Reported to the ECHA (European Chemicals Agency) database. (2001). Potassium gluconate: toxicity to aquatic algae and cyanobacteria https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/4940257

Reported to the ECHA (European Chemicals Agency) database. (2002). Potassium gluconate: short-term toxicity to fish https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/4940263

Reported to the ECHA (European Chemicals Agency) database. (2009). D-gluconic acid: skin sensitisation: in vivo (LLNA) https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/4940232

Reported to the ECHA (European Chemicals Agency) database. (2009). D-gluconic acid: skin irritation/corrosion https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/4940239

Reported to the ECHA (European Chemicals Agency) database. (2009). D-gluconic acid: eye irritation: 001 Key | experimental result https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/4940242

Reported to the ECHA (European Chemicals Agency) database. (2009). D-gluconic acid: acute toxicity: dermal https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/4940240

Reported to the ECHA (European Chemicals Agency) database. (2013). Sodium glucoheptonate: developmental toxicity/teratogenicity: 001 key https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/4864283

Reported to the ECHA (European Chemicals Agency) database. (2013). Sodium glucoheptonate: short-term repeated dose toxicity: oral 001 key https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/4864285

Reported to the ECHA (European Chemicals Agency) database. (2015a). D-gluconic acid: genetic toxicity: in vitro: 001 key | experimental result. https://echa.europa.eu/registration-dossier/-/registered-dossier/1957/7/7/2/?documentUUID=6f375db7-807a-4898-b654-5569828e5ee4

Reported to the ECHA (European Chemicals Agency) database. (2015b). D-gluconic acid: genetic toxicity: in vitro: 003 key | experimental result. Helsinki, Finland. https://echa.europa.eu/registration-dossier/-/registered-dossier/1957/7/7/2/?documentUUID=d1628eb2-7b0e-475e-ad72-f88c1013e568

Reported to the ECHA (European Chemicals Agency) database. (2015c). D-glucono-1,5-lactone: genetic toxicity: in vitro: 006 key | experimental result. https://echa.europa.eu/registration-dossier/-/registered-dossier/1952/7/7/2/?documentUUID=bdc6a902-15a0-471c-b347-87df4bed48a3

Reported to the ECHA (European Chemicals Agency) database. (2015d). D-glucono-1,5-lactone: genetic toxicity: in vitro: 010 supporting | experimental result. https://echa.europa.eu/registration-dossier/-/registered-dossier/1952/7/7/2/?documentUUID=d2f3b96e-f5b1-4338-af8c-c5ab4161aca2

Litton Bionetics. (1974). Mutagenic evaluation of compound FDA 71-72, glucono-delta-lactone. (FDABF-GRAS-282). Washington, DC: U.S. Food and Drug Administration.

Litton Bionetics. (1975a). Mutagenic evaluation of compound FDA 73-5, calcium gluconate. (FDABF-GRAS - 328). Washington, DC: U.S. Food and Drug Administration.

Litton Bionetics, I, nc. (1975). Mutagenic evaluation of compounds FDA 75-5, 000527-07-1, sodium gluconate, FCC, fine granular. Litton Bionetics, Inc.

NTP (National Toxicology Program). (2018). G06 - Ames summary data: gluono delta lactone. https://manticore.niehs.nih.gov/cebssearch/study/002-02207-0001-0000-4

OECD (2004). Gluconic acid and its derivatives. Technical Report. HERO ID: https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/2072857

P. Gautheron, J. Giroux, M. Cottin, L. Audegond, A. Morilla, L. Mayordomo-Blanco, A. Tortajada, G. Haynes, J. A. Vericat, A. L. Et (1994). Interlaboratory assessment of the bovine corneal opacity and permeability (BCOP) assay Toxicology In Vitro, 8(3,3), 381-392. https://heronet.epa.gov/heronet/index.cfm/reference/download/reference_id/2077994

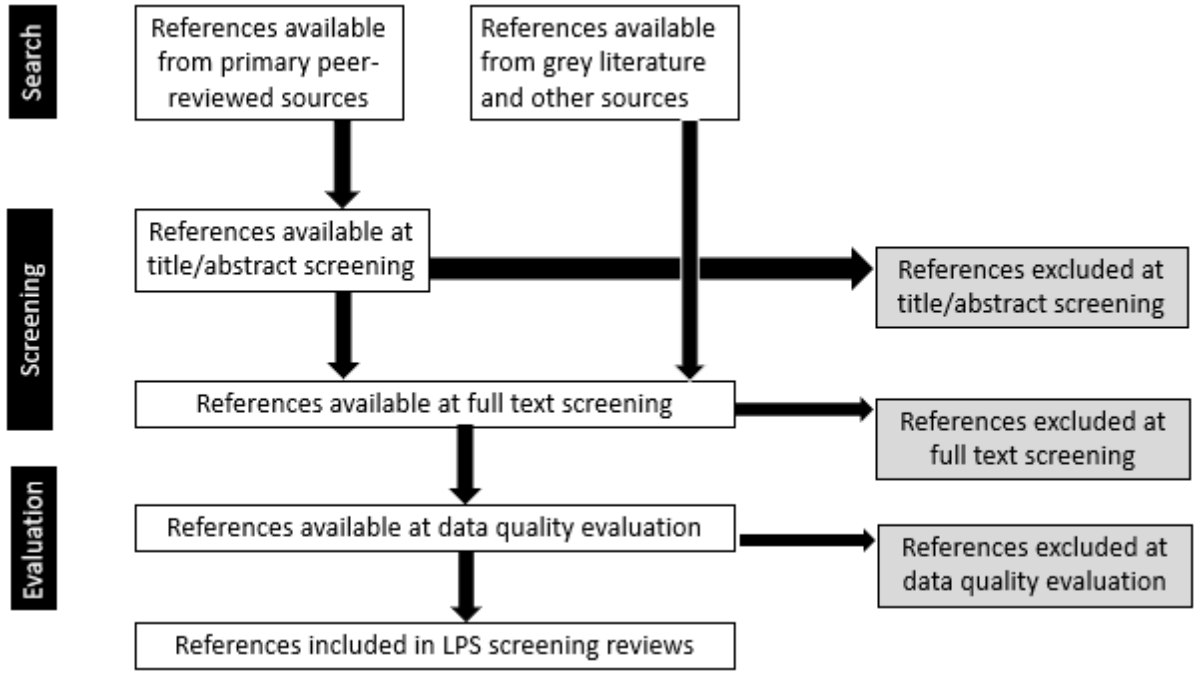
Appendix C: Literature Search Outcomes

C.1 Literature Search and Review

This section briefly describes the literature search and review process, search terms, and search outcomes for the hazard and fate screening of sodium gluconate. Search outcomes and reference details are provided on the candidate's HERO[48] project page.

EPA created a fit-for-purpose process to transparently document the literature search and review[49] of available hazard and fate information for low-priority substance (LPS) candidates. References from peer-reviewed primary sources, grey sources,[50] and other sources were identified, screened at the title/abstract and full-text level, and evaluated for data quality based on discipline-specific criteria. An overview of the literature search and review process is illustrated in Figure C1.

Figure C.1: Overview of the Literature Search and Review Process



C.1.1 Search for Analog Data

To supplement the information on the candidate chemical, sodium gluconate, the following LPS candidates were used as analogs for read-across: sodium glucoheptonate (CASRN 31138-65-5), D-

[48] The HERO low-priority substance candidate project pages are accessible to the public at https://hero.epa.gov/hero/.

[49] Discussed in the document "Approach Document for Screening Hazard Information for Low-Priority Substances Under TSCA."

[50] Grey literature and additional sources are the broad category of studies not found in standard, peer-reviewed literature database searches. This includes U.S. and international government agency websites, non-government organization (NGO) websites, and data sources that are difficult to find, or are not included, in the peer-reviewed databases, such as white papers, conference proceedings, technical reports, reference books, dissertations, and information on various stakeholder websites.

gluconic acid (CASRN 526-95-4), calcium gluconate (CASRN 299-28-5), and glucono-delta-lactone (CASRN 90-80-2). D-arabinonic acid (CASRN 488-30-2) was also considered as an analog but not used for designation. For more details and justification on analogs, see section 6.1.1. Analogs were used to fill data gaps on endpoints for which sodium gluconate lacked quality data, such as developmental toxicity, and to add to the weight of the scientific evidence. Analog references were searched, screened, and evaluated using the same process as references on sodium gluconate described above.[49] Sodium gluconate and the analogs mentioned above fall under the gluconates cluster in HERO.

Table C.1: Sources Used for Analog Search

Resource	URL
ATSDR	http://www.atsdr.cdc.gov/toxprofiles/index.asp
ChemID (EPA – HPVIS via ChemID)	http://chem.sis.nlm.nih.gov/chemidplus/
CIR	http://www.cir-safety.org/ingredients
ECHA	http://echa.europa.eu/web/guest/information-on-chemicals/registered-substances
ECOTOX	https://cfpub.epa.gov/ecotox/quick_query.htm
EPA – ChemView (incl. TSCATS, RBP/HC, and HPV/HPVIS)	https://chemview.epa.gov/chemview
European Food Safety Authority (EFSA)	http://www.efsa.europa.eu/
FDA	https://www.fda.gov/default.htm
HERA	http://www.heraproject.com/RiskAssessment.cfm
NICNAS	http://www.nicnas.gov.au/
NITE (J-CHECK)	http://www.safe.nite.go.jp/jcheck/search.action?request_locale=en
NTP	https://ntpsearch.niehs.nih.gov/home
OECD/SIDS	https://hpvchemicals.oecd.org/UI/Search.aspx; http://webnet.oecd.org/hpv/ui/SponsoredChemicals.aspx

C.1.2 Search Terms and Results

EPA began the literature review process for the hazard screening of sodium gluconate by developing search terms. To gather publicly available information, specific search terms were applied for each discipline and across databases and grey literature sources. Table C.2 lists the search terms used in the database search of peer -reviewed literature for the gluconates cluster including sodium gluconate. For grey literature and other secondary sources, Table C.3 lists the search terms used for sodium gluconate and analogs.

Table C.2: Search Terms Used in Peer Reviewed Databases		
Discipline	**Database**	**Search terms**[51]
Human Health	PubMed	((527-07-1[rn] OR 299-27-4[rn] OR 526-95-4[rn] OR 90-80-2[rn] OR 299-28-5[rn]) AND (("Gluconates/toxicity"[mh] OR "Gluconates/adverse effects"[mh] OR "Gluconates/poisoning"[mh] OR "Gluconates/pharmacokinetics"[mh]) OR ("Gluconates"[mh] AND ("environmental exposure"[mh] OR ci[sh])) OR ("Gluconates"[mh] AND toxicokinetics[mh:noexp]) OR ("Gluconates/blood"[mh] OR "Gluconates/cerebrospinal fluid"[mh] OR "Gluconates/urine"[mh]) OR ("Gluconates"[mh] AND ("endocrine system"[mh] OR "hormones, hormone substitutes, and hormone antagonists"[mh] OR "endocrine disruptors"[mh])) OR ("Gluconates"[mh] AND ("computational biology"[mh] OR "medical informatics"[mh] OR genomics[mh] OR genome[mh] OR proteomics[mh] OR proteome[mh] OR metabolomics[mh] OR metabolome[mh] OR genes[mh] OR "gene expression"[mh] OR phenotype[mh] OR genetics[mh] OR genotype[mh] OR transcriptome[mh] OR ("systems biology"[mh] AND ("environmental exposure"[mh] OR "epidemiological monitoring"[mh] OR analysis[sh])) OR "transcription, genetic "[mh] OR "reverse transcription"[mh] OR "transcriptional activation"[mh] OR "transcription factors"[mh] OR ("biosynthesis"[sh] AND (RNA[mh] OR DNA[mh])) OR "RNA, messenger"[mh] OR "RNA, transfer"[mh] OR "peptide biosynthesis"[mh] OR "protein biosynthesis"[mh] OR "reverse transcriptase polymerase chain reaction"[mh] OR "base sequence"[mh] OR "trans-activators"[mh] OR "gene expression profiling"[mh])) OR ("Gluconates/antagonists and inhibitors"[mh]) OR ("Gluconates/metabolism"[mh] AND ("humans"[mh] OR "animals"[mh])) OR ("Gluconates"[mh] AND cancer[sb]) OR ("Gluconates/pharmacology"[majr]))) (("1,5-D-Gluconolactone"[tw] OR "1,5-Gluconolactone"[tw] OR "2,3,4,5,6-Pentahydroxyhexanoic acid"[tw] OR "BVD Addicrete"[tw] OR "Biocal"[tw] OR "CalGlucon"[tw] OR "Calcicol"[tw] OR "Calcium D-Gluconate"[tw] OR "Calcium Gluconate"[tw] OR "D-(+)-Gluconic acid delta-lactone"[tw] OR "D-Gluconic acid"[tw] OR "D-Gluconic acid delta-lactone"[tw] OR "D-Gluconic acid lactone"[tw] OR "D-Gluconic acid-delta-lactone"[tw] OR "D-Gluconic delta-lactone"[tw] OR "D-Glucono-1,5-lactone"[tw] OR "D-Glucono-delta-lactone"[tw] OR "D-delta-Gluconolactone"[tw] OR "GLUCONO-delta- LACTONE"[tw] OR "Glucal"[tw] OR "Gluconic acid"[tw] OR "Gluconic acid sodium salt"[tw] OR "Gluconic delta-lactone"[tw] OR "Glucono delta lactone"[tw] OR "Glucono delta-lactone"[tw] OR "Gluconodeltalactone"[tw] OR "Gluconolactone"[tw] OR "Glycogenic acid"[tw] OR "Glyconic acid"[tw] OR "Kalium-beta"[tw] OR "Maltonic acid"[tw] OR "Monopotassium D-Gluconate"[tw] OR "Monosodium D-Gluconate"[tw] OR "Monosodium Gluconate"[tw] OR "Pentahydroxycaproic acid"[tw] OR "Potassium D-Gluconate"[tw] OR "Potassium Gluconate"[tw] OR "Sodium 2,3,4,5,6-pentahydroxy-1-hexanoate"[tw] OR "Sodium D-Gluconate"[tw] OR "Sodium Gluconate"[tw] OR "Sodium Gluconate [USP]"[tw] OR "beta-Glucono-1,5-lactone"[tw] OR "calcium Gluconate"[tw] OR "delta-D-Gluconolactone"[tw] OR "delta-Gluconolactone"[tw] OR "sodium Gluconate"[tw] OR "delta-Gluconolactone"[tw] OR ".delta.-Gluconolactone"[tw] OR "Calcium hexagluconate"[tw] OR "GLUCONATE CALCIUM"[tw] OR "GLUCONATE SODIUM"[tw] OR "GLUCONATE, CALCIUM"[tw] OR "GLUCONATE, SODIUM"[tw] OR "Calcet"[tw] OR "Calciofon"[tw] OR "Calcipur"[tw] OR "Calcium hexagluconate"[tw] OR "Calglucol"[tw] OR "Clewat GL"[tw] OR "Delta-D-GLUCONOLACTON"[tw] OR "Deltagluconolactone"[tw] OR "Dextronic acid"[tw] OR "D-Glucono-1,5-lacton"[tw] OR "D-glucono-1,5-lactona"[tw] OR "D-Glulonic acid, monosodium salt"[tw] OR "D-Guconic acid, .delta.-lactone"[tw] OR "Disparlight

[51] Additional language or syntax such as [tw], [rn], [org], and [nm] were added to search terms. These are unique to individual databases and must be applied to search terms so that the query can run properly.

Table C.2: Search Terms Used in Peer Reviewed Databases		
		DV"[tw] OR "Dragocal"[tw] OR "Ebucin"[tw] OR "Fujiglucon"[tw] OR "Glonsen"[tw] OR "Glosanto"[tw] OR "Glucobiogen"[tw] OR "GLUCONATE SODIUM"[tw] OR "GLUCONATE, SODIUM"[tw] OR "GLUCONO-1,5-LACTONE, D-"[tw] OR "Gluconsan K"[tw] OR "Helshas A"[tw] OR "Kalium Gluconate"[tw] OR "Kalpren"[tw] OR "Kaon elixir"[tw] OR "Katorin"[tw] OR "K-lao"[tw] OR "Novocal"[tw] OR "Pasexon 100T"[tw] OR "PMP Sodium Gluconate"[tw] OR "Potalium"[tw] OR "Potasoral"[tw] OR "Potassuril"[tw] OR "Resitard P 608A"[tw] OR "Sirokal"[tw] OR "Sunmorl N 60S"[tw]) NOT medline[sb])
	Toxline	(527-07-1[rn] OR 299-27-4[rn] OR 526-95-4[rn] OR 90-80-2[rn] OR 299-28-5[rn] OR"BVD Addicrete" OR "1,5-D-Gluconolactone" OR "1,5-Gluconolactone" OR "2,3,4,5,6-Pentahydroxyhexanoic acid" OR "Biocal" OR "CalGlucon" OR "Calcicol" OR "Calcium D-Gluconate" OR "Calcium Gluconate" OR "Gluconic acid delta-lactone" OR "D-Gluconic acid" OR "D-Gluconic acid delta-lactone" OR "D-Gluconic acid lactone" OR "D-Gluconic acid-delta-lactone" OR "D-Gluconic delta-lactone" OR "D-Glucono-1,5-lactone" OR "D-Glucono-delta-lactone" OR "D-delta-Gluconolactone" OR "GLUCONO-delta- LACTONE" OR "Glucal" OR "Gluconic acid" OR "Gluconic acid sodium salt" OR "Gluconic delta-lactone" OR "Glucono delta lactone" OR "Glucono delta-lactone" OR "Gluconodeltalactone" OR "Gluconolactone" OR "Glycogenic acid" OR "Glyconic acid" OR "Kalium-beta" OR "Kaon" OR "Maltonic acid" OR "Monopotassium D-Gluconate" OR "Monosodium D-Gluconate" OR "Monosodium Gluconate" OR "Pentahydroxycaproic acid" OR "Potassium D-Gluconate" OR "Potassium Gluconate" OR "Sodium 2,3,4,5,6-pentahydroxy-1-hexanoate" OR "Sodium D-Gluconate" OR "Sodium Gluconate" OR "Sodium Gluconate (USP)" OR "beta-Glucono-1,5-lactone" OR "calcium Gluconate" OR "delta-D-Gluconolactone" OR "delta-Gluconolactone" OR "sodium Gluconate" OR "delta-Gluconolactone" OR ".delta.-Gluconolactone" OR "Calcium hexagluconate" OR "GLUCONATE CALCIUM" OR "GLUCONATE SODIUM" OR "GLUCONATE, CALCIUM" OR "GLUCONATE, SODIUM" OR "Calcet") AND (ANEUPL [org] OR BIOSIS [org] OR CIS [org] OR DART [org] OR EMIC [org] OR EPIDEM [org] OR FEDRIP [org] OR HEEP [org] OR HMTC [org] OR IPA [org] OR RISKLINE [org] OR MTGABS [org] OR NIOSH [org] OR NTIS [org] OR PESTAB [org] OR PPBIB [org]) AND NOT PubMed [org] AND NOT pubdart [org] "Calciofon" OR "Calcipur" OR "Calglucol" OR "Clewat GL" OR "Delta-D-GLUCONOLACTON" OR "Deltagluconolactone" OR "Dextronic acid" OR "D-Glucono-1,5-lacton" OR "D-glucono-1,5-lactona" OR "D-Glulonic acid, monosodium salt" OR "D-Guconic acid, .delta.-lactone" OR "Disparlight DV" OR "Dragocal" OR "Ebucin" OR "Fujiglucon" OR "Glonsen" OR "Glosanto" OR "Glucobiogen" OR "GLUCONO-1,5-LACTONE, D-" OR "Gluconsan K" OR "Helshas A" OR "Kalium Gluconate" OR "Kalpren" OR "Kaon elixir" OR "Katorin" OR "K-lao" OR "Novocal" OR "Pasexon 100T" OR "PMP Sodium Gluconate" OR "Potalium" OR "Potasoral" OR "Potassuril" OR "Resitard P 608A" OR "Sirokal" OR "Sunmorl N 60S"
	TSCATS 1	(527-07-1 [rn] OR 299-27-4 [rn] OR 526-95-4 [rn] OR 90-80-2 [rn] OR 299-28-5 [rn]) AND (TSCATS [org])
	WOS	TS=("527-07-1" OR "299-27-4" OR "526-95-4" OR "90-80-2" OR "299-28-5" OR "1,5-D-Gluconolactone" OR "1,5-Gluconolactone" OR "2,3,4,5,6-Pentahydroxyhexanoic acid" OR "BVD Addicrete" OR "Biocal" OR "CalGlucon" OR "Calcicol" OR "Calcium D-Gluconate" OR "Calcium Gluconate" OR "D-(+)-Gluconic acid δ-lactone" OR "D-Gluconic acid" OR "D-Gluconic acid delta-lactone" OR "D-Gluconic acid lactone" OR "D-Gluconic acid-delta-lactone" OR "D-Gluconic delta-lactone" OR "D-Glucono-1,5-lactone" OR "D-Glucono-δ-lactone" OR "D-delta-Gluconolactone" OR "GLUCONO-δ- LACTONE" OR "Glucal" OR "Gluconic acid" OR "Gluconic acid sodium salt" OR "Gluconic delta-lactone" OR "Glucono delta lactone" OR "Glucono delta-lactone" OR "Gluconodeltalactone" OR "Gluconolactone" OR "Glycogenic acid" OR "Glyconic acid" OR "Kalium-beta" OR "Maltonic acid" OR "Monopotassium D-Gluconate" OR "Monosodium D-Gluconate" OR "Monosodium Gluconate" OR "Pentahydroxycaproic acid" OR "Potassium D-

Table C.2: Search Terms Used in Peer Reviewed Databases		
		Gluconate" OR "Potassium Gluconate" OR "Sodium 2,3,4,5,6-pentahydroxy-1-hexanoate" OR "Sodium D-Gluconate" OR "Sodium Gluconate" OR "Sodium Gluconate [USP]" OR "beta-Glucono-1,5-lactone" OR "calcium Gluconate" OR "delta-D-Gluconolactone" OR "delta-Gluconolactone" OR "sodium Gluconate" OR "δ-Gluconolactone" OR ".delta.-Gluconolactone" OR "Calcium hexagluconate" OR "GLUCONATE CALCIUM" OR "GLUCONATE SODIUM" OR "GLUCONATE, CALCIUM" OR "GLUCONATE, SODIUM" OR "D-glucono-1,5-lactona" OR "GLUCONO-1,5-LACTONE, D-" OR "K-lao") AND ((WC=("Toxicology" OR "Endocrinology & Metabolism" OR "Gastroenterology & Hepatology" OR "Gastroenterology & Hepatology" OR "Hematology" OR "Neurosciences" OR "Obstetrics & Gynecology" OR "Pharmacology & Pharmacy" OR "Physiology" OR "Respiratory System" OR "Urology & Nephrology" OR "Anatomy & Morphology" OR "Andrology" OR "Pathology" OR "Otorhinolaryngology" OR "Ophthalmology" OR "Pediatrics" OR "Oncology" OR "Reproductive Biology" OR "Developmental Biology" OR "Biology" OR "Dermatology" OR "Allergy" OR "Public, Environmental & Occupational Health") OR SU=("Anatomy & Morphology" OR "Cardiovascular System & Cardiology" OR "Developmental Biology" OR "Endocrinology & Metabolism" OR "Gastroenterology & Hepatology" OR "Hematology" OR "Immunology" OR "Neurosciences & Neurology" OR "Obstetrics & Gynecology" OR "Oncology" OR "Ophthalmology" OR "Pathology" OR "Pediatrics" OR "Pharmacology & Pharmacy" OR "Physiology" OR "Public, Environmental & Occupational Health" OR "Respiratory System" OR "Toxicology" OR "Urology & Nephrology" OR "Reproductive Biology" OR "Dermatology" OR "Allergy")) OR (WC="veterinary sciences" AND (TS="rat" OR TS="rats" OR TS="mouse" OR TS="murine" OR TS="mice" OR TS="guinea" OR TS="muridae" OR TS=rabbit* OR TS=lagomorph* OR TS=hamster* OR TS=ferret* OR TS=gerbil* OR TS=rodent* OR TS="dog" OR TS="dogs" OR TS=beagle* OR TS="canine" OR TS="cats" OR TS="feline" OR TS="pig" OR TS="pigs" OR TS="swine" OR TS="porcine" OR TS=monkey* OR TS=macaque* OR TS=baboon* OR TS=marmoset*)) OR (TS=toxic* AND (TS="rat" OR TS="rats" OR TS="mouse" OR TS="murine" OR TS="mice" OR TS="guinea" OR TS="muridae" OR TS=rabbit* OR TS=lagomorph* OR TS=hamster* OR TS=ferret* OR TS=gerbil* OR TS=rodent* OR TS="dog" OR TS="dogs" OR TS=beagle* OR TS="canine" OR TS="cats" OR TS="feline" OR TS="pig" OR TS="pigs" OR TS="swine" OR TS="porcine" OR TS=monkey* OR TS=macaque* OR TS=baboon* OR TS=marmoset* OR TS="child" OR TS="children" OR TS=adolescen* OR TS=infant* OR TS="WORKER" OR TS="WORKERS" OR TS="HUMAN" OR TS=patient* OR TS=mother OR TS=fetal OR TS=fetus OR TS=citizens OR TS=milk OR TS=formula OR TS=epidemio* OR TS=population* OR TS=exposure* OR TS=questionnaire OR SO=epidemio*)) OR TI=toxic*) Indexes=SCI-EXPANDED, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, CCR-EXPANDED, IC Timespan=All years TS=("Calcet" OR "Calciofon" OR "Calcipur" OR "Calglucol" OR "Clewat GL" OR "Delta-D-GLUCONOLACTON" OR "Deltagluconolactone" OR "Dextronic acid" OR "D-Glucono-1,5-lacton" OR "D-Glulonic acid, monosodium salt" OR "D-Guconic acid, .delta.-lactone" OR "Disparlight DV" OR "Dragocal" OR "Ebucin" OR "Fujiglucon" OR "Glonsen" OR "Glosanto" OR "Glucobiogen" OR "Gluconsan K" OR "Helshas A" OR "Kalium Gluconate" OR "Kalpren" OR "Kaon elixir" OR "Katorin" OR "Novocal" OR "Pasexon 100T" OR "PMP Sodium Gluconate" OR "Potalium" OR "Potasoral" OR "Potassuril" OR "Resitard P 608A" OR "Sirokal" OR "Sunmorl N 60S") Indexes=SCI-EXPANDED, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, CCR-EXPANDED, IC Timespan=All years
Environmental Hazard	WOS	TS=("527-07-1" OR "299-27-4" OR "526-95-4" OR "90-80-2" OR "299-28-5" OR "1,5-D-Gluconolactone" OR "1,5-Gluconolactone" OR "2,3,4,5,6-Pentahydroxyhexanoic acid" OR "BVD Addicrete" OR "Biocal" OR "CalGlucon" OR "Calcicol" OR "Calcium D-Gluconate" OR "Calcium Gluconate" OR "D-(+)-Gluconic acid δ-lactone" OR "D-Gluconic acid" OR "D-Gluconic acid delta-lactone" OR "D-Gluconic acid lactone" OR "D-Gluconic acid-delta-lactone" OR "D-Gluconic delta-lactone" OR "D-Glucono-1,5-lactone" OR

Table C.2: Search Terms Used in Peer Reviewed Databases		
		"D-Glucono-δ-lactone" OR "D-delta-Gluconolactone" OR "GLUCONO-δ- LACTONE" OR "Glucal" OR "Gluconic acid" OR "Gluconic acid sodium salt" OR "Gluconic delta-lactone" OR "Glucono delta lactone" OR "Glucono delta-lactone" OR "Gluconodeltalactone" OR "Gluconolactone" OR "Glycogenic acid" OR "Glyconic acid" OR "Kalium-beta" OR "Maltonic acid" OR "Monopotassium D-Gluconate" OR "Monosodium D-Gluconate" OR "Monosodium Gluconate" OR "Pentahydroxycaproic acid" OR "Potassium D-Gluconate" OR "Potassium Gluconate" OR "Sodium 2,3,4,5,6-pentahydroxy-1-hexanoate" OR "Sodium D-Gluconate" OR "Sodium Gluconate" OR "Sodium Gluconate [USP]" OR "beta-Glucono-1,5-lactone" OR "calcium Gluconate" OR "delta-D-Gluconolactone" OR "delta-Gluconolactone" OR "sodium Gluconate" OR "δ-Gluconolactone" OR ".delta.-Gluconolactone" OR "Calcium hexagluconate" OR "GLUCONATE CALCIUM" OR "GLUCONATE SODIUM" OR "GLUCONATE, CALCIUM" OR "GLUCONATE, SODIUM" OR "D-glucono-1,5-lactona" OR "GLUCONO-1,5-LACTONE, D-" OR "K-lao") AND ((WC=("Agriculture, Dairy & Animal Science" OR "Biodiversity Conservation" OR "Biology" OR "Developmental Biology" OR "Ecology" OR "Entomology" OR "Environmental Sciences" OR "Environmental Studies" OR "Fisheries" OR "Forestry" OR "Limnology" OR "Marine & Freshwater Biology" OR "Microbiology" OR "Mycology" OR "Oceanography" OR "Ornithology" OR "Plant Sciences" OR “Reproductive Biology” OR "Zoology")) OR (SU=("Agriculture" OR "Biodiversity & Conservation" OR “Developmental Biology” OR "Entomology" OR "Environmental Sciences & Ecology" OR "Fisheries" OR "Forestry" OR "Marine & Freshwater Biology" OR "Microbiology" OR "Mycology" OR "Plant Sciences" OR “Reproductive Biology” OR "Zoology" OR "Oceanography")) OR (TI=toxic*) OR (TS=(ecotox* OR environment* OR phytotox* OR pollut* OR "A. platyrhynchos" OR "agnatha" OR "agnathan" OR "alligator" OR "alligators" OR "amphibian" OR "amphibians" OR "amphipod" OR "amphipoda" OR "amphipods" OR "Anas platyrhynchos" OR "annelid" OR "annelida" OR "annelids" OR "Antilocapridae" OR "apidae" OR "Aplodontidae" OR "Apoidea" OR "aquatic" OR "archiannelid" OR "archiannelida" OR "Arvicolinae" OR "aves" OR "avian" OR "avians" OR "badger" OR "badgers" OR "barnacle" OR "barnacles" OR "bass" OR "bear" OR "bears" OR "beaver" OR "beavers" OR "bee" OR "bees" OR "bird" OR "birds" OR "bivalve" OR "bivalves" OR "bleak" OR "bluegill" OR "bluegills" OR "bluehead" OR "bobwhite" OR "bobwhites" OR "Bovidae" OR "C. carpio" OR "caiman" OR "Canidae" OR "carp" OR "Castoridae" OR "catfish" OR "cephalopod" OR "cephalopoda" OR "cephalopods" OR "Cervidae" OR "chicken" OR "chickens" OR "chiselmouth" OR "clam" OR "clams" OR "cockle" OR "cockles" OR "cod" OR "copepod" OR "copepoda" OR "copepods" OR "coturnix" OR "crab" OR "crabs" OR "crappie" OR "crappies" OR "crayfish" OR "croaker" OR "crocodile" OR "crocodiles" OR "crustacea" OR "crustacean" OR "crustaceans" OR "Cyprinus carpio" OR "D. magna" OR "D. rerio" OR "dace" OR "Danio rerio" OR "daphnia" OR "Daphnia magna" OR "darter" OR "darters" OR "Dasypodidae" OR "Dicotylidae" OR "Didelphidae" OR "Dipodidae" OR "dog" OR "dogs" OR "dogfish" OR "duck" OR "duckling" OR "ducklings" OR "ducks" OR "earthworm" OR "earthworms" OR "ec50" OR "ec50s" OR "echinoderm" OR "echinoderms" OR "eel" OR "eels" OR "elasmobranch" OR "Equidae" OR "Erethizontidae" OR "Felidae" OR "ferret" OR "fish" OR "fisher" OR "fishers" OR "fishes" OR "flagfish" OR "flatworm" OR "flatworms" OR "flounder" OR "frog" OR "frogs" OR "galaxias" OR "gallus" OR "gastropod" OR "gastropoda" OR "gastropods" OR "Geomyidae" OR "goldfish" OR "gourami" OR "gouramy" OR "Green Algae" OR "grunion" OR "guppies" OR "guppy" OR "haddock" OR "hagfish" OR "haplodrili" OR "Harvest mice " OR "Harvest mouse" OR "herring" OR "Heteromyidae" OR "honeybee" OR "honeybees" OR "hooknose" OR "inanga" OR "killifish" OR "L. idus" OR "L. macrochirus" OR "lamprey" OR "lampreys" OR "lc50" OR "lc50s" OR "leech" OR "lemming" OR "Lepomis macrochirus" OR "Leporidae" OR "lethal concentration" OR "Leuciscus idus" OR "lizard" OR "lizards" OR "lobster" OR "lobsters" OR "macroinvertebrate" OR "macroinvertebrates" OR "mallard" OR "mallards" OR "marten" OR "medaka" OR "menhaden" OR "Microtus" OR "milkfish" OR "mink" OR "minnow" OR "minnows" OR "mollusc" OR "molluscs" OR "mollusk" OR "mollusks" OR "molly" OR "mrigal" OR "mudfish" OR "mudsucker" OR "mulles" OR "mullet" OR "mummichog" OR "mummichogs" OR "mussel" OR "mussels" OR "Mustelidae" OR "Myocastoridae" OR "Mysid shrimp" OR "newt" OR "newts" OR "northern pike" OR "O. latipes" OR "O. mykiss" OR "Ochotonidae" OR "octopi" OR

Table C.2: Search Terms Used in Peer Reviewed Databases		
		"octopus" OR "oligochaeta" OR "oligochaete" OR "Oncorhynchus mykiss" OR "Onychomys" OR "opossum" OR "Oryzias latipes" OR "oyster" OR "oysters" OR "P. promelas" OR "P. reticulata" OR "P. subcapitata" OR "perch" OR "Peromyscus" OR "Pimephales promelas" OR "pinfish" OR "pinfishes" OR "planaria" OR "planarian" OR "Poecilia reticulata" OR "polychaeta" OR "polychaete" OR "polychaetes" OR "Procyonidae" OR "Pseudokirchneriella subcapitata" OR "puffer" OR "puffers" OR "pumpkinseed" OR "pumpkinseeds" OR "pupfish" OR "quahog" OR "quahogs" OR "quail" OR "quails" OR "rasbora" OR "rasboras" OR "Reithrodontomys" OR "reptile" OR "reptiles" OR "rohu" OR "S. erythrophthalmus" OR "S. quadricauda" OR "S. subspicatus" OR "salamander" OR "salamanders" OR "salmon" OR "scallop" OR "scallops" OR "Scardinius erythrophthalmus" OR "Scenedesmus quadricauda " OR "Scenedesmus subspicatus" OR "Sciuridae" OR "sea anemone" OR "sea anemones" OR "sea cucumber" OR "sea cucumbers" OR "sea urchin" OR "sea urchins" OR "seabass" OR "seabream" OR "shark" OR "sharks" OR "shiner" OR "shiners" OR "shrimp" OR "Sigmodon" OR "Sigmodontinae" OR "silverside" OR "silversides" OR "skunk" OR "skunks" OR "snake" OR "snakehead" OR "snakes" OR "songbird" OR "songbirds" OR "Soricidae" OR "squid" OR "starfish" OR "stickleback" OR "sticklebacks" OR "sting ray" OR "sting rays" OR "sucker" OR "suckers" OR "Suidae" OR "sunfish" OR "Talpidae" OR "teleost" OR "teleostei" OR "teleosts" OR "terrapin" OR "terrapins" OR "tilapia" OR "tilapiaz" OR "toad" OR "toadfish" OR "toadfishes" OR "toads" OR "tortoise" OR "tortoises" OR "trout" OR "tubificid" OR "tubificidae" OR "tubificids" OR "turkey" OR "turkeys" OR "turtle" OR "turtles" OR "Ursidae" OR "vole" OR "walleye" OR "walleyes" OR "water flea" OR "water fleas" OR "waterbird" OR "waterbirds" OR "waterfowl" OR "waterfowls" OR "weakfish" OR "weasel" OR "whelk" OR "whelks" OR "wildlife"))) Indexes=SCI-EXPANDED, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, CCR-EXPANDED, IC Timespan=All years
	Toxline	Same as human health strategy synonyms only
	TSCATS 1	Same as human health strategy CASRN only
	Proquest	TITLE=("Gluconic acid δ-lactone" OR "D-Glucono-δ-lactone" OR "glucono-δ-lactone") TITLE=("1,5-Gluconolactone" OR "Calcicol" OR "Calcium Gluconate" OR "Calcium D-Gluconate" OR "D-Gluconic acid" OR "D-Gluconic acid delta-lactone" OR "D-Gluconic acid lactone" OR "D-Gluconic acid-delta-lactone" OR "D-Gluconic delta-lactone" OR "D-Glucono-1,5-lactone" OR "D-delta-Gluconolactone" OR "Glucal" OR "Gluconic acid" OR "Gluconic delta-lactone" OR "Glucono delta lactone" OR "Glucono delta-lactone" OR "Gluconodeltalactone" OR "Gluconolactone" OR "Glycogenic acid" OR "Glyconic acid" OR "Monosodium D-Gluconate") TITLE=("Monosodium Gluconate" OR "Potassium D-Gluconate" OR "Potassium Gluconate" OR "Sodium D-Gluconate" OR "Sodium Gluconate" OR "beta-Glucono-1,5-lactone" OR "calcium Gluconate" OR "delta-D-Gluconolactone" OR "delta-Gluconolactone" OR "sodium Gluconate" OR "gluconate calcium" OR "gluconate sodium" OR "d-glucono-1,5-lactona" OR "glucono-1,5-lactone, d-" OR "1,5-D-Gluconolactone" OR "Deltagluconolactone" OR "Biocal" OR "Kalium Gluconate") SUBJECT=("1,5-Gluconolactone" OR "Calcicol" OR "Calcium Gluconate" OR "Calcium D-Gluconate" OR "D-Gluconic acid" OR "D-Gluconic acid delta-lactone" OR "D-Gluconic acid lactone" OR "D-Gluconic acid-delta-lactone" OR "D-Gluconic delta-lactone" OR "D-Glucono-1,5-lactone" OR "D-delta-Gluconolactone" OR "Glucal" OR "Gluconic acid" OR "Gluconic delta-lactone" OR "Glucono delta lactone" OR "Glucono delta-lactone" OR "Gluconodeltalactone" OR "Gluconolactone" OR "Glycogenic acid" OR "Glyconic acid" OR "Monosodium D-Gluconate")

Table C.2: Search Terms Used in Peer Reviewed Databases		
		SUBJECT=("Monosodium Gluconate" OR "Potassium D-Gluconate" OR "Potassium Gluconate" OR "Sodium D-Gluconate" OR "Sodium Gluconate" OR "beta-Glucono-1,5-lactone" OR "calcium Gluconate" OR "delta-D-Gluconolactone" OR "delta-Gluconolactone" OR "sodium Gluconate" OR "gluconate calcium" OR "gluconate sodium" OR "d-glucono-1,5-lactona" OR "glucono-1,5-lactone, d-" OR "1,5-D-Gluconolactone" OR "Deltagluconolactone" OR "Biocal" OR "Kalium Gluconate") ABSTRACT=("1,5-Gluconolactone" OR "Calcicol" OR "Calcium Gluconate" OR "Calcium D-Gluconate" OR "D-Gluconic acid" OR "D-Gluconic acid delta-lactone" OR "D-Gluconic acid lactone" OR "D-Gluconic acid-delta-lactone" OR "D-Gluconic delta-lactone" OR "D-Glucono-1,5-lactone" OR "D-delta-Gluconolactone" OR "Glucal" OR "Gluconic acid" OR "Gluconic delta-lactone" OR "Glucono delta lactone" OR "Glucono delta-lactone" OR "Gluconodeltalactone" OR "Gluconolactone" OR "Glycogenic acid" OR "Glyconic acid" OR "Monosodium D-Gluconate") ABSTRACT=("Monosodium Gluconate" OR "Potassium D-Gluconate" OR "Potassium Gluconate" OR "Sodium D-Gluconate" OR "Sodium Gluconate" OR "beta-Glucono-1,5-lactone" OR "calcium Gluconate" OR "delta-D-Gluconolactone" OR "delta-Gluconolactone" OR "sodium Gluconate" OR "gluconate calcium" OR "gluconate sodium" OR "d-glucono-1,5-lactona" OR "glucono-1,5-lactone, d-" OR "1,5-D-Gluconolactone" OR "Deltagluconolactone" OR "Biocal" OR "Kalium Gluconate") ABSTRACT=("2,3,4,5,6-Pentahydroxyhexanoic acid" OR "BVD Addicrete" OR "CalGlucon" OR "Kalium-beta" OR "Maltonic acid" OR "Monopotassium D-Gluconate" OR "Pentahydroxycaproic acid" OR "Sodium 2,3,4,5,6-pentahydroxy-1-hexanoate" OR "Calcium hexagluconate" OR "K-Iao" OR "Calcet" OR "Calcipur" OR "D-Glucono-1,5-lacton" OR "Novocal") SUBJECT=("2,3,4,5,6-Pentahydroxyhexanoic acid" OR "BVD Addicrete" OR "CalGlucon" OR "Kalium-beta" OR "Maltonic acid" OR "Monopotassium D-Gluconate" OR "Pentahydroxycaproic acid" OR "Sodium 2,3,4,5,6-pentahydroxy-1-hexanoate" OR "Calcium hexagluconate" OR "K-Iao" OR "Calcet" OR "Calcipur" OR "D-Glucono-1,5-lacton" OR "Novocal") TITLE=("2,3,4,5,6-Pentahydroxyhexanoic acid" OR "BVD Addicrete" OR "CalGlucon" OR "Kalium-beta" OR "Maltonic acid" OR "Monopotassium D-Gluconate" OR "Pentahydroxycaproic acid" OR "Sodium 2,3,4,5,6-pentahydroxy-1-hexanoate" OR "Calcium hexagluconate" OR "K-Iao" OR "Calcet" OR "Calcipur" OR "D-Glucono-1,5-lacton" OR "Novocal") "Calciofon" OR "Calglucol" OR "Clewat GL" OR "Delta-D-GLUCONOLACTON" OR "Dextronic acid" OR "D-Glulonic acid, monosodium salt" OR "D-Guconic acid, .delta.-lactone" OR "Disparlight DV" OR "Dragocal" OR "Ebucin" OR "Fujiglucon" OR "Glonsen" OR "Glosanto" OR "Glucobiogen" OR "Gluconsan K" OR "Helshas A" OR "Kalpren" OR "Kaon elixir" OR "Katorin" OR "Pasexon 100T" OR "Potalium" OR "Potasoral" OR "Potassuril" OR "Resitard P 608A" OR "Sirokal" OR "Sunmorl N 60S"
Fate	WOS	TS=("527-07-1" OR "299-27-4" OR "526-95-4" OR "90-80-2" OR "299-28-5" OR "1,5-D-Gluconolactone" OR "1,5-Gluconolactone" OR "2,3,4,5,6-Pentahydroxyhexanoic acid" OR "BVD Addicrete" OR "Biocal" OR "CalGlucon" OR "Calcicol" OR "Calcium D-Gluconate" OR "Calcium Gluconate" OR "D-(+)-Gluconic acid δ-lactone" OR "D-Gluconic acid" OR "D-Gluconic acid delta-lactone" OR "D-Gluconic acid lactone" OR "D-Gluconic acid-delta-lactone" OR "D-Gluconic delta-lactone" OR "D-Glucono-1,5-lactone" OR "D-Glucono-δ-lactone" OR "D-delta-Gluconolactone" OR "GLUCONO-δ- LACTONE" OR "Glucal" OR "Gluconic acid" OR "Gluconic acid sodium salt" OR "Gluconic delta-lactone" OR "Glucono delta lactone" OR "Glucono delta-lactone" OR "Gluconodeltalactone" OR "Gluconolactone" OR "Glycogenic acid" OR "Glyconic acid" OR "Kalium-beta" OR "Maltonic acid" OR

Table C.2: Search Terms Used in Peer Reviewed Databases		
		"Monopotassium D-Gluconate" OR "Monosodium D-Gluconate" OR "Monosodium Gluconate" OR "Pentahydroxycaproic acid" OR "Potassium D-Gluconate" OR "Potassium Gluconate" OR "Sodium 2,3,4,5,6-pentahydroxy-1-hexanoate" OR "Sodium D-Gluconate" OR "Sodium Gluconate" OR "Sodium Gluconate [USP]" OR "beta-Glucono-1,5-lactone" OR "calcium Gluconate" OR "delta-D-Gluconolactone" OR "delta-Gluconolactone" OR "sodium Gluconate" OR "δ-Gluconolactone" OR ".delta.-Gluconolactone" OR "Calcium hexagluconate" OR "GLUCONATE CALCIUM" OR "GLUCONATE SODIUM" OR "GLUCONATE, CALCIUM" OR "GLUCONATE, SODIUM" OR "D-glucono-1,5-lactona" OR "GLUCONO-1,5-LACTONE, D-" OR "K-lao") AND TS=(adsorp* OR aerob* OR anaerob* OR bioaccumulat* OR bioavail* OR bioconcentrat* OR biodegrad* OR biomoni* OR biotrans* OR degrad* OR dispers* OR fish* OR hydroly* leach* OR migrat* OR partic* OR partition* OR persisten* OR photoly* OR volatil* OR abiotic OR absorb OR absorption OR accumulation-rate OR aerosol OR aerosols OR air OR anoxic OR atm-m3/mol OR biomagnification OR biosolids OR biota OR breakdown-product OR breakdown-products OR chelation OR coagulation complexation OR decay-rate OR diffusion-coefficient OR dissolution OR dust OR effluent OR environmental-fate OR evaporation-from-water OR excretion OR flocculation OR flux OR fugacity OR gas-phase-mass-transfer OR ground-water OR groundwater OR half-life OR henry's-law OR incinerate OR incineration OR indoor-outdoor-ratio OR influent OR ingestion OR intake OR kinetics OR liquid-phase-mass-transfer OR mass-transfer-coefficient OR microcosm OR modified-state-space OR particle-size OR particulate OR pathway OR pathways OR penetration-factor OR penetration-ratio OR photostability OR placenta OR plasma OR plume OR point-source OR point-sources OR pore-water OR pretreatment-program OR redox OR sediment OR serum OR sewage-treatment OR sludge OR soil OR subsurface-intrusion OR surface-water-concentration OR time-weighted-average OR transfer OR transformation OR trophic-magnification OR vapor OR wait-time OR wastewater-treatment OR weight-fraction OR wildlife OR BAF OR BCF OR BSAF OR BSAFs OR KAW OR Kd OR KOA OR KOC OR POTW OR SES OR WWTP OR ((OECD OR OPPTS OR OCSPP) AND (Guideline OR guidelines))) Indexes=SCI-EXPANDED, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, CCR-EXPANDED, IC Timespan=All years

Table C.3: Search Terms Used in Grey Literature and Additional Sources	
Chemical	**Search terms**
Gluconates cluster (D-gluconic acid; Calcium gluconate; Potassium gluconate; Sodium gluconate; Glucono-delta-lactone)	Searched as a string or individually depending on resource: 527-07-1[rn] OR 299-27-4[rn] OR 526-95-4[rn] OR 90-80-2[rn] OR 299-28-5[rn] OR "1,5-D-Gluconolactone" OR "1,5-Gluconolactone" OR "2,3,4,5,6-Pentahydroxyhexanoic acid" OR "BVD Addicrete" OR "Biocal" OR "CalGlucon" OR "Calcicol" OR "Calcium D-Gluconate" OR "Calcium Gluconate" OR "D-(+)-Gluconic acid δ-lactone" OR "D-Gluconic acid" OR "D-Gluconic acid delta-lactone" OR "D-Gluconic acid lactone" OR "D-Gluconic acid-delta-lactone" OR "D-Gluconic delta-lactone" OR "D-Glucono-1,5-lactone" OR "D-Glucono-δ-lactone" OR "D-delta-Gluconolactone" OR "GLUCONO-δ- LACTONE" OR "Glucal" OR "Gluconic acid" OR "Gluconic acid sodium salt" OR "Gluconic delta-lactone" OR "Glucono delta lactone" OR "Glucono delta-lactone" OR "Gluconodeltalactone" OR "Gluconolactone" OR "Glycogenic acid" OR "Glyconic acid" OR "KOK" OR "Kalium-beta" OR "Kaon" OR "Maltonic acid" OR "Monopotassium D-Gluconate" OR "Monosodium D-Gluconate" OR "Monosodium Gluconate" OR "Pentahydroxycaproic acid" OR "Potassium D-Gluconate" OR "Potassium Gluconate" OR "Sodium 2,3,4,5,6-pentahydroxy-1-hexanoate" OR "Sodium D-Gluconate" OR "Sodium Gluconate" OR "Sodium Gluconate [USP]" OR "beta-Glucono-1,5-lactone" OR "calcium Gluconate" OR "delta-D-Gluconolactone" OR "delta-Gluconolactone" OR "sodium Gluconate" OR "δ-Gluconolactone"
Analog searched	D-arabinonic acid (488-30-2)

After the search terms were applied, more than 5,200 references returned by all search efforts across peer-reviewed databases and grey literature sources. The total number of references include database results, additional strategies, and analog searches. All references from the search efforts were screened and evaluated through the LPS literature search and review process.[49] Of these, 43 references were included for data evaluation and used to support the designation of sodium gluconate as LPS. The included hazard and fate references are listed in the bibliography of Appendix B.

C.2 Excluded Studies and Rationale

This section lists the excluded references, by HERO ID, found to be off-topic or unacceptable for use in the hazard screening of sodium gluconate. The excluded references are organized by discipline (human health hazard, environmental hazard, and fate), presented along with a rationale based on exclusion criteria. The criteria[49] was used to determine off-topic references in the title/abstract or full text screening and to determine unacceptable references in the data quality evaluation are provided in the form of questions.

C.2.1 Human Health Hazard Excluded References

For the screening review of sodium gluconate, EPA excluded a total of 2163 references when assessing human health hazard. Off-topic references (e.g., studies that did not contain information relevant to human health) were excluded at either title/abstract screening (see Table C.4), or full-text screening (see Table C.5). Unacceptable references (e.g., studies that did not meet data quality metrics) were excluded at full-text screening (see Tables C.6 and C.7). Off-topic and unacceptable references are displayed next to the corresponding exclusion criteria.

Table C.4: Off-Topic References Excluded at Title/Abstract Screening for Human Health Hazard									
Reference excluded (HERO ID) because the reference did NOT contain information needs[52] relevant to human health hazard									
4941098	4947559	4945570	4944757	4942343	4946452	4946710	4948770	4947042	4941553
1001515	4947560	4945571	4944758	4942344	4946453	4946711	4948772	4947043	4941555
1022900	4947561	4945616	4944759	4942372	4946454	4946712	4948773	4947046	4941558
1038153	4947562	4945617	4944760	4942373	4946455	4946713	4948774	4947047	4941559
1066651	4947563	4945619	4944761	4942374	4946481	4946714	4948777	4947049	4941562
1089041	4947564	4945622	4944762	4942376	4946482	4946716	4948778	4947050	4941563
1170178	4947569	4945623	4944763	4942379	4946483	4946717	4948779	4947051	4941569
1170332	4947570	4945625	4944764	4942415	4946484	4946718	4948781	4947052	4941572
1170465	4947571	4945627	4944765	4942417	4946485	4946719	4948782	4947054	4941575
1174803	4947572	4945628	4944766	4942420	4946486	4946722	4948783	4947055	4941581
1187359	4947573	4945629	4944767	4942426	4946487	4946723	4948784	4947057	4941590
1194210	4947574	4945632	4944768	4942429	4946488	4946724	4948786	4947059	4941594
1199146	4947575	4945633	4944769	4942435	4946489	4946725	4948787	4947060	4941598
1199417	4947578	4945634	4944770	4942437	4946490	4946726	4948788	4947061	4941599
1203834	4947580	4945636	4944771	4942441	4946492	4946729	4948789	4947062	4941604
1296238	4947581	4945637	4944772	4942442	4946494	4946730	4948790	4947063	4941607
1299143	4947583	4945639	4944774	4942443	4946495	4946731	4948791	4947064	4941612
1333838	4947584	4945641	4944775	4942444	4946496	4946732	4948792	4947066	4941625
1344568	4947585	4945642	4944776	4942448	4946497	4946733	4948793	4947067	4941627
1425184	4947586	4945645	4944777	4942449	4946498	4946734	4948794	4947068	4941632
1441798	4947588	4945646	4944779	4942450	4946499	4946735	4948795	4947070	4941633
1457562	4947589	4945647	4944780	4942451	4946500	4946736	4948797	4947071	4941639
1478015	4947590	4945648	4944782	4942452	4946501	4946737	4948798	4947072	4941647
1510657	4947591	4945649	4944783	4942453	4946514	4946738	4948799	4947074	4941649
1576583	4947592	4945650	4944784	4942456	4946515	4946739	4948800	4947075	4941696
1615817	4947593	4945652	4944785	4942459	4946516	4946740	4948801	4947076	4941701
1619316	4947594	4945654	4944786	4942460	4946518	4946741	4948802	4947077	4941703
1686935	4947595	4945655	4944832	4942461	4946519	4946742	4948803	4947078	4941705
1759188	4947596	4945657	4944833	4942504	4946520	4946743	4948804	4947102	4941706

[52] The information needs for human health hazard includes a list of study characteristics pertaining to the study population/test organism, types of exposures and routes, use of controls, type and level of effects. A complete list of the information needs is provided in Table A1 of the "Approach Document for Screening Hazard Information for Low-Priority Substances Under TSCA". These information needs helped guide the development of questions for title/abstract and full-text screening.

Table C.4: Off-Topic References Excluded at Title/Abstract Screening for Human Health Hazard									
1759826	4947597	4945682	4944834	4942506	4946521	4946744	4948805	4947103	4941782
1759942	4947600	4945684	4944835	4942508	4946522	4946757	4948806	4947524	4941786
1779633	4947602	4945685	4944838	4942509	4946523	4946758	4948808	4947525	4941789
1795253	4947616	4945686	4944840	4942510	4946524	4946759	4948810	4947540	4941790
1796284	4947617	4945687	4944843	4942511	4946525	4946760	4948811	4947541	4941794
1796454	4947618	4945689	4944844	4942514	4946526	4946761	4948812	4947542	4941796
1834323	4947619	4945690	4944845	4942515	4946527	4946762	4948813	4947543	4941800
1838996	4947621	4945692	4944847	4942517	4946528	4946763	4948816	4947545	4941801
1854895	4947623	4945693	4944848	4942519	4946529	4946765	4948817	4947546	4941870
1854935	4947624	4945694	4944849	4942520	4946530	4946766	4948818	4947547	4941876
1855160	4947625	4945695	4944850	4942521	4946531	4946767	4948819	4947548	4941883
1860655	4947626	4945696	4944851	4942522	4946533	4946768	4948820	4947550	4941984
1874618	4947627	4945697	4944852	4942523	4946534	4946769	4948821	4947552	4941985
1925103	4947628	4945698	4944853	4942528	4946535	4946770	4948822	4947553	4941990
1941284	4947629	4945699	4944854	4942529	4946536	4946772	4948823	4947554	4941995
194296	4947631	4945700	4944855	4942531	4946537	4946774	4948824	4947555	4941999
19702	4947632	4945701	4944856	4942533	4946553	4946775	4948825	4947556	4942157
19800	4947633	4945702	4944857	4942535	4946554	4946776	4948826	4947557	4942164
19855	4947634	4945703	4944858	4942536	4946555	4946783	4948827	4947558	4942166
1989183	4947635	4945704	4944859	4942543	4946556	4946784	4948829	4946353	4942173
1989218	4947636	4945705	4944860	4942551	4946558	4946786	4948830	4946354	4942174
1995656	4947638	4945728	4944861	4942575	4946559	4946787	4948831	4946355	4942176
1996971	4947639	4945729	4944862	4942577	4946561	4946788	4948832	4946356	4942177
1997743	4947640	4945730	4944863	4942579	4946562	4946789	4948833	4946358	4942248
1998522	4947641	4945732	4944864	4942583	4946563	4946791	4948836	4946381	4942252
2047443	4947642	4945733	4944865	4942586	4946564	4946792	4948837	4946382	4942258
2055366	4947643	4945735	4944885	4942589	4946567	4946805	4948838	4946383	4942259
2055579	4947644	4945736	4944886	4942591	4946568	4946806	4948839	4946385	4942260
2061011	4947645	4945738	4944887	4942594	4946569	4946809	4948840	4946386	4942262
2065984	4947646	4945739	4944888	4942645	4946570	4946810	4948841	4946388	4942266
2066129	4947647	4945741	4944889	4942649	4946571	4946812	4948842	4946390	4942267
2066780	4947648	4945743	4944891	4942650	4946572	4946814	4948843	4946391	4942268
2067584	4947649	4945744	4944892	4942651	4946573	4946816	4948844	4946394	4942276
2070843	4947652	4945745	4944894	4942652	4946575	4946817	4948845	4946395	4942284

Table C.4: Off-Topic References Excluded at Title/Abstract Screening for Human Health Hazard									
2071429	4947654	4945746	4944896	4942653	4946576	4946818	4948848	4946396	4942308
2072857	4947656	4945747	4944897	4942654	4946587	4946819	4948849	4946397	4942310
2073796	4947658	4945749	4944898	4942655	4946588	4946841	4948850	4946398	4942317
2153531	4947659	4945750	4944899	4942659	4946589	4946842	4948851	4946400	4942319
2173478	4947664	4945776	4944900	4942661	4946591	4946845	4948853	4946401	4942330
2239588	4947672	4945777	4944901	4942663	4946592	4946846	4948854	4946402	4942337
2247422	4947673	4945778	4944902	4942665	4946593	4946847	4948856	4946403	4942339
2251366	4947675	4945779	4944903	4942693	4946594	4946848	4948857	4946404	4942342
2283940	4947677	4945780	4944928	4942694	4946595	4946850	4948858	4946405	4941190
2303508	4947679	4945781	4944929	4942703	4946598	4946851	4948859	4946431	4941192
2305122	4947680	4945782	4944930	4942710	4946600	4946852	4948860	4946432	4941200
2534708	4947681	4945784	4944931	4942711	4946601	4946853	4948861	4946433	4941208
2600620	4947682	4945786	4944933	4942759	4946602	4946854	4948862	4946434	4941212
2740828	4947683	4945787	4944934	4942764	4946603	4946855	4948863	4946435	4941216
2777828	4947684	4945788	4944935	4942765	4946606	4946856	4948864	4946436	4941219
2789501	4947685	4945789	4944936	4942766	4946607	4946857	4948866	4946437	4941227
2789962	4947686	4945791	4944937	4942767	4946609	4946860	4948867	4946438	4941240
2791730	4947702	4945792	4944938	4942771	4946610	4946861	4948868	4946440	4941241
2792369	4947703	4945793	4944940	4942818	4946640	4946862	4948869	4946443	4941246
2794737	4947705	4945794	4944941	4942821	4946641	4946863	4948870	4946445	4941260
2797535	4947706	4945814	4944942	4942823	4946642	4946864	4948871	4946446	4941262
2807224	4947707	4945816	4944943	4942826	4946644	4946865	4948872	4946448	4941265
2850509	4947708	4945817	4944944	4942830	4946645	4946866	4948873	4946449	4941271
2862040	4947709	4945818	4944945	4942831	4946646	4946867	4948874	4946451	4941273
2878901	4947710	4945819	4944946	4942832	4946647	4946868	4948875	4941311	4941281
2885345	4947711	4945820	4944990	4942833	4946648	4946869	4948876	4941314	4941286
2949563	4947713	4945821	4944991	4942834	4946649	4946870	4948877	4941317	4941294
3000211	4947715	4945823	4944992	4942835	4946650	4946872	4948879	4941325	4941297
3010958	4947716	4945824	4944994	4942837	4946651	4946874	4948880	4941326	4941298
3036081	4947718	4945826	4944995	4942838	4946652	4946875	4948881	4941329	4941300
3036375	4947736	4945827	4944997	4942873	4946654	4946876	4948882	4941330	4941301
3045285	4947737	4945828	4944998	4942874	4946656	4946877	4948883	4941340	4941305
3055823	4947738	4945829	4945002	4942876	4946657	4946906	4949354	4941306	4945443
3103748	4947739	4945833	4945003	4942877	4946658	4946907	4949487	4943591	4945445

Table C.4: Off-Topic References Excluded at Title/Abstract Screening for Human Health Hazard									
3115256	4947740	4945834	4945004	4942879	4946660	4946909	4949488	4943643	4945446
3147238	4947741	4945835	4945005	4942881	4946661	4946910	4949489	4943648	4945447
3188921	4947743	4945836	4945006	4942882	4946662	4946912	4949490	4943656	4945448
3196035	4947744	4945837	4945007	4942883	4946692	4946914	516548	4943660	4945449
3235430	4947745	4945859	4945008	4942885	4946693	4946915	540101	4943731	4945450
3350277	4947746	4945860	4945009	4942886	4946694	4946918	56529	4943733	4945451
3382476	4947747	4945861	4945010	4942887	4946695	4946919	57347	4943737	4945452
3491920	4947748	4945862	4945012	4942889	4946696	4946931	607379	4943744	4945454
3514544	4947749	4945863	4945013	4942890	4946697	4946932	620381	4943746	4945455
3538354	4947752	4945864	4945015	4942891	4946698	4946933	625668	4943775	4945456
3664515	4947753	4945865	4945016	4942892	4946699	4946934	646810	4943777	4945457
3673078	4947754	4945866	4945019	4942894	4946701	4946935	662010	4943782	4945458
3734303	4947758	4945867	4945021	4942932	4946702	4946936	700296	4943783	4945460
3737219	4947759	4945868	4945022	4942936	4946703	4946937	74679	4943791	4945461
3738347	4947760	4945869	4945023	4942939	4946705	4946939	76919	4943793	4945462
3740044	4947761	4945870	4945024	4942945	4946706	4946940	824640	4943862	4945513
3791358	4947763	4945871	4945025	4943111	4946707	4946941	882492	4943867	4945514
3804682	4947766	4945872	4945026	4943115	4946708	4946942	895563	4943868	4945515
3804687	4947767	4945873	4945027	4943117	4945319	4946943	4941397	4943869	4945516
3810075	4947768	4945874	4945028	4943121	4945322	4946944	4941402	4943874	4945517
3817993	4947769	4945875	4945029	4943126	4945323	4946945	4941408	4943879	4945518
3818691	4947770	4945876	4945031	4943152	4945324	4946946	4941413	4943929	4945519
3822728	4947780	4945877	4945032	4943155	4945325	4946948	4941414	4943931	4945520
3877916	4947781	4945878	4945033	4943165	4945327	4946950	4941425	4943946	4945521
3993283	4947782	4945879	4945034	4943169	4945328	4946951	4941429	4943947	4945522
3994810	4947783	4945880	4945035	4943216	4945329	4946952	4941430	4944146	4945523
3996821	4947784	4945881	4945037	4943217	4945330	4946953	4941433	4944149	4945524
3998333	4947785	4945882	4945038	4943221	4945380	4946954	4941434	4944150	4945526
3998349	4947786	4945903	4945040	4943234	4945381	4946956	4941439	4944156	4945527
3998366	4947787	4945905	4945072	4943235	4945382	4946957	4941441	4944157	4945528
3998664	4947788	4945907	4945073	4943267	4945383	4946959	4941442	4944162	4945529
3998780	4947789	4945908	4945078	4943274	4945384	4946961	4941446	4944164	4945530
3999112	4947790	4945910	4945082	4943276	4945386	4946963	4941453	4944464	4945531
3999175	4947791	4945912	4945085	4943279	4945387	4946966	4941454	4944471	4945553

Table C.4: Off-Topic References Excluded at Title/Abstract Screening for Human Health Hazard									
3999274	4947792	4945914	4945087	4943282	4945389	4946985	4941457	4944475	4945555
3999304	4947793	4945915	4945088	4943287	4945390	4946987	4941461	4944476	4945556
3999778	4947794	4945916	4945089	4943295	4945391	4946989	4941464	4944486	4945559
4000762	4947795	4945917	4945090	4943301	4945392	4946991	4941471	4944582	4945560
4001000	4947796	4945919	4945092	4943306	4945393	4946993	4941473	4944584	4945561
4016792	4947797	4945920	4945093	4943332	4945394	4946996	4941474	4944587	4945565
4072289	4947798	4945921	4945094	4943334	4945395	4946997	4941475	4944595	4945566
4078713	4947800	4945923	4945095	4943340	4945396	4946998	4941478	4944599	4945567
4114843	4947801	4945924	4945096	4943345	4945397	4946999	4941480	4944742	4945569
4119345	4947802	4945973	4945097	4943349	4945398	4947000	4941483	4944743	4946225
4119539	4947803	4945974	4945098	4943395	4945399	4947004	4941485	4944747	4946226
4119545	4947805	4945976	4945099	4943399	4945400	4947005	4941488	4944751	4946227
4119546	4947806	4945977	4945100	4943400	4945401	4947006	4941495	4944756	4946228
4119556	4947807	4945979	4945101	4943461	4945403	4947007	4941505	4946278	4946229
4119563	4947808	4945981	4945103	4943471	4945405	4947009	4941510	4946280	4946230
4119567	4947809	4945982	4945104	4943473	4945406	4947010	4941511	4946281	4946231
4119601	4947810	4945983	4945108	4943478	4945407	4947013	4941512	4946282	4946232
4119602	4947811	4945984	4945109	4943537	4945408	4947014	4941513	4946283	4946233
4119603	4947812	4945985	4945125	4943541	4945409	4947015	4941517	4946284	4946235
4119721	4947813	4945986	4945126	4943545	4945410	4947016	4941524	4946285	4946236
4119722	4947814	4945987	4945127	4943548	4945411	4947017	4941533	4946286	4946237
4120082	4947815	4945988	4945129	4943577	4945412	4947020	4941534	4946287	4946238
4120474	4947830	4945989	4945136	4943580	4945413	4947021	4941537	4946336	4946239
4120476	4947831	4945991	4945137	4943581	4945414	4947024	4941542	4946337	4946240
4120490	4947832	4945992	4945138	4943583	4945415	4947026	4941543	4946338	4946241
4120587	4947833	4945993	4945139	4943588	4945416	4947027	4941544	4946339	4946242
4120643	4947834	4945994	4945142	4943589	4945417	4947028	4941546	4946340	4946243
4120652	4947835	4945995	4945144	4943590	4945442	4947029	4941552	4946342	4946265
4120814	4947836	4945996	4945145	4946155	4945273	4850105	4948636	4946343	4946267
4139774	4947837	4946019	4945146	4946156	4945274	4917748	4948637	4946344	4946268
4163187	4947838	4946021	4945147	4946157	4945275	4940942	4948638	4946345	4946270
4168726	4947840	4946022	4945148	4946159	4945276	4940944	4948639	4946346	4946271
4220713	4947841	4946023	4945149	4946160	4945277	4940945	4948641	4946347	4946272
4231040	4947842	4946024	4945150	4946161	4945278	4940947	4948642	4946348	4946273

Table C.4: Off-Topic References Excluded at Title/Abstract Screening for Human Health Hazard									
4232125	4947843	4946026	4945151	4946162	4945280	4940948	4948643	4946350	4946275
4291829	4947844	4946027	4945152	4946163	4945281	4940952	4948644	4946351	4948733
4291993	4947845	4946028	4945153	4946165	4945282	4940954	4948647	4946352	4948734
4292632	4947846	4946030	4945154	4946166	4945283	4940955	4948648	4941123	4948735
4298898	4947856	4946031	4945155	4946167	4945284	4940956	4948649	4941128	4948736
4302320	4947879	4946032	4945157	4946168	4945285	4940957	4948650	4941129	4948738
4314415	4947880	4946034	4945159	4946169	4945287	4940960	4948651	4941132	4948739
4314853	4947881	4946035	4945164	4946170	4945288	4940961	4948652	4941134	4948742
4316393	4947882	4946036	4945189	4946220	4945314	4940962	4948653	4941138	4948748
4318467	4947883	4946037	4945191	4946221	4945316	4940963	4948654	4941139	4948749
4319651	4947884	4946038	4945192	4946223	4945317	4940965	4948655	4941140	4948750
4328331	4947885	4946039	4945194	4946224	4945318	4940967	4948656	4941141	4948751
4328874	4947886	4946040	4945195	4948690	4941347	4940970	4948657	4941155	4948752
4331885	4947887	4946042	4945196	4948691	4941349	4940982	4948659	4941159	4948753
4335224	4947888	4946066	4945197	4948692	4941351	4940988	4948660	4941167	4948754
4367920	4947889	4946067	4945199	4948695	4941365	4940991	4948661	4941174	4948755
4370006	4947890	4946068	4945202	4948696	4941366	4940999	4948662	4941178	4948756
4375986	4947891	4946070	4945203	4948697	4941371	4941003	4948663	4941184	4948757
4386526	4947892	4946071	4945206	4948698	4941376	4941010	4948665	4941186	4948758
4403828	4947893	4946072	4945207	4948699	4941382	4941015	4948666	4948766	4948759
4435320	4947895	4946074	4945208	4948700	4941384	4941020	4948670	4948767	4948760
4476451	4947896	4946075	4945209	4948701	4941385	4941024	4948671	4948769	4948762
4487858	4947897	4946076	4945210	4948703	4941388	4941028	4948672	4941116	4948763
4496995	4947898	4946077	4945211	4948704	4941389	4941029	4948674	4941119	4948764
4543359	4947899	4946078	4945213	4948705	4941395	4941031	4948675	4948720	4948765
4552415	4947900	4946079	4945214	4948706	4948721	4941039	4948676	4948689	4948719
4556226	4947901	4946082	4945215	4948707	4948722	4941049	4948677	4948688	4945272
4559952	4947902	4946083	4945216	4948710	4948724	4941054	4948678	4946099	4945240
4566619	4947903	4946084	4945218	4948711	4948725	4941055	4948680	4946100	4945241
4631617	4947905	4946085	4945219	4948712	4948726	4941057	4948681	4946101	4945242
4650894	4947906	4946086	4945220	4948713	4948727	4941062	4948682	4946102	4945244
4653850	4947907	4946087	4945221	4948714	4948729	4941074	4948683	4946103	4945245
4657003	4947908	4946088	4945231	4948715	4948730	4941078	4948684	4946105	4945246
4665367	4947909	4946089	4945232	4948716	4948731	4941085	4948685	4946106	4945247

Table C.4: Off-Topic References Excluded at Title/Abstract Screening for Human Health Hazard									
4684048	4947910	4946092	4945233	4948717	4948732	4941094	4948686	4946153	4945248
4686505	4947911	4946094	4945234	4948718	4941099	4941097	4948687	4850050	4948635
4730988	4947913	4946095	4945235	4946154	4850046	4948633	4948632	4850039	4948631
4744135	4947914	4946096	4945238	4850044	4837204	4948630	4948625	4837184	4948627
4799476	4947915	4946097	4945239	4836748	4830850	4948624	4823251	4947916	
Reference excluded (HERO ID) because the reference primarily contained *in silico* data									
4946274									

Table C.5: Screening Questions and Off-Topic References Excluded at Full Text Screening for Human Health Hazard		
Question	**Off-topic if answer is:**	**References excluded (HERO ID)**
Does the reference contain information pertaining to a low- priority substance candidate?	No	1989362 2207460 2789349 2791674 3086385 3814978 4057262 4120689 4940080 4940983 4941058 4941079 4941188 4942457 4943219 4943543 4944890 4944993 4945140 4945217 4945402 4945459 4945624 4945990 4946069

Table C.5: Screening Questions and Off-Topic References Excluded at Full Text Screening for Human Health Hazard		
Question	**Off-topic if answer is:**	**References excluded (HERO ID)**
		4946090 4946098 4946349 4946399 4946439 4946444 4946557 4946560 4947799 4947804 4947894 4947526 4947549 4947587 4947620 4947717 4946779 4946605 4946611 4941448 4941472
What type of source is this reference?	Review article or book chapter that contains only citations to primary literature sources	4947756 4947348 4940076 4940077 4940079 1336123
What kind of evidence does this reference primarily contain?	*In silico* studies that DO NOT contain experimental verification	N/A
The following question apply to HUMAN evidence only		
Does the reference report an exposure route that is or is presumed to be by an inhalation, oral, or dermal route?	No	4837202

Table C.5: Screening Questions and Off-Topic References Excluded at Full Text Screening for Human Health Hazard		
Question	**Off-topic if answer is:**	**References excluded (HERO ID)**
Does the reference report both test substance exposure(s) AND related health outcome(s)?	No	N/A
If the reference reports an exposure to a chemical mixture, are measures of the test substance or related metabolite(s) reported independently of other chemicals? Note: If the paper does not pertain to mixtures, choose "Not Applicable".	No	N/A
The following question apply to ANIMAL evidence only		
Does the reference report an exposure route that is by inhalation, oral, or dermal route?	No	4837125 4837151 4837154 4850267 4850273 4850277 4851347
Does the reference report both test substance-related exposure(s) AND related health outcome(s)?	No	4837154
Does the reference report the duration of exposure?	No	N/A
Does the reference report an exposure to the test substance only (i.e. no mixtures with the exception of aqueous solutions and reasonable impurities and byproducts)?	No	N/A
Does the paper report a negative control that is a vehicle control or no treatment control?	No[53]	N/A

[53] Except for acute mammalian toxicity and skin and eye irritation studies, where the use of a negative control may not be required (e.g., OECD 403 Acute Inhalation Toxicity Guidelines).

Table C.5: Screening Questions and Off-Topic References Excluded at Full Text Screening for Human Health Hazard		
Question	**Off-topic if answer is:**	**References excluded (HERO ID)**
The following questions apply to MECHANISTIC/ALTERNATIVE TEST METHODS evidence only		
Does the reference report a negative control that is a vehicle control or no treatment control?	No	N/A
Does the reference report an exposure to the test substance only (i.e. no mixtures with the exception of aqueous solutions and reasonable impurities and byproducts)?	No	N/A
For genotoxicity studies only: Does the study use a positive control?	No	N/A

Table C.6: Data Quality Metrics and Unacceptable References Excluded at Data Quality Evaluation for Human Health Hazard – Animal		
Data Quality Metric	**Unacceptable if:**	**References excluded (HERO ID)**
Metric 1: Test substance identity	• The test substance identity cannot be determined from the information provided (e.g., nomenclature was unclear and CASRN or structure were not reported). **OR** • For mixtures, the components and ratios were not characterized or did not include information that could result in a reasonable approximation of components.	N/A.
Metric 2: Negative and vehicle controls	A concurrent negative control group was not included or reported. **OR** The reported negative control group was not appropriate (e.g., age/weight of animals differed between control and treated groups).	N/A.
Metric 3: Positive controls	When applicable, an appropriate concurrent positive control (i.e., inducing a positive response) was not used.	4947904
Metric 4: Reporting of doses/concentrations	Doses/concentrations were not reported and could not be calculated using default or reported estimates of body weight and diet/water intake (e.g.,	4940200 4947904 4947912

Table C.6: Data Quality Metrics and Unacceptable References Excluded at Data Quality Evaluation for Human Health Hazard – Animal		
Data Quality Metric	**Unacceptable if:**	**References excluded (HERO ID)**
	default intake values are not available for pregnant animals).	
Metric 5: Exposure duration	The duration of exposure was not reported. **OR** The reported exposure duration was not suited to the study type and/or outcome(s) of interest (e.g., <28 days for repeat dose).	4947904
Metric 6: Test animal characteristics	The test animal species was not reported. **OR** The test animal (species, strain, sex, life-stage, source) was not appropriate for the evaluation of the specific outcome(s) of interest (e.g., genetically modified animals, strain was uniquely susceptible or resistant to one or more outcome of interest).	4947912 4946441 4940200
Metric 7: Number of animals per group	The number of animals per study group was not reported. **OR** The number of animals per study group was insufficient to characterize toxicological effects (e.g., 1-2 animals in each group).	N/A.
Metric 8: Outcome assessment methodology	The outcome assessment methodology was not sensitive for the outcome(s) of interest (e.g., evaluation of endpoints outside the critical window of development, a systemic toxicity study that evaluated only grossly observable endpoints, such as clinical signs and mortality, etc.).	4953507 4947912 4940200 4940252 4940248
Metric 9: Reporting of data	Data presentation was inadequate (e.g., the report does not differentiate among findings in multiple exposure groups). **OR** Major inconsistencies were present in reporting of	4946441 4940200 2077994

Table C.6: Data Quality Metrics and Unacceptable References Excluded at Data Quality Evaluation for Human Health Hazard – Animal		
Data Quality Metric	**Unacceptable if:**	**References excluded (HERO ID)**
	results.	

Table C.7: Data Quality Metrics and Unacceptable References Excluded at Data Quality Evaluation for Human Health Hazard – In Vitro		
Data Quality Metric	**Unacceptable if:**	**References excluded (HERO ID)**
Metric 1: Test substance identity	The test substance identity or description cannot be determined from the information provided (e.g., nomenclature was unclear and CASRN or structure were not reported). **OR** For mixtures, the components and ratios were not characterized or did not include information that could result in a reasonable approximation of components.	N/A.
Metric 2: Negative controls	A concurrent negative control group was not included or reported. **OR** The reported negative control group was not appropriate (e.g., different cell lines used for controls and test substance exposure).	N/A.
Metric 3: Positive controls	A concurrent positive control or proficiency group was not used.	N/A.
Metric 4: Assay type	The assay type was not reported. **OR** The assay type was not appropriate for the study type or outcome of interest (e.g., *in vitro* skin corrosion protocol used for *in vitro* skin irritation assay).	N/A.
Metric 5: Reporting of concentration	The exposure doses/concentrations or amounts of test substance were not reported.	4940248 4940252 4947755
Metric 6: Exposure duration	No information on exposure duration(s) was reported. **OR** The exposure duration was not appropriate for the study type and/or outcome of interest (e.g., 24 hours exposure for bacterial reverse mutation test).	4940248 4940252

Table C.7: Data Quality Metrics and Unacceptable References Excluded at Data Quality Evaluation for Human Health Hazard – In Vitro		
Data Quality Metric	**Unacceptable if:**	**References excluded (HERO ID)**
Metric 7: Metabolic activation	No information on the characterization and use of a metabolic activation system was reported. **OR** The exposure duration was not appropriate for the study type and/or outcome of interest (e.g., 24 hours exposure for bacterial reverse mutation test).	4940252
Metric 8: Test model	The test model was not reported **OR** The test model was not routinely used for evaluation of the specific outcome of interest.	4940252
Metric 9: Outcome assessment methodology	The outcome assessment methodology was not reported. **OR** The assessment methodology was not appropriate for the outcome(s) of interest (e.g., cells were evaluated for chromosomal aberrations immediately after exposure to the test substance instead of after post-exposure incubation period).	N/A.

C.2.2 Environmental Hazard

For the screening review of this LPS candidate sodium gluconate, EPA excluded a total of 1892 references when assessing environmental hazard. Off-topic environmental hazard references excluded at title/abstract screening are listed in Table C.8, and those excluded at full-text screening are listed in Table C.9. References in Table C.10 represent unacceptable studies based on specific data quality metrics for environmental hazard. Off-topic and unacceptable references are displayed next to the corresponding exclusion criteria.

Table C.8: Off-Topic References Excluded at Title/Abstract Screening for Environmental Hazard									
Reference excluded (HERO ID) because the reference did NOT contain information needs[54] relevant to environmental hazard									
4947751	4941614	4947806	4942654	4941384	4942713	4267702	4941467	4941052	4941595
19702	4941616	4947807	4942655	4941385	4942714	4302029	4941484	4941053	4941601
19800	4941617	4947808	4942659	4941388	4942754	4327101	4941487	4941056	4941608
19855	4941618	4947809	4942661	4941389	4942758	4366817	4941491	4941058	4942451
1997743	4941621	4947810	4942663	4941395	4942773	4375143	4941492	4941060	4942452
2061011	4941622	4947811	4942665	4941397	4942775	4380671	4941500	4941068	4942453
2066780	4941623	4947812	4942693	4941402	4942817	4390129	4941503	4941069	4942456
2070843	4941626	4947813	4942694	4941408	4942819	4392515	4941504	4941076	4942459
2073796	4941628	4947814	4942710	4941413	4942820	4396121	4941507	4941081	4942460
2251366	4941629	4947815	4942711	4941414	4942822	4447128	4941509	4941082	4942461
2305122	4941630	4947830	4942759	4941425	4942825	4472242	4941516	4941089	4942504
2740828	4941635	4947831	4942764	4941429	4942827	4529995	4941521	4941090	4942506
2789501	4941637	4947832	4942765	4941430	4942828	4531080	4941522	4941096	4942508
2792369	4941641	4947833	4942766	4941433	4943335	4593855	4941525	4941108	4942509
2885345	4941642	4947834	4942767	4941434	4943351	4602816	4941526	4941109	4942510
3036081	4941702	4947835	4943126	4941439	4943392	4640938	4941529	4941115	4942511
3036375	4941704	4947836	4943155	4941441	4943393	4683188	4941530	4941124	4942514
3045285	4941712	4947837	4943165	4941442	4943394	4734068	4941536	4941125	4942515
3103748	4941781	4947838	4943169	4941446	4943402	4743036	4941538	4941126	4942517
3147238	4941788	4947840	4943216	4941454	4943403	4848493	4941540	4941135	4942519
3188921	4941792	4947841	4943217	4941457	4943413	4940980	4941545	4941136	4942520
3235430	4941793	4947842	4943221	4941461	4943458	4940981	4941547	4941146	4942521
3491920	4941795	4947843	4943234	4941464	4943464	4940984	4941548	4941149	4942522
3514544	4941798	4947844	4943235	4941471	4943466	4940985	4941554	4941152	4942523
3538354	4941799	4947845	4943267	4941473	4943470	4940989	4941560	4941153	4942528
3664515	4941802	4947846	4943279	4941474	4943475	4940994	4941566	4941154	4942529
3673078	4941868	4947856	4943282	4941475	4943476	4940997	4941567	4941161	4942531
3737219	4941869	4947879	4943295	4941478	4943479	4940998	4941570	4941165	4942533
3738347	4941878	4947880	4943301	4941480	4943526	4941001	4941571	4941172	4942535
3740044	4941879	4947881	4943334	4941485	4943530	4941011	4941574	4941173	4942536

[54] The information needs for environmental hazard includes a list of study characteristics pertaining to the test organism/species, type and level of effects, and use of controls. A complete list of the information needs is provided in Table A2 of the "Approach Document for Screening Hazard Information for Low-Priority Substances Under TSCA". These information needs helped guide the development of questions for title/abstract and full-text screening.

Table C.8: Off-Topic References Excluded at Title/Abstract Screening for Environmental Hazard									
3791358	4941882	4947882	4943345	4941488	4943531	4941012	4941578	4941182	4942543
3804682	4941888	4947883	4943395	4941495	4943533	4941013	4941579	4941183	4942551
3804687	4941980	4947884	4943399	4941505	4943535	4941017	4941580	4941185	4942575
3993283	4941987	4947885	4943400	4941510	4943540	4941022	4941583	4941187	4942577
3994810	4941989	4947886	4943541	4941511	4943543	4941023	4941584	4941195	4942579
3998664	4941991	4947888	4943580	4941512	4943547	4941033	4941585	4941197	4942583
3998780	4942158	4947900	4943581	4941513	4943572	4941036	4941586	4941199	4942586
3999304	4942172	4947901	4943648	4941517	4943574	4941037	4941591	4941206	4942589
4072289	4942249	4947911	4943656	4941524	4943582	4941043	4941592	4941214	4942591
4114843	4942250	57347	4943660	4941533	4943586	4941051	4941593	4941215	4942594
4119345	4942253	620381	4943775	4941534	4943641	4941790	4944160	4941218	4942645
4119539	4942257	824640	4944150	4941537	4943645	4941794	4944167	4941220	4942649
4119545	4942261	2126383	4944162	4941542	4943646	4941796	4944168	4941229	4942650
4119546	4942265	2540871	4944164	4941543	4943647	4941800	4944466	4941230	4942651
4119556	4942278	3086385	4944464	4941544	4943650	4941801	4944467	4941235	4942652
4119563	4942280	4057262	4944471	4941552	4943653	4941870	4944473	4941249	4942653
4119567	4942281	4120689	4944475	4941553	4943658	4941876	4944480	4941254	4941357
4119601	4942305	4941406	4944476	4941555	4943659	4941883	4944481	4941256	4941359
4119602	4942315	4942322	4944486	4941558	4943661	4941984	4944484	4941258	4941361
4119603	4942318	4942457	4944582	4941559	4943747	4941985	4944485	4941259	4941369
4119721	4942321	4942502	4944584	4941562	4943748	4941990	4944585	4941261	4941372
4119722	4942327	4942646	4944587	4941563	4943749	4941995	4944594	4941263	4941378
4120082	4942328	4946444	4944595	4941569	4943771	4941999	4944596	4941267	4941381
4120474	4942335	4946517	4944747	4941572	4943787	4942157	4944602	4941274	4941394
4120476	4942336	4946663	4945164	4941575	4943789	4942164	4944735	4941276	4941399
4120490	4942340	4947549	4945914	4941581	4943857	4942166	4944749	4941283	4941410
4120587	4942345	4947576	4945996	4941590	4943861	4942173	4944752	4941285	4941427
4120643	4942348	4947601	4946076	4941594	4943866	4942174	4945064	4941288	4941428
4120652	4942371	4947653	4946281	4941598	4943870	4942176	4945066	4941304	4941432
4120814	4942377	4947661	4946397	4941599	4943876	4942177	4945070	4941310	4941436
4220713	4942380	4947799	4946398	4941604	4943877	4942248	4945074	4941312	4941444
4291829	4942387	4947804	4946443	4941607	4943878	4942252	4945077	4941315	4941445
4292632	4942418	4947912	4946489	4941612	4943927	4942258	4945079	4941318	4941447
4314415	4942419	689851	4946519	4941627	4943928	4942259	4945114	4941319	4941455

Table C.8: Off-Topic References Excluded at Title/Abstract Screening for Environmental Hazard									
4314853	4942421	1040854	4946593	4941632	4943933	4942260	4945115	4941324	4941458
4316393	4942423	1047348	4946606	4941633	4943935	4942262	4945117	4941335	4941459
4319651	4942425	1048216	4946644	4941639	4943938	4942266	4945130	4941336	4941462
4331885	4942427	1112254	4946651	4941649	4943940	4942267	4945131	4941350	4941463
4375986	4942433	1115753	4946654	4941696	4943943	4942268	4945158	4941352	4953115
4403828	4942438	1159046	4946658	4941701	4943944	4942276	4945161	4941354	4953507
4435320	4942439	1206893	4946661	4941703	4943945	4942284	4945168	4941355	4955506
4496995	4942440	1336123	4947524	4941705	4943949	4942308	4945172	4941356	4955507
4543359	4942445	1454202	4947540	4941706	4943954	4942310	4947587	4942435	4955508
4552415	4942446	1509898	4947541	4941782	4943963	4942317	4947620	4942437	4955537
4556226	4942447	1613593	4947542	4941786	4944154	4942319	4947622	4942441	594396
4941208	4942455	1617565	4947543	4941789	4944155	4942330	4947688	4942442	922028
4941212	4942458	1631128	4947546	4942426	4947755	4942337	4947704	4942344	4947742
4941216	4942462	1749650	4947547	3460102	4947648	4942339	4947712	4941325	4942592
4941219	4942505	1772048	4947553	3469615	4947649	4942342	4947717	4941326	4942593
4941227	4942507	1850785	4947559	3723672	4947656	4942343	4942587	4941329	4942648
4941240	4942512	1939810	4947563	3735756	4947658	4941371	4942705	4941330	4942656
4941241	4942513	2005861	4947569	3753979	4947672	4941376	4942708	4941340	4942657
4941246	4942516	2035841	4947571	3830637	4947677	4941382	4942712	4941347	4942658
4941260	4942518	2036229	4947572	4066561	4947785	4942374	4947765	4941349	4942662
4941262	4942525	2043990	4947588	4074472	4947788	4942376	4947894	4941351	4942666
4941265	4942526	2050830	4947589	4078548	4947800	4942379	4947904	4941365	4942667
4941271	4942527	2077994	4947593	4078783	4947801	4942417	4952780	4941366	4942697
4941281	4942530	2087723	4947594	4081337	4947802	4942420	4947756	3198770	4947646
4941294	4942532	2219727	4947595	4081374	4947803	4941314	4942578	3187873	4947643
4941297	4942534	2226345	4947597	4166472	4947805	4941311	4942576	2952166	4947642
4941298	4942537	2574699	4947623	4942443	4947757	2862299	4947639	4942429	4942373
4941300	4942541	2587722	4947625	4942444	4947762	2821389	4947638	4942450	4942372
4941301	4942544	2589049	4947634	4942448	4947764	4941317	4942545	4941306	4942550
4947751	4941614	4947806	4942654	4941384	4942713	4267702	4941467	4941052	4941595
19702	4941616	4947807	4942655	4941385	4942714	4302029	4941484	4941053	4941601
19800	4941617	4947808	4942659	4941388	4942754	4327101	4941487	4941056	4941608
19855	4941618	4947809	4942661	4941389	4942758	4366817	4941491	4941058	4942451
1997743	4941621	4947810	4942663	4941395	4942773	4375143	4941492	4941060	4942452

Table C.8: Off-Topic References Excluded at Title/Abstract Screening for Environmental Hazard									
2061011	4941622	4947811	4942665	4941397	4942775	4380671	4941500	4941068	4942453
2066780	4941623	4947812	4942693	4941402	4942817	4390129	4941503	4941069	4942456
2070843	4941626	4947813	4942694	4941408	4942819	4392515	4941504	4941076	4942459
2073796	4941628	4947814	4942710	4941413	4942820	4396121	4941507	4941081	4942460
2251366	4941629	4947815	4942711	4941414	4942822	4447128	4941509	4941082	4942461
2305122	4941630	4947830	4942759	4941425	4942825	4472242	4941516	4941089	4942504
2740828	4941635	4947831	4942764	4941429	4942827	4529995	4941521	4941090	4942506
2789501	4941637	4947832	4942765	4941430	4942828	4531080	4941522	4941096	4942508
2792369	4941641	4947833	4942766	4941433	4943335	4593855	4941525	4941108	4942509
2885345	4941642	4947834	4942767	4941434	4943351	4602816	4941526	4941109	4942510
3036081	4941702	4947835	4943126	4941439	4943392	4640938	4941529	4941115	4942511
3036375	4941704	4947836	4943155	4941441	4943393	4683188	4941530	4941124	4942514
3045285	4941712	4947837	4943165	4941442	4943394	4734068	4941536	4941125	4942515
3103748	4941781	4947838	4943169	4941446	4943402	4743036	4941538	4941126	4942517
3147238	4941788	4947840	4943216	4941454	4943403	4848493	4941540	4941135	4942519
3188921	4941792	4947841	4943217	4941457	4943413	4940980	4941545	4941136	4942520
3235430	4941793	4947842	4943221	4941461	4943458	4940981	4941547	4941146	4942521
3491920	4941795	4947843	4943234	4941464	4943464	4940984	4941548	4941149	4942522
3514544	4941798	4947844	4943235	4941471	4943466	4940985	4941554	4941152	4942523
3538354	4941799	4947845	4943267	4941473	4943470	4940989	4941560	4941153	4942528
3664515	4941802	4947846	4943279	4941474	4943475	4940994	4941566	4941154	4942529
3673078	4941868	4947856	4943282	4941475	4943476	4940997	4941567	4941161	4942531
3737219	4941869	4947879	4943295	4941478	4943479	4940998	4941570	4941165	4942533
3738347	4941878	4947880	4943301	4941480	4943526	4941001	4941571	4941172	4942535
3740044	4941879	4947881	4943334	4941485	4943530	4941011	4941574	4941173	4942536
3791358	4941882	4947882	4943345	4941488	4943531	4941012	4941578	4941182	4942543
3804682	4941888	4947883	4943395	4941495	4943533	4941013	4941579	4941183	4942551
3804687	4941980	4947884	4943399	4941505	4943535	4941017	4941580	4941185	4942575
3993283	4941987	4947885	4943400	4941510	4943540	4941022	4941583	4941187	4942577
3994810	4941989	4947886	4943541	4941511	4943543	4941023	4941584	4941195	4942579
3998664	4941991	4947888	4943580	4941512	4943547	4941033	4941585	4941197	4942583
3998780	4942158	4947900	4943581	4941513	4943572	4941036	4941586	4941199	4942586
3999304	4942172	4947901	4943648	4941517	4943574	4941037	4941591	4941206	4942589
4072289	4942249	4947911	4943656	4941524	4943582	4941043	4941592	4941214	4942591

Table C.8: Off-Topic References Excluded at Title/Abstract Screening for Environmental Hazard									
4114843	4942250	57347	4943660	4941533	4943586	4941051	4941593	4941215	4942594
4119345	4942253	620381	4943775	4941534	4943641	4941790	4944160	4941218	4942645
4119539	4942257	824640	4944150	4941537	4943645	4941794	4944167	4941220	4942649
4119545	4942261	2126383	4944162	4941542	4943646	4941796	4944168	4941229	4942650
4119546	4942265	2540871	4944164	4941543	4943647	4941800	4944466	4941230	4942651
4119556	4942278	3086385	4944464	4941544	4943650	4941801	4944467	4941235	4942652
4119563	4942280	4057262	4944471	4941552	4943653	4941870	4944473	4941249	4942653
4119567	4942281	4120689	4944475	4941553	4943658	4941876	4944480	4941254	4941357
4119601	4942305	4941406	4944476	4941555	4943659	4941883	4944481	4941256	4941359
4119602	4942315	4942322	4944486	4941558	4943661	4941984	4944484	4941258	4941361
4119603	4942318	4942457	4944582	4941559	4943747	4941985	4944485	4941259	4941369
4119721	4942321	4942502	4944584	4941562	4943748	4941990	4944585	4941261	4941372
4119722	4942327	4942646	4944587	4941563	4943749	4941995	4944594	4941263	4941378
4120082	4942328	4946444	4944595	4941569	4943771	4941999	4944596	4941267	4941381
4120474	4942335	4946517	4944747	4941572	4943787	4942157	4944602	4941274	4941394
4120476	4942336	4946663	4945164	4941575	4943789	4942164	4944735	4941276	4941399
4120490	4942340	4947549	4945914	4941581	4943857	4942166	4944749	4941283	4941410
4120587	4942345	4947576	4945996	4941590	4943861	4942173	4944752	4941285	4941427
4120643	4942348	4947601	4946076	4941594	4943866	4942174	4945064	4941288	4941428
4120652	4942371	4947653	4946281	4941598	4943870	4942176	4945066	4941304	4941432
4120814	4942377	4947661	4946397	4941599	4943876	4942177	4945070	4941310	4941436
4220713	4942380	4947799	4946398	4941604	4943877	4942248	4945074	4941312	4941444
4291829	4942387	4947804	4946443	4941607	4943878	4942252	4945077	4941315	4941445
4292632	4942418	4947912	4946489	4941612	4943927	4942258	4945079	4941318	4941447
4314415	4942419	689851	4946519	4941627	4943928	4942259	4945114	4941319	4941455
4314853	4942421	1040854	4946593	4941632	4943933	4942260	4945115	4941324	4941458
4316393	4942423	1047348	4946606	4941633	4943935	4942262	4945117	4941335	4941459
4319651	4942425	1048216	4946644	4941639	4943938	4942266	4945130	4941336	4941462
4331885	4942427	1112254	4946651	4941649	4943940	4942267	4945131	4941350	4941463
4375986	4942433	1115753	4946654	4941696	4943943	4942268	4945158	4941352	4953115
4403828	4942438	1159046	4946658	4941701	4943944	4942276	4945161	4941354	4953507
4435320	4942439	1206893	4946661	4941703	4943945	4942284	4945168	4941355	4955506
4496995	4942440	1336123	4947524	4941705	4943949	4942308	4945172	4941356	4955507
4543359	4942445	1454202	4947540	4941706	4943954	4942310	4947587	4942435	4955508

Table C.8: Off-Topic References Excluded at Title/Abstract Screening for Environmental Hazard									
4552415	4942446	1509898	4947541	4941782	4943963	4942317	4947620	4942437	4955537
4556226	4942447	1613593	4947542	4941786	4944154	4942319	4947622	4942441	594396
4941208	4942455	1617565	4947543	4941789	4944155	4942330	4947688	4942442	922028
4941212	4942458	1631128	4947546	4942426	4947755	4942337	4947704	4942344	4947742
4941216	4942462	1749650	4947547	3460102	4947648	4942339	4947712	4941325	4942592
4941219	4942505	1772048	4947553	3469615	4947649	4942342	4947717	4941326	4942593
4941227	4942507	1850785	4947559	3723672	4947656	4942343	4942587	4941329	4942648
4941240	4942512	1939810	4947563	3735756	4947658	4941371	4942705	4941330	4942656
4941241	4942513	2005861	4947569	3753979	4947672	4941376	4942708	4941340	4942657
4941246	4942516	2035841	4947571	3830637	4947677	4941382	4942712	4941347	4942658
4941260	4942518	2036229	4947572	4066561	4947785	4942374	4947765	4941349	4942662
4941262	4942525	2043990	4947588	4074472	4947788	4942376	4947894	4941351	4942666
4941265	4942526	2050830	4947589	4078548	4947800	4942379	4947904	4941365	4942667
4941271	4942527	2077994	4947593	4078783	4947801	4942417	4952780	4941366	4942697
4941281	4942530	2087723	4947594	4081337	4947802	4942420	4947756	3198770	4947646
4941294	4942532	2219727	4947595	4081374	4947803	4941314	4942578	3187873	4947643
4941297	4942534	2226345	4947597	4166472	4947805	4941311	4942576	2952166	4947642
4941298	4942537	2574699	4947623	4942443	4947757	2862299	4947639	4942429	4942373
4941300	4942541	2587722	4947625	4942444	4947762	2821389	4947638	4942450	4942372
4941301	4942544	2589049	4947634	4942448	4947764	4941317	4942545	4941306	4942550
4941305									
Reference excluded (HERO ID) because the reference primarily contained *in silico* data									
N/A.									

Table C.9: Screening Questions and Off-Topic References Excluded at Full-Text Screening for Environmental Hazard		
Question	**Off-topic if answer is:**	**References excluded (HERO ID)**
Does the reference contain information pertaining to a low- priority substance candidate?	No	1576583 2777828 4940080 4941620 4944742 4940081 4940082 4944478

Table C.9: Screening Questions and Off-Topic References Excluded at Full-Text Screening for Environmental Hazard		
Question	**Off-topic if answer is:**	**References excluded (HERO ID)**
What type of source is this reference?	Review article or book chapter that contains only citations to primary literature sources	N/A.
Is quantitative environmental hazard data presented?	No	N/A.
Is this primarily a modeling/simulation study? [Note: select "No" if experimental verification was included in the study]	Yes	N/A.
Is environmental hazard data presented for standard or non-standard aquatic or terrestrial species (fish, invertebrates, microorganisms, non-mammalian terrestrial species)?	No	4942584
Is exposure measured for the target substance or is the test substance a mixture (except for reasonable impurities, byproducts, and aqueous solutions) or formulated product?	Mixture	N/A.
	Formulated Product	N/A.
Does the reference report a duration of exposure?	No	N/A.
Does the reference report a negative control that is a vehicle control or no treatment control?	No	4940264
Does the reference include endpoints in the information needs?	No	5077191

Table C.10: Data Quality Metrics and Unacceptable References Excluded at Data Quality Evaluation for Environmental Hazard		
Question	**Unacceptable if:**	**References excluded (HERO ID)**
Metric 1: Test substance identity	The test substance identity or description cannot be determined from the information provided (e.g., nomenclature was unclear, CASRN or structure were not reported, substance name/ description does not match CASRN). **OR** For mixtures, the components and ratios were not characterized or did not include information that could result in a reasonable approximation of components.	4940261 4940258
Metric 2: Negative controls	A concurrent negative control group was not included or reported.	4940258 4940261

Table C.10: Data Quality Metrics and Unacceptable References Excluded at Data Quality Evaluation for Environmental Hazard		
Question	**Unacceptable if:**	**References excluded (HERO ID)**
Metric 3: Experimental system	The experimental system (e.g., static, semi-static, or flow-through regime) was not described.	4940256 4940258 4940261 4942597
Metric 4: Reporting of concentrations	Test concentrations were not reported.	4940256 4940258 4940261 4942597
Metric 5: Exposure duration	The duration of exposure was not reported. **OR** The reported exposure duration was not suited to the study type and/or outcome(s) of interest (e.g., study intended to assess effects on reproduction did not expose organisms for an acceptable period of time prior to mating).	N/A.
Metric 6: Test organism characteristics	The test species was not reported. **OR** The test species, life stage, or age was not appropriate for the outcome(s) of interest.	4940256 4940258 4940261 4942597
Metric 7: Outcome assessment methodology	The outcome assessment methodology was not reported.	N/A.
Metric 8: Reporting of data	Data presentation was inadequate. **OR** Major inconsistencies were present in reporting of results.	4942597 4940261 4940258 4940256

C.2.3 Fate

For the screening review of LPS candidate sodium gluconate, EPA excluded a total of 5045 references when assessing environmental fate. Off-topic fate references excluded at title/abstract screening are listed in Table C.11, and those excluded at full-text screening are listed in Table C.12. References in Table C.13 represent unacceptable studies based on specific data quality metrics for fate. Off-topic and unacceptable references are displayed next to the corresponding exclusion criteria.

Table C.11: Off-Topic References Excluded at Initial Screening for Fate									
Reference excluded (HERO ID) because the reference did NOT contain information needs[55] relevant to environmental fate									
4947698	4948277	4947773	4947149	4944733	4941880	4550270	4941700	4947044	4943779
1016211	4948278	4947775	4947150	4944734	4941881	4560033	4941707	4947079	4943780
1019493	4948279	4947776	4947151	4944736	4941884	4560428	4941708	4947080	4943781
1029322	4948280	4947777	4947152	4944737	4941885	4561187	4941709	4947081	4943784
1033739	4948281	4947779	4947163	4944738	4941887	4566211	4941710	4947082	4943785
1039487	4948282	4947816	4947165	4944739	4941889	4568392	4941711	4947083	4943786
1040116	4948283	4947817	4947166	4944740	4941977	4568878	4941713	4947084	4943788
1046204	4948284	4947818	4947167	4944741	4941978	4569215	4941714	4947085	4943790
1047517	4948285	4947819	4947168	4944744	4941979	4575011	4941715	4947086	4943792
1050803	4948287	4947820	4947169	4944745	4941981	4575154	4941780	4947087	4943794
1050863	4948288	4947821	4947170	4944746	4941982	4580065	4941783	4947088	4943859
1062433	4948289	4947823	4947171	4944748	4941983	4602820	4941784	4947089	4943860
1071558	4948290	4947824	4947172	4944750	4941986	4604183	4941785	4947090	4943864
1110499	4948291	4947825	4947173	4944753	4941988	4605077	4941787	4947091	4943865
1150251	4948292	4947826	4947174	4944754	4941992	4611583	4941791	4947092	4943871
1155637	4948293	4947827	4947205	4944755	4941993	4635279	4941797	4947093	4943872
1157207	4948295	4947828	4947206	4944781	4941996	4649607	4941871	4947094	4943873
1160131	4948296	4947829	4947207	4944836	4941997	465562	4941872	4947095	4943875
1168172	4948297	4947865	4947208	4944837	4941998	4669682	4941873	4947096	4943880
1172952	4948298	4947866	4947209	4944839	4942000	4690884	4941874	4947097	4943922
1177273	4948299	4947867	4947210	4944842	4942156	4701208	4941875	4947098	4943923
1178025	4948300	4947868	4947211	4944846	4942159	4702596	4941877	4947116	4943924
1181715	4948301	4947869	4947212	4944890	4942161	471016	4941257	4947118	4943925
1184177	4948302	4947870	4947213	4944893	4942162	4721847	4941264	4947119	4943926
1195839	4948303	4947871	4947214	4944904	4942163	4731581	4941266	4947120	4943930
1198396	4948304	4947872	4947215	4944932	4942165	4735898	4941268	4947121	4943932
1203783	4948306	4947873	4947216	4944939	4942167	4738596	4941269	4947123	4943934
1205930	4948307	4947874	4947217	4944989	4942168	4740054	4941270	4947124	4943936
1207770	4948308	4947875	4947218	4944996	4942169	4740811	4941272	4947125	4943937
1231527	4948309	4947876	4947219	4945011	4942170	4745391	4941275	4947126	4943939

[55] The information needs for fate includes a list of study characteristics pertaining to the associated media and exposure pathways, associated processes, and use of controls. A complete list of the information needs is provided in Table A3 of the "Approach Document for Screening Hazard Information for Low-Priority Substances Under TSCA". These information needs helped guide the development of questions for title/abstract and full-text screening.

Table C.11: Off-Topic References Excluded at Initial Screening for Fate									
1235526	4948310	4947877	4947220	4945017	4942171	4745578	4941277	4947127	4943941
1436203	4948311	4947878	4947230	4945018	4942175	4747789	4941278	4947128	4943942
1457148	4948312	4947919	4947232	4945020	4942178	4752490	4941279	4947129	4943948
1457225	4948313	4947920	4947233	4945030	4942247	4752887	4941280	4947142	4943950
1457818	4948314	4947921	4947235	4945036	4942251	4764276	4941282	4947143	4943951
1457820	4948315	4947922	4947237	4945060	4942279	4772353	4941284	4947144	4943952
1533019	4948316	4947923	4947238	4945063	4942282	4787173	4941287	4947145	4943953
1573231	4948317	4947925	4947239	4945065	4942283	4790967	4941289	4947146	4943955
1577430	4948318	4947926	4947240	4945067	4942304	4801136	4941290	4947147	4943956
1585355	4948319	4947927	4947241	4945068	4942306	4802652	4941291	4947148	4943957
1589711	4948320	4947928	4947242	4945069	4942307	4823262	4941292	4388644	4943958
1655444	4948321	4947929	4947243	4945071	4942309	4825338	4941293	4389070	4943959
1666268	4948322	4947930	4947244	4945075	4942311	4825720	4941295	4389626	4943960
1675258	4948323	4947931	4947245	4945076	4942312	4827713	4941296	4389627	4943961
1689366	4948324	4947932	4947275	4945080	4942313	4828341	4941299	4393002	4943962
1693800	4948325	4947933	4947276	4945081	4942314	4837124	4941302	4393091	4943964
1726534	4948326	4947937	4947277	4945084	4942316	4841066	4941303	4393545	4943965
1734774	4948327	4947938	4947278	4945086	4942320	4860634	4941308	4394660	4943966
1735836	4948328	4947939	4947279	4945091	4942323	4868812	4941309	4395155	4943967
1759021	4948329	4947940	4947280	4945102	4942324	4882501	4941313	4397168	4944145
1759382	4948330	4947941	4947281	4945105	4942325	4911786	4941320	4397170	4944147
1760075	4948335	4947942	4947282	4945106	4942326	4925504	4941322	4399544	4944148
1760390	4948336	4947943	4947283	4945107	4942329	4940943	4941323	4400383	4944151
1760397	4948337	4947944	4947284	4945113	4942331	4940946	4941327	4402033	4944152
1763482	4948338	4947945	4947285	4945116	4942332	4940949	4941328	4402340	4944153
1765216	4948339	4947946	4947286	4945118	4942333	4940950	4941331	4414610	4944158
1766188	4948340	4947947	4947287	4945119	4942334	4940951	4941332	4421420	4944159
1768182	4948342	4947948	4947288	4945120	4942338	4940953	4941333	4421814	4944161
1800285	4948343	4947949	4947289	4945121	4942341	4940959	4941334	4423753	4944163
1866419	4948344	4947950	4947290	4945122	4942346	4940966	4941337	4424564	4944165
1876441	4948346	4947951	4947291	4945123	4942347	4940969	4941338	4428098	4944166
1928573	4948347	4947952	4947293	4945124	4942349	4940972	4941339	4428556	4944465
1930841	4948348	4947983	4947294	4945128	4942370	4940973	4941341	4429864	4944468
1933097	4948351	4947984	4947295	4945132	4942375	4940974	4941342	4432591	4944469

Table C.11: Off-Topic References Excluded at Initial Screening for Fate									
194067	4948353	4947985	4947297	4945133	4942378	4940975	4941343	4435487	4944470
1952145	4948354	4947986	4947298	4945134	4942381	4940976	4941345	4437429	4944472
1953874	4948355	4947987	4947299	4945135	4942382	4940977	4941348	4443804	4944474
1966495	4948356	4947988	4947300	4945141	4942383	4940978	4941353	4446236	4944477
1989950	4948357	4947989	4947301	4945143	4942384	4940979	4941358	4455300	4944479
1991173	4948358	4947991	4947302	4945156	4942385	4940983	4941360	4455775	4944482
1994721	4948359	4947992	4947303	4945162	4942386	4940986	4941362	4458084	4944483
1999661	4948361	4947993	4947304	4945163	4942388	4940987	4941363	4458232	4944583
2015596	4948362	4947994	4947305	4945165	4942389	4940990	4941364	4461689	4944586
2017597	4948363	4947995	4947306	4945166	4942390	4940992	4941367	4466667	4944588
2021125	4948364	4948004	4947307	4945167	4942414	4940993	4941368	4468382	4944589
2023172	4948365	4948005	4947308	4945193	4942416	4940995	4941373	4469050	4944590
2023413	4948366	4948006	4947309	4945200	4942422	4940996	4941374	4474837	4944591
2036356	4948367	4948007	4947310	4945201	4942424	4941000	4941375	4481056	4944592
2039057	4948368	4948008	4947311	4945204	4942428	4941002	4941377	4487506	4944593
2051784	4948369	4948009	4947312	4945205	4942430	4941004	4941379	4489237	4944597
2055086	4948371	4948010	4947313	4945212	4942431	4941005	4941380	4489772	4944598
2056537	4948372	4948011	4947314	4945236	4942432	4941006	4941383	4490354	4944600
2061182	4948373	4948012	4947315	4945237	4942434	4941007	4941386	4490449	4944601
2061422	4948374	4948013	4947316	4945279	4942436	4941008	4941387	4492191	4944603
2061561	4948375	4948014	4947317	4945286	4942454	4941009	4941390	4496631	4944604
2063060	4948376	4948015	4947318	4945315	4942524	4941016	4941391	4498882	4944731
2113515	4948377	4948016	4947319	4945321	4942538	4941018	4941392	4499501	4374970
2113530	4948378	4948025	4947320	4945326	4942540	4941019	4941393	452687	4375238
2113659	4948379	4948026	4947321	4945379	4942542	4941021	4941396	4531331	4377416
2114236	4948380	4948027	4947322	4945385	4942547	4941025	4941400	4533599	4377635
2303433	4948381	4948028	4947323	4945388	4942548	4941026	4941401	4534977	4377831
2338751	4948382	4948029	4947324	4945404	4942549	4941027	4941403	4537145	4378841
2362114	4948383	4948030	4947325	4945418	4942580	4941030	4941404	4538528	4380919
2375285	4948384	4948032	4947326	4945441	4942581	4941032	4941405	4540422	4382409
2457324	4948385	4948033	4947327	4945444	4942582	4941034	4941407	4548071	4382411
2466449	4948386	4948034	4947329	4945453	4942585	4941035	4941409	4548314	4384048
2521268	4948387	4948035	4947330	4945511	4942588	4941038	4941411	4549483	4947034
2522503	4948388	4948036	4947331	4945512	4942590	4941040	4941412	4947695	4947035

Table C.11: Off-Topic References Excluded at Initial Screening for Fate									
2524040	4948389	4948037	4947332	4945525	4942595	4941041	4941415	4947697	4374603
2524248	4948390	4948038	4947333	4945557	4942596	4941042	4941416	4946796	4943347
2536666	4948391	4948039	4947335	4945562	4942597	4941044	4941421	4946797	4943348
2563719	4948392	4948040	4947336	4945564	4942598	4941045	4941422	4946798	4943350
2565690	4948393	4948041	4947337	4945568	4942647	4941046	4941423	4946799	4943396
2592746	4948394	4948042	4947338	4945610	4942660	4941047	4941426	4946800	4943397
2594197	4948395	4948043	4947339	4945626	4942664	4941048	4941431	4946801	4943398
2594309	4948396	4948044	4947340	4945630	4942692	4941050	4941437	4946802	4943404
2595846	4948397	4948045	4947341	4945635	4942695	4941059	4941438	4946803	4943405
2604429	4948399	4948046	4947342	4945640	4942696	4941061	4941440	4946804	4943406
2615236	4948400	4948047	4947344	4945643	4942698	4941063	4941443	4946807	4943407
2647504	4948401	4948048	4947345	4945653	4942699	4941064	4941448	4946811	4943408
2648592	4948402	4948049	4947346	4945683	4942700	4941065	4941449	4946813	4943409
2665770	4948403	4948051	4947347	4945727	4942701	4941066	4941450	4946815	4943410
2673392	4948404	4948052	4947348	4945731	4942702	4941067	4941451	4946820	4943411
2675088	4948405	4948054	4947349	4945734	4942704	4941070	4941452	4946821	4943412
2683055	4948406	4948055	4947350	4945737	4942706	4941071	4941456	4946822	4943414
2693859	4948407	4948056	4947351	4945740	4942707	4941072	4941460	4946824	4943415
2742638	4948408	4948057	4947352	4945742	4942709	4941073	4941465	4946825	4943459
2748861	4948410	4948058	4947353	4945775	4942755	4941075	4941466	4946826	4943460
2750435	4948411	4948059	4947354	4945783	4942760	4941077	4941468	4946827	4943462
2750990	4948412	4948060	4947355	4945822	4942761	4941079	4941469	4946828	4943463
2810934	4948413	4948061	4947356	4945825	4942762	4941080	4941470	4946829	4943465
2833030	4948414	4948062	4947357	4945830	4942763	4941083	4941472	4946830	4943467
2861950	4948415	4948063	4947358	4945832	4942768	4941084	4941476	4946831	4943469
2864545	4948416	4948064	4947359	4945904	4942769	4941087	4941477	4946832	4943472
2864817	4948417	4948065	4947360	4945906	4942770	4941088	4941479	4946833	4943474
2880619	4948418	4948066	4947361	4945922	4942772	4941091	4941481	4946834	4943477
2880620	4948419	4948067	4947362	4945925	4942774	4941092	4941482	4946835	4943480
2880624	4948420	4948068	4947363	4945975	4942824	4941093	4941486	4946836	4943525
2893306	4948423	4948070	4947364	4946069	4942880	4941095	4941489	4946837	4943527
2915743	4948424	4948071	4947365	4946073	4942934	4941100	4941490	4946838	4943528
2982625	4948425	4948072	4947366	4946080	4942935	4941101	4941493	4946839	4943529
2984623	4948426	4948073	4947367	4946158	4942937	4941102	4941494	4946840	4943532

Table C.11: Off-Topic References Excluded at Initial Screening for Fate									
3007069	4948427	4948074	4947368	4946172	4942938	4941103	4941496	4946843	4943534
3015522	4948428	4948075	4947369	4946277	4942940	4941104	4941497	4946844	4943536
3022174	4948429	4948076	4947370	4946279	4942941	4941105	4941498	4946849	4943538
3028004	4948430	4948077	4947371	4946447	4942943	4941107	4941499	4946858	4943539
3039688	4948431	4948078	4947372	4946577	4942944	4941110	4941501	4946859	4943542
3068597	4948433	4948079	4947373	4946578	4942947	4941112	4941502	4946873	4943544
3069497	4948441	4948080	4947374	4946579	4942950	4941113	4941506	4946878	4943546
3088505	4948442	4948081	4947375	4946580	4942951	4941114	4941508	4946879	4943573
3115335	4948443	4948082	4947376	4946581	4942952	4941117	4941514	4946880	4943575
3116865	4948444	4948083	4947377	4946582	4942953	4941118	4941515	4946881	4943576
3120121	4948445	4948084	4947378	4946583	4942954	4941120	4941518	4946882	4943578
3163432	4948446	4948085	4947379	4946584	4942955	4941121	4941519	4946883	4943579
3169252	4948447	4948086	4947380	4946585	4943106	4941122	4941520	4946884	4943584
3173200	4948448	4948087	4947381	4946586	4943110	4941130	4941523	4946885	4943585
3212876	4948449	4948088	4947382	4946624	4943113	4941131	4941527	4946886	4943587
3213885	4948450	4948089	4947383	4946625	4943114	4941133	4941528	4946887	4943592
3228265	4948451	4948090	4947384	4946627	4943116	4941142	4941531	4946888	4943593
3268792	4948452	4948092	4947385	4946628	4943119	4941143	4941532	4946889	4943594
3328916	4948463	4948093	4947386	4946629	4943122	4941144	4941535	4946890	4943595
3346350	4948464	4948094	4947387	4946630	4943123	4941145	4941539	4946891	4943640
3374260	4948465	4948095	4947388	4946631	4943125	4941147	4941541	4946892	4943642
3379967	4948466	4948096	4947389	4946632	4943149	4941148	4941549	4946893	4943644
3391658	4948467	4948097	4947390	4946633	4943153	4941150	4941550	4946894	4943649
3398035	4948468	4948098	4947391	4946634	4943154	4941151	4941551	4946895	4943651
3410241	4948469	4948099	4947392	4946635	4943156	4941157	4941556	4946896	4943652
3425319	4948470	4948100	4947393	4946636	4943160	4941158	4941557	4946897	4943654
3430301	4948471	4948101	4947394	4946637	4943161	4941160	4941561	4946898	4943655
3453603	4948472	4948102	4947395	4946638	4943162	4941162	4941564	4946899	4943657
3457917	4948473	4948103	4947396	4946664	4943163	4941163	4941565	4946900	4943662
3458439	4948474	4948104	4947397	4946665	4943164	4941164	4941568	4946901	4943727
3459150	4948485	4948105	4947398	4946666	4943166	4941166	4941573	4946902	4943728
3459165	4948486	4948106	4947399	4946667	4943167	4941168	4941576	4946903	4946955
3460447	4948487	4948107	4947400	4946668	4943168	4941169	4941577	4946904	4946958
3468890	4948488	4948108	4947401	4946669	4943170	4941170	4941582	4946905	4946960

Table C.11: Off-Topic References Excluded at Initial Screening for Fate									
3472099	4948489	4948109	4947402	4946670	4943215	4941175	4941587	4946908	4946962
3472209	4948490	4948110	4947403	4946671	4943219	4941176	4941588	4946913	4946964
3487563	4948491	4948111	4947404	4946672	4943222	4941177	4941589	4946916	4946965
3578984	4948492	4948112	4947405	4946673	4943223	4941179	4941596	4946917	4946967
3602591	4948493	4948113	4947406	4946674	4943225	4941181	4941600	4946921	4946968
3651958	4948494	4948114	4947407	4946675	4943226	4941188	4941602	4946922	4946969
3652834	4948495	4948115	4947408	4946676	4943229	4941189	4941605	4946923	4946970
3673708	4948498	4948117	4947409	4946677	4943230	4941191	4941606	4946924	4946971
3695614	4948499	4948118	4947410	4946678	4943231	4941193	4941609	4946925	4946972
3701231	4948500	4948119	4947412	4946679	4943232	4941194	4941610	4946926	4946973
3702762	4948501	4948120	4947413	4946680	4943233	4941196	4941611	4946927	4946974
3721521	4948502	4948121	4947414	4946681	4943236	4941198	4941613	4946928	4946975
3725946	4948503	4948122	4947415	4946682	4943262	4941201	4941615	4946929	4946976
3730534	4948504	4948123	4947416	4946684	4943263	4941202	4941620	4946930	4946977
3732912	4948505	4948124	4947417	4946685	4943264	4941203	4941631	4946938	4946978
3736162	4948506	4948125	4947418	4946686	4943265	4941204	4941634	4946947	4946979
3736910	4948507	4948126	4947419	4946687	4943266	4941209	4941636	4948264	4946980
3760441	4948508	4948127	4947420	4946688	4943268	4941211	4941638	4948265	4946981
3766605	4948509	4948128	4947421	4946689	4943269	4941213	4941640	4948266	4946982
3810924	4948510	4948129	4947422	4946690	4943270	4941223	4941643	4948268	4946983
3814826	4948511	4948130	4947423	4946715	4943272	4941224	4941644	4948269	4946986
3814978	4948512	4948131	4947424	4946720	4943275	4941226	4941645	4948270	4946988
382373	4948513	4948132	4947425	4946721	4943277	4941228	4941646	4948271	4946990
3844770	4948514	4948133	4947426	4946727	4943278	4941231	4941648	4948272	4946995
3845301	4948515	4948134	4947427	4946728	4943280	4941232	4941693	4948273	4947002
3890547	4948516	4948135	4947428	4946745	4943283	4941233	4941694	4948274	4947003
3896824	4948517	4948136	4947429	4946746	4943284	4941234	4941695	4948275	4947008
3997235	4948518	4948137	4947430	4946747	4943285	4941236	4941697	4948276	4947011
3999296	4948519	4948138	4947431	4946748	4943289	4941237	4941698	4947699	4947012
4000271	4948520	4948139	4947432	4946749	4943291	4941238	4941699	4947700	4947023
4000746	4948521	4948140	4947433	4946750	4943293	4941239	4943729	4947701	4947025
4000887	4948522	4948141	4947434	4946751	4943298	4941242	4943732	4947771	4947031
4001578	4948523	4948142	4947435	4946752	4943300	4941243	4943734	4947772	4947032
4001654	4948525	4948143	4947436	4946753	4943303	4941244	4943735	4948250	4947606

Table C.11: Off-Topic References Excluded at Initial Screening for Fate									
4002230	4948526	4948144	4947437	4946754	4943304	4941245	4943736	4948251	4947607
4002590	4948527	4948145	4947438	4946755	4943305	4941247	4943738	4948254	4947608
4060629	4948528	4948147	4947439	4946756	4943307	4941248	4943739	4948255	4947609
4072033	4948529	4948148	4947440	4946764	4943331	4941250	4943740	4948256	4947610
4072901	4948530	4948149	4947441	4946771	4943333	4941251	4943741	4948257	4947611
4073919	4948531	4948150	4947442	4946773	4943336	4941252	4943742	4948258	4947612
4074665	4948532	4948151	4947443	4946778	4943337	4941253	4943743	4948259	4947613
4075996	4948533	4948152	4947444	4946780	4943338	4941255	4943745	4948260	4947614
4076964	4948534	4948153	4947445	4946781	4943339	4947036	4943750	4948261	4947615
4077417	4948535	4948154	4947446	4946785	4943341	4947037	4943772	4948262	4947637
4077717	4948536	4948155	4947447	4946790	4943342	4947038	4943773	4948263	4947655
4078894	4948537	4948156	4947448	4946793	4943343	4947039	4943774	4947033	4947694
4078912	4948538	4948157	4947449	4946794	4943344	4947040	4943776	4361132	4947671
4079654	4948541	4948158	4947450	4946795	4943346	4947041	4943778	4364365	4947674
4079719	4948542	4948159	4947451	4301328	4948621	4948208	4947500	4372651	4947676
4079990	4948543	4948160	4947452	4304269	4948622	4948209	4947501	4372807	4947689
4080001	4948544	4948161	4947453	4305966	4948623	4948210	4947502	4373863	4947691
4081443	4948545	4948162	4947454	4306562	4948645	4948211	4947504	4374940	4947692
4081645	4948546	4948163	4947455	4306578	4949331	4948212	4947505	4351902	4947662
4081873	4948547	4948165	4947456	4307324	4949337	4948213	4947506	4352597	4947665
4084810	4948548	4948166	4947457	4316595	4949345	4948214	4947507	4353385	4947666
4097819	4948549	4948167	4947458	4316812	4949346	4948215	4947508	4353505	4947667
4114369	4948550	4948168	4947459	4318136	4949347	4948216	4947509	4353835	4947668
4116098	4948552	4948169	4947460	4318925	4949348	4948217	4947510	4357745	4947669
4117629	4948553	4948170	4947461	4320317	4949349	4948218	4947511	4360490	4947670
4117928	4948554	4948171	4947462	4320976	4949350	4948220	4947512	4948201	4947491
4122451	4948563	4948172	4947463	4321430	4949352	4948221	4947513	4948202	4947492
4124988	4948564	4948173	4947464	4322919	4949353	4948222	4947514	4948203	4947493
4126830	4948565	4948174	4947465	4323216	495092	4948223	4947515	4948204	4947495
4126895	4948566	4948175	4947466	4323406	4955505	4948224	4947516	4948205	4947497
4127815	4948567	4948177	4947467	4324327	507820	4948225	4947517	4948206	4947498
4129992	4948568	4948178	4947468	4325158	522256	4948226	4947518	4948207	4947499
4136697	4948569	4948179	4947469	4326156	537490	4948227	4947519	4294080	4948614
4139892	4948570	4948180	4947470	4326235	548569	4948228	4947520	4296853	4948615

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4143804	4948571	4948181	4947471	4327041	575554	4948229	4947521	4297436	4948616
4157071	4948572	4948182	4947472	4328316	591959	4948230	4947522	4297712	4948617
4159679	4948573	4948183	4947473	4328408	598668	4948231	4947523	4298001	4948618
4173188	4948574	4948184	4947474	4332430	602441	4948232	4947526	4298548	4948619
4178444	4948575	4948185	4947475	4336125	606605	4948233	4947527	4299510	4948620
4190733	4948598	4948186	4947476	4336978	611913	4948234	4947528	4948246	4947579
4231047	4948599	4948187	4947477	4337606	613239	4948235	4947529	4948247	4947603
4235097	4948600	4948188	4947478	4339098	615871	4948236	4947530	4948248	4947604
4240014	4948601	4948189	4947479	4339522	617208	4948237	4947531	4948249	4947605
4262024	4948602	4948190	4947480	4339956	629282	4948238	4947532	4347581	891935
4262300	4948603	4948191	4947481	4340116	646765	4948240	4947533	4347659	895847
4262485	4948604	4948192	4947482	4342930	647923	4948241	4947534	4348605	988952
4263158	4948605	4948193	4947483	4345073	658259	4948242	4947535	4349589	4947657
4266177	4948607	4948194	4947484	4345505	740516	4948243	4947537	4948198	4947488
4266761	4948608	4948195	4947485	4345787	749061	4948244	4947538	4948199	4947489
4289653	4948609	4948196	4947486	4345880	863181	4948245	4947539	4948200	4947490
4291783	4948610	4948197	4947487	4292272	4948613	4291880	4948612	4291857	4948611
4947698	4948277	4947773	4947149	4944733	4941880	4550270	4941700	4947044	4943779
1016211	4948278	4947775	4947150	4944734	4941881	4560033	4941707	4947079	4943780
1019493	4948279	4947776	4947151	4944736	4941884	4560428	4941708	4947080	4943781
1029322	4948280	4947777	4947152	4944737	4941885	4561187	4941709	4947081	4943784
1033739	4948281	4947779	4947163	4944738	4941887	4566211	4941710	4947082	4943785
1039487	4948282	4947816	4947165	4944739	4941889	4568392	4941711	4947083	4943786
1040116	4948283	4947817	4947166	4944740	4941977	4568878	4941713	4947084	4943788
1046204	4948284	4947818	4947167	4944741	4941978	4569215	4941714	4947085	4943790
1047517	4948285	4947819	4947168	4944744	4941979	4575011	4941715	4947086	4943792
1050803	4948287	4947820	4947169	4944745	4941981	4575154	4941780	4947087	4943794
1050863	4948288	4947821	4947170	4944746	4941982	4580065	4941783	4947088	4943859
1062433	4948289	4947823	4947171	4944748	4941983	4602820	4941784	4947089	4943860
1071558	4948290	4947824	4947172	4944750	4941986	4604183	4941785	4947090	4943864
1110499	4948291	4947825	4947173	4944753	4941988	4605077	4941787	4947091	4943865
1150251	4948292	4947826	4947174	4944754	4941992	4611583	4941791	4947092	4943871
1155637	4948293	4947827	4947205	4944755	4941993	4635279	4941797	4947093	4943872
1157207	4948295	4947828	4947206	4944781	4941996	4649607	4941871	4947094	4943873

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1160131	4948296	4947829	4947207	4944836	4941997	465562	4941872	4947095	4943875
1168172	4948297	4947865	4947208	4944837	4941998	4669682	4941873	4947096	4943880
1172952	4948298	4947866	4947209	4944839	4942000	4690884	4941874	4947097	4943922
1177273	4948299	4947867	4947210	4944842	4942156	4701208	4941875	4947098	4943923
1178025	4948300	4947868	4947211	4944846	4942159	4702596	4941877	4947116	4943924
1181715	4948301	4947869	4947212	4944890	4942161	471016	4941257	4947118	4943925
1184177	4948302	4947870	4947213	4944893	4942162	4721847	4941264	4947119	4943926
1195839	4948303	4947871	4947214	4944904	4942163	4731581	4941266	4947120	4943930
1198396	4948304	4947872	4947215	4944932	4942165	4735898	4941268	4947121	4943932
1203783	4948306	4947873	4947216	4944939	4942167	4738596	4941269	4947123	4943934
1205930	4948307	4947874	4947217	4944989	4942168	4740054	4941270	4947124	4943936
1207770	4948308	4947875	4947218	4944996	4942169	4740811	4941272	4947125	4943937
1231527	4948309	4947876	4947219	4945011	4942170	4745391	4941275	4947126	4943939
1235526	4948310	4947877	4947220	4945017	4942171	4745578	4941277	4947127	4943941
1436203	4948311	4947878	4947230	4945018	4942175	4747789	4941278	4947128	4943942
1457148	4948312	4947919	4947232	4945020	4942178	4752490	4941279	4947129	4943948
1457225	4948313	4947920	4947233	4945030	4942247	4752887	4941280	4947142	4943950
1457818	4948314	4947921	4947235	4945036	4942251	4764276	4941282	4947143	4943951
1457820	4948315	4947922	4947237	4945060	4942279	4772353	4941284	4947144	4943952
1533019	4948316	4947923	4947238	4945063	4942282	4787173	4941287	4947145	4943953
1573231	4948317	4947925	4947239	4945065	4942283	4790967	4941289	4947146	4943955
1577430	4948318	4947926	4947240	4945067	4942304	4801136	4941290	4947147	4943956
1585355	4948319	4947927	4947241	4945068	4942306	4802652	4941291	4947148	4943957
1589711	4948320	4947928	4947242	4945069	4942307	4823262	4941292	4388644	4943958
1655444	4948321	4947929	4947243	4945071	4942309	4825338	4941293	4389070	4943959
1666268	4948322	4947930	4947244	4945075	4942311	4825720	4941295	4389626	4943960
1675258	4948323	4947931	4947245	4945076	4942312	4827713	4941296	4389627	4943961
1689366	4948324	4947932	4947275	4945080	4942313	4828341	4941299	4393002	4943962
1693800	4948325	4947933	4947276	4945081	4942314	4837124	4941302	4393091	4943964
1726534	4948326	4947937	4947277	4945084	4942316	4841066	4941303	4393545	4943965
1734774	4948327	4947938	4947278	4945086	4942320	4860634	4941308	4394660	4943966
1735836	4948328	4947939	4947279	4945091	4942323	4868812	4941309	4395155	4943967
1759021	4948329	4947940	4947280	4945102	4942324	4882501	4941313	4397168	4944145
1759382	4948330	4947941	4947281	4945105	4942325	4911786	4941320	4397170	4944147

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1760075	4948335	4947942	4947282	4945106	4942326	4925504	4941322	4399544	4944148
1760390	4948336	4947943	4947283	4945107	4942329	4940943	4941323	4400383	4944151
1760397	4948337	4947944	4947284	4945113	4942331	4940946	4941327	4402033	4944152
1763482	4948338	4947945	4947285	4945116	4942332	4940949	4941328	4402340	4944153
1765216	4948339	4947946	4947286	4945118	4942333	4940950	4941331	4414610	4944158
1766188	4948340	4947947	4947287	4945119	4942334	4940951	4941332	4421420	4944159
1768182	4948342	4947948	4947288	4945120	4942338	4940953	4941333	4421814	4944161
1800285	4948343	4947949	4947289	4945121	4942341	4940959	4941334	4423753	4944163
1866419	4948344	4947950	4947290	4945122	4942346	4940966	4941337	4424564	4944165
1876441	4948346	4947951	4947291	4945123	4942347	4940969	4941338	4428098	4944166
1928573	4948347	4947952	4947293	4945124	4942349	4940972	4941339	4428556	4944465
1930841	4948348	4947983	4947294	4945128	4942370	4940973	4941341	4429864	4944468
1933097	4948351	4947984	4947295	4945132	4942375	4940974	4941342	4432591	4944469
194067	4948353	4947985	4947297	4945133	4942378	4940975	4941343	4435487	4944470
1952145	4948354	4947986	4947298	4945134	4942381	4940976	4941345	4437429	4944472
1953874	4948355	4947987	4947299	4945135	4942382	4940977	4941348	4443804	4944474
1966495	4948356	4947988	4947300	4945141	4942383	4940978	4941353	4446236	4944477
1989950	4948357	4947989	4947301	4945143	4942384	4940979	4941358	4455300	4944479
1991173	4948358	4947991	4947302	4945156	4942385	4940983	4941360	4455775	4944482
1994721	4948359	4947992	4947303	4945162	4942386	4940986	4941362	4458084	4944483
1999661	4948361	4947993	4947304	4945163	4942388	4940987	4941363	4458232	4944583
2015596	4948362	4947994	4947305	4945165	4942389	4940990	4941364	4461689	4944586
2017597	4948363	4947995	4947306	4945166	4942390	4940992	4941367	4466667	4944588
2021125	4948364	4948004	4947307	4945167	4942414	4940993	4941368	4468382	4944589
2023172	4948365	4948005	4947308	4945193	4942416	4940995	4941373	4469050	4944590
2023413	4948366	4948006	4947309	4945200	4942422	4940996	4941374	4474837	4944591
2036356	4948367	4948007	4947310	4945201	4942424	4941000	4941375	4481056	4944592
2039057	4948368	4948008	4947311	4945204	4942428	4941002	4941377	4487506	4944593
2051784	4948369	4948009	4947312	4945205	4942430	4941004	4941379	4489237	4944597
2055086	4948371	4948010	4947313	4945212	4942431	4941005	4941380	4489772	4944598
2056537	4948372	4948011	4947314	4945236	4942432	4941006	4941383	4490354	4944600
2061182	4948373	4948012	4947315	4945237	4942434	4941007	4941386	4490449	4944601
2061422	4948374	4948013	4947316	4945279	4942436	4941008	4941387	4492191	4944603
2061561	4948375	4948014	4947317	4945286	4942454	4941009	4941390	4496631	4944604

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2063060	4948376	4948015	4947318	4945315	4942524	4941016	4941391	4498882	4944731
2113515	4948377	4948016	4947319	4945321	4942538	4941018	4941392	4499501	4374970
2113530	4948378	4948025	4947320	4945326	4942540	4941019	4941393	452687	4375238
2113659	4948379	4948026	4947321	4945379	4942542	4941021	4941396	4531331	4377416
2114236	4948380	4948027	4947322	4945385	4942547	4941025	4941400	4533599	4377635
2303433	4948381	4948028	4947323	4945388	4942548	4941026	4941401	4534977	4377831
2338751	4948382	4948029	4947324	4945404	4942549	4941027	4941403	4537145	4378841
2362114	4948383	4948030	4947325	4945418	4942580	4941030	4941404	4538528	4380919
2375285	4948384	4948032	4947326	4945441	4942581	4941032	4941405	4540422	4382409
2457324	4948385	4948033	4947327	4945444	4942582	4941034	4941407	4548071	4382411
2466449	4948386	4948034	4947329	4945453	4942585	4941035	4941409	4548314	4384048
2521268	4948387	4948035	4947330	4945511	4942588	4941038	4941411	4549483	4947034
2522503	4948388	4948036	4947331	4945512	4942590	4941040	4941412	4947695	4947035
2524040	4948389	4948037	4947332	4945525	4942595	4941041	4941415	4947697	4374603
2524248	4948390	4948038	4947333	4945557	4942596	4941042	4941416	4946796	4943347
2536666	4948391	4948039	4947335	4945562	4942597	4941044	4941421	4946797	4943348
2563719	4948392	4948040	4947336	4945564	4942598	4941045	4941422	4946798	4943350
2565690	4948393	4948041	4947337	4945568	4942647	4941046	4941423	4946799	4943396
2592746	4948394	4948042	4947338	4945610	4942660	4941047	4941426	4946800	4943397
2594197	4948395	4948043	4947339	4945626	4942664	4941048	4941431	4946801	4943398
2594309	4948396	4948044	4947340	4945630	4942692	4941050	4941437	4946802	4943404
2595846	4948397	4948045	4947341	4945635	4942695	4941059	4941438	4946803	4943405
2604429	4948399	4948046	4947342	4945640	4942696	4941061	4941440	4946804	4943406
2615236	4948400	4948047	4947344	4945643	4942698	4941063	4941443	4946807	4943407
2647504	4948401	4948048	4947345	4945653	4942699	4941064	4941448	4946811	4943408
2648592	4948402	4948049	4947346	4945683	4942700	4941065	4941449	4946813	4943409
2665770	4948403	4948051	4947347	4945727	4942701	4941066	4941450	4946815	4943410
2673392	4948404	4948052	4947348	4945731	4942702	4941067	4941451	4946820	4943411
2675088	4948405	4948054	4947349	4945734	4942704	4941070	4941452	4946821	4943412
2683055	4948406	4948055	4947350	4945737	4942706	4941071	4941456	4946822	4943414
2693859	4948407	4948056	4947351	4945740	4942707	4941072	4941460	4946824	4943415
2742638	4948408	4948057	4947352	4945742	4942709	4941073	4941465	4946825	4943459
2748861	4948410	4948058	4947353	4945775	4942755	4941075	4941466	4946826	4943460
2750435	4948411	4948059	4947354	4945783	4942760	4941077	4941468	4946827	4943462

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2750990	4948412	4948060	4947355	4945822	4942761	4941079	4941469	4946828	4943463
2810934	4948413	4948061	4947356	4945825	4942762	4941080	4941470	4946829	4943465
2833030	4948414	4948062	4947357	4945830	4942763	4941083	4941472	4946830	4943467
2861950	4948415	4948063	4947358	4945832	4942768	4941084	4941476	4946831	4943469
2864545	4948416	4948064	4947359	4945904	4942769	4941087	4941477	4946832	4943472
2864817	4948417	4948065	4947360	4945906	4942770	4941088	4941479	4946833	4943474
2880619	4948418	4948066	4947361	4945922	4942772	4941091	4941481	4946834	4943477
2880620	4948419	4948067	4947362	4945925	4942774	4941092	4941482	4946835	4943480
2880624	4948420	4948068	4947363	4945975	4942824	4941093	4941486	4946836	4943525
2893306	4948423	4948070	4947364	4946069	4942880	4941095	4941489	4946837	4943527
2915743	4948424	4948071	4947365	4946073	4942934	4941100	4941490	4946838	4943528
2982625	4948425	4948072	4947366	4946080	4942935	4941101	4941493	4946839	4943529
2984623	4948426	4948073	4947367	4946158	4942937	4941102	4941494	4946840	4943532
3007069	4948427	4948074	4947368	4946172	4942938	4941103	4941496	4946843	4943534
3015522	4948428	4948075	4947369	4946277	4942940	4941104	4941497	4946844	4943536
3022174	4948429	4948076	4947370	4946279	4942941	4941105	4941498	4946849	4943538
3028004	4948430	4948077	4947371	4946447	4942943	4941107	4941499	4946858	4943539
3039688	4948431	4948078	4947372	4946577	4942944	4941110	4941501	4946859	4943542
3068597	4948433	4948079	4947373	4946578	4942947	4941112	4941502	4946873	4943544
3069497	4948441	4948080	4947374	4946579	4942950	4941113	4941506	4946878	4943546
3088505	4948442	4948081	4947375	4946580	4942951	4941114	4941508	4946879	4943573
3115335	4948443	4948082	4947376	4946581	4942952	4941117	4941514	4946880	4943575
3116865	4948444	4948083	4947377	4946582	4942953	4941118	4941515	4946881	4943576
3120121	4948445	4948084	4947378	4946583	4942954	4941120	4941518	4946882	4943578
3163432	4948446	4948085	4947379	4946584	4942955	4941121	4941519	4946883	4943579
3169252	4948447	4948086	4947380	4946585	4943106	4941122	4941520	4946884	4943584
3173200	4948448	4948087	4947381	4946586	4943110	4941130	4941523	4946885	4943585
3212876	4948449	4948088	4947382	4946624	4943113	4941131	4941527	4946886	4943587
3213885	4948450	4948089	4947383	4946625	4943114	4941133	4941528	4946887	4943592
3228265	4948451	4948090	4947384	4946627	4943116	4941142	4941531	4946888	4943593
3268792	4948452	4948092	4947385	4946628	4943119	4941143	4941532	4946889	4943594
3328916	4948463	4948093	4947386	4946629	4943122	4941144	4941535	4946890	4943595
3346350	4948464	4948094	4947387	4946630	4943123	4941145	4941539	4946891	4943640
3374260	4948465	4948095	4947388	4946631	4943125	4941147	4941541	4946892	4943642

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3379967	4948466	4948096	4947389	4946632	4943149	4941148	4941549	4946893	4943644
3391658	4948467	4948097	4947390	4946633	4943153	4941150	4941550	4946894	4943649
3398035	4948468	4948098	4947391	4946634	4943154	4941151	4941551	4946895	4943651
3410241	4948469	4948099	4947392	4946635	4943156	4941157	4941556	4946896	4943652
3425319	4948470	4948100	4947393	4946636	4943160	4941158	4941557	4946897	4943654
3430301	4948471	4948101	4947394	4946637	4943161	4941160	4941561	4946898	4943655
3453603	4948472	4948102	4947395	4946638	4943162	4941162	4941564	4946899	4943657
3457917	4948473	4948103	4947396	4946664	4943163	4941163	4941565	4946900	4943662
3458439	4948474	4948104	4947397	4946665	4943164	4941164	4941568	4946901	4943727
3459150	4948485	4948105	4947398	4946666	4943166	4941166	4941573	4946902	4943728
3459165	4948486	4948106	4947399	4946667	4943167	4941168	4941576	4946903	4946955
3460447	4948487	4948107	4947400	4946668	4943168	4941169	4941577	4946904	4946958
3468890	4948488	4948108	4947401	4946669	4943170	4941170	4941582	4946905	4946960
3472099	4948489	4948109	4947402	4946670	4943215	4941175	4941587	4946908	4946962
3472209	4948490	4948110	4947403	4946671	4943219	4941176	4941588	4946913	4946964
3487563	4948491	4948111	4947404	4946672	4943222	4941177	4941589	4946916	4946965
3578984	4948492	4948112	4947405	4946673	4943223	4941179	4941596	4946917	4946967
3602591	4948493	4948113	4947406	4946674	4943225	4941181	4941600	4946921	4946968
3651958	4948494	4948114	4947407	4946675	4943226	4941188	4941602	4946922	4946969
3652834	4948495	4948115	4947408	4946676	4943229	4941189	4941605	4946923	4946970
3673708	4948498	4948117	4947409	4946677	4943230	4941191	4941606	4946924	4946971
3695614	4948499	4948118	4947410	4946678	4943231	4941193	4941609	4946925	4946972
3701231	4948500	4948119	4947412	4946679	4943232	4941194	4941610	4946926	4946973
3702762	4948501	4948120	4947413	4946680	4943233	4941196	4941611	4946927	4946974
3721521	4948502	4948121	4947414	4946681	4943236	4941198	4941613	4946928	4946975
3725946	4948503	4948122	4947415	4946682	4943262	4941201	4941615	4946929	4946976
3730534	4948504	4948123	4947416	4946684	4943263	4941202	4941620	4946930	4946977
3732912	4948505	4948124	4947417	4946685	4943264	4941203	4941631	4946938	4946978
3736162	4948506	4948125	4947418	4946686	4943265	4941204	4941634	4946947	4946979
3736910	4948507	4948126	4947419	4946687	4943266	4941209	4941636	4948264	4946980
3760441	4948508	4948127	4947420	4946688	4943268	4941211	4941638	4948265	4946981
3766605	4948509	4948128	4947421	4946689	4943269	4941213	4941640	4948266	4946982
3810924	4948510	4948129	4947422	4946690	4943270	4941223	4941643	4948268	4946983
3814826	4948511	4948130	4947423	4946715	4943272	4941224	4941644	4948269	4946986

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3814978	4948512	4948131	4947424	4946720	4943275	4941226	4941645	4948270	4946988
382373	4948513	4948132	4947425	4946721	4943277	4941228	4941646	4948271	4946990
3844770	4948514	4948133	4947426	4946727	4943278	4941231	4941648	4948272	4946995
3845301	4948515	4948134	4947427	4946728	4943280	4941232	4941693	4948273	4947002
3890547	4948516	4948135	4947428	4946745	4943283	4941233	4941694	4948274	4947003
3896824	4948517	4948136	4947429	4946746	4943284	4941234	4941695	4948275	4947008
3997235	4948518	4948137	4947430	4946747	4943285	4941236	4941697	4948276	4947011
3999296	4948519	4948138	4947431	4946748	4943289	4941237	4941698	4947699	4947012
4000271	4948520	4948139	4947432	4946749	4943291	4941238	4941699	4947700	4947023
4000746	4948521	4948140	4947433	4946750	4943293	4941239	4943729	4947701	4947025
4000887	4948522	4948141	4947434	4946751	4943298	4941242	4943732	4947771	4947031
4001578	4948523	4948142	4947435	4946752	4943300	4941243	4943734	4947772	4947032
4001654	4948525	4948143	4947436	4946753	4943303	4941244	4943735	4948250	4947606
4002230	4948526	4948144	4947437	4946754	4943304	4941245	4943736	4948251	4947607
4002590	4948527	4948145	4947438	4946755	4943305	4941247	4943738	4948254	4947608
4060629	4948528	4948147	4947439	4946756	4943307	4941248	4943739	4948255	4947609
4072033	4948529	4948148	4947440	4946764	4943331	4941250	4943740	4948256	4947610
4072901	4948530	4948149	4947441	4946771	4943333	4941251	4943741	4948257	4947611
4073919	4948531	4948150	4947442	4946773	4943336	4941252	4943742	4948258	4947612
4074665	4948532	4948151	4947443	4946778	4943337	4941253	4943743	4948259	4947613
4075996	4948533	4948152	4947444	4946780	4943338	4941255	4943745	4948260	4947614
4076964	4948534	4948153	4947445	4946781	4943339	4947036	4943750	4948261	4947615
4077417	4948535	4948154	4947446	4946785	4943341	4947037	4943772	4948262	4947637
4077717	4948536	4948155	4947447	4946790	4943342	4947038	4943773	4948263	4947655
4078894	4948537	4948156	4947448	4946793	4943343	4947039	4943774	4947033	4947694
4078912	4948538	4948157	4947449	4946794	4943344	4947040	4943776	4361132	4947671
4079654	4948541	4948158	4947450	4946795	4943346	4947041	4943778	4364365	4947674
4079719	4948542	4948159	4947451	4301328	4948621	4948208	4947500	4372651	4947676
4079990	4948543	4948160	4947452	4304269	4948622	4948209	4947501	4372807	4947689
4080001	4948544	4948161	4947453	4305966	4948623	4948210	4947502	4373863	4947691
4081443	4948545	4948162	4947454	4306562	4948645	4948211	4947504	4374940	4947692
4081645	4948546	4948163	4947455	4306578	4949331	4948212	4947505	4351902	4947662
4081873	4948547	4948165	4947456	4307324	4949337	4948213	4947506	4352597	4947665
4084810	4948548	4948166	4947457	4316595	4949345	4948214	4947507	4353385	4947666

Table C.11: Off-Topic References Excluded at Initial Screening for Fate									
4097819	4948549	4948167	4947458	4316812	4949346	4948215	4947508	4353505	4947667
4114369	4948550	4948168	4947459	4318136	4949347	4948216	4947509	4353835	4947668
4116098	4948552	4948169	4947460	4318925	4949348	4948217	4947510	4357745	4947669
4117629	4948553	4948170	4947461	4320317	4949349	4948218	4947511	4360490	4947670
4117928	4948554	4948171	4947462	4320976	4949350	4948220	4947512	4948201	4947491
4122451	4948563	4948172	4947463	4321430	4949352	4948221	4947513	4948202	4947492
4124988	4948564	4948173	4947464	4322919	4949353	4948222	4947514	4948203	4947493
4126830	4948565	4948174	4947465	4323216	495092	4948223	4947515	4948204	4947495
4126895	4948566	4948175	4947466	4323406	4955505	4948224	4947516	4948205	4947497
4127815	4948567	4948177	4947467	4324327	507820	4948225	4947517	4948206	4947498
4129992	4948568	4948178	4947468	4325158	522256	4948226	4947518	4948207	4947499
4136697	4948569	4948179	4947469	4326156	537490	4948227	4947519	4294080	4948614
4139892	4948570	4948180	4947470	4326235	548569	4948228	4947520	4296853	4948615
4143804	4948571	4948181	4947471	4327041	575554	4948229	4947521	4297436	4948616
4157071	4948572	4948182	4947472	4328316	591959	4948230	4947522	4297712	4948617
4159679	4948573	4948183	4947473	4328408	598668	4948231	4947523	4298001	4948618
4173188	4948574	4948184	4947474	4332430	602441	4948232	4947526	4298548	4948619
4178444	4948575	4948185	4947475	4336125	606605	4948233	4947527	4299510	4948620
4190733	4948598	4948186	4947476	4336978	611913	4948234	4947528	4948246	4947579
4231047	4948599	4948187	4947477	4337606	613239	4948235	4947529	4948247	4947603
4235097	4948600	4948188	4947478	4339098	615871	4948236	4947530	4948248	4947604
4240014	4948601	4948189	4947479	4339522	617208	4948237	4947531	4948249	4947605
4262024	4948602	4948190	4947480	4339956	629282	4948238	4947532	4347581	891935
4262300	4948603	4948191	4947481	4340116	646765	4948240	4947533	4347659	895847
4262485	4948604	4948192	4947482	4342930	647923	4948241	4947534	4348605	988952
4263158	4948605	4948193	4947483	4345073	658259	4948242	4947535	4349589	4947657
4266177	4948607	4948194	4947484	4345505	740516	4948243	4947537	4948198	4947488
4266761	4948608	4948195	4947485	4345787	749061	4948244	4947538	4948199	4947489
4289653	4948609	4948196	4947486	4345880	863181	4948245	4947539	4948200	4947490
4291783	4948610	4948197	4947487	4292272	4948613	4291880	4948612	4291857	4948611
Reference excluded (HERO ID) because the reference primarily contained *in silico* data									
N/A.									

Table C.12: Screening Questions and Off-Topic References Excluded at Full-Text Screening for Fate		
Question	**Off-topic if answer is:**	**References excluded (HERO ID)**
Does the reference contain information pertaining to a low- priority substance candidate?	No	2072857 2087723 2952166 4940068 4940982 4941471 4941530 4942773 4942837 4943107 4943577 4943581 4943928 4944476 4944582 4947122 4948176
What type of source is this reference?	Review article or book chapter that contains only citations to primary literature sources	N/A.
Is quantitative fate data presented?	No	4943165
Is this primarily a modeling/simulation study? [Note: Select "Yes" only if there is no experimental verification]	Yes	N/A.

Table C.13: Data Quality Metrics and Unacceptable References Excluded at Data Quality Evaluation for Fate		
Data quality metric	**Unacceptable if:**	**References excluded (HERO ID)**
Metric 1: Test substance identity	The test substance identity or description cannot be determined from the information provided (e.g., nomenclature was unclear and CASRN or structure were not reported). **OR** For mixtures, the components and ratios were not characterized or did not include information that	N/A.

Table C.13: Data Quality Metrics and Unacceptable References Excluded at Data Quality Evaluation for Fate		
Data quality metric	**Unacceptable if:**	**References excluded (HERO ID)**
	could result in a reasonable approximation of components.	
Metric 2: Study controls	The study did not include or report crucial control groups that consequently made the study unusable (e.g., no positive control for a biodegradation study reporting 0% removal). **OR** The vehicle used in the study was likely to unduly influence the study results.	4940081 4940201
Metric 3: Test substance stability	There were problems with test substance stability, homogeneity, or preparation that had an impact on concentration or dose estimates and interfered with interpretation of study results.	N/A.
Metric 4: Test method suitability	The test method was not reported or not suitable for the test substance. **OR** The test concentrations were not reported. **OR** The reported test concentrations were not measured, and the nominal concentrations reported greatly exceeded the substances water solubility, which would greatly inhibit meaningful interpretation of the outcomes.	N/A.
Metric 5: Testing conditions	Testing conditions were not reported, and the omission would likely have a substantial impact on study results. **OR** Testing conditions were not appropriate for the method (e.g., a biodegradation study at temperatures that inhibit the microorganisms).	4940201
Metric 6: System type and design- partitioning	Equilibrium was not established or reported, preventing meaningful interpretation of study results. **OR**	4940201

Table C.13: Data Quality Metrics and Unacceptable References Excluded at Data Quality Evaluation for Fate		
Data quality metric	**Unacceptable if:**	**References excluded (HERO ID)**
	The system type and design (e.g. static, semi-static, and flow-through; sealed, open) were not capable of appropriately maintaining substance concentrations, preventing meaningful interpretation of study results.	
Metric 7: Test organism-degradation	The test organism, species, or inoculum source were not reported, preventing meaningful interpretation of the study results.	N/A.
Metric 8: Test organism-partitioning	The test organism information was not reported. **OR** The test organism is not routinely used and would likely prevent meaningful interpretation of the study results.	N/A.
Metric 9: Outcome assessment methodology	The assessment methodology did not address or report the outcome(s) of interest.	N/A.
Metric 10: Data reporting	Insufficient data were reported to evaluate the outcome of interest or to reasonably infer an outcome of interest. **OR** The analytical method used was not suitable for detection or quantification of the test substance. **OR** Data indicate that disappearance or transformation of the parent compound was likely due to some other process.	4940201 4940081
Metric 11: Confounding variables	There were sources of variability and uncertainty in the measurements and statistical techniques or between study groups.	4940201
Metric 12: Verification or plausibility of results	Reported value was completely inconsistent with reference substance data, related physical chemical properties, or otherwise implausible, indicating that a serious study deficiency exists (identified or not).	N/A.