DEPARTMENT OF THE AIR FORCE
377TH AIR BASE WING (AFGSC)

Colonel Eric H. Froehlich
377 ABW/CC
2000 Wyoming Blvd SE
Kirtland AFB NM 87117-5600

DEC 13 2015

Mr. John Kieling, Manager
RCRA Permits Management Program
Hazardous Waste Bureau (HWB)
New Mexico Environment Department (NMED)
2905 Rodeo Park Road
Santa Fe, New Mexico 87505

RE: Kirtland Air Force Base Bulk Fuels Facility Mid-Plume Pump & Treat System Basis of Design – Addendum #1

Dear Mr. Kieling

Attached please find *Mid-Plume Pump & Treat System Basis of Design – Addendum #1*, which supplements the Work Plan and the Final Basis of Design for the full-scale Groundwater Treatment System. The document specifically outlines the control of pH of effluent water as the granulated activated carbon (GAC) equilibrates with water passing through it. This document is in support of the Kirtland Air Force Base Bulk Fuels Facility Spill restoration site.

We appreciate your attention to this matter. We look forward to continued collaboration to improve project activities and documents. Please contact Mr. Wayne Bitner at 505.853.3484 or at ludie.bitner@us.af.mil, or Ms. Victoria Branson at 505.846.6362 or at victoria.branson@us.af.mil if you have any questions or concerns.

Sincerely,

ERIC H. FROEHLICH, Colonel, USAF
Commander

cc:
NMED-EHD (Roberts, McQuillan, Agnew)
NMED (Longmire)
NMED-HWB (Cobrain)
NMED-GWQB (Bustamante, Huddleson)

NMED-PSTB (Reuter)
NMED-OGC (Kendall)
EPA Region 6 (King, Ellinger)
AFCEC-CZRX (Bodour)
USACE-ABQ District Office (Simpler, Phaneuf)
Public Info Repository (Central New Mexico Community College), Administrative Record/Information Repository (AR/IR), and File

40 CFR 270.11
DOCUMENT CERTIFICATION
DECEMBER 2015

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

ERIC H. FROEHLICH, Colonel, USAF
Commander, 377th Air Base Wing

This document has been approved for public release.

KIRTLAND AIR FORCE BASE
377th Air Base Wing Public Affairs

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www.CBI.com

December 11, 2015

Subject: Kirtland Air Force Base Bulk Fuel Facility Mid-Plume Pump and Treat System Basis of Design – Addendum #1

This Kirtland Air Force Base (KAFB) Bulk Fuel Facility (BFF) Basis of Design Addendum #1 has been prepared by CB&I Federal Services LLC (CB&I) for the U.S. Army Corps of Engineers (USACE), Albuquerque District, under Contract No. W912DY-10-D-0014. This document supplements the Work Plan (USACE, 2014) and Final Basis of Design (USACE, 2015) for the full-scale Groundwater Treatment System (GWTS) by describing the procedure that will be followed during the start-up of GWTS to control pH of the effluent water as the granulated activated carbon (GAC) equilibrates with the water passing through it.

pH Adjustment of Initial Activated Carbon Effluent Water

When most GAC units are initially put on-stream in water treatment systems, the pH of the GAC effluent will typically increase by about 1 pH unit, with the extent and duration of the pH increase dependent upon the water quality (Calgon, 2015; DESOTEC, 2015). The rise in pH is due to the carbon's adsorption of chlorides, sulfates, nitrates, and other anions from the water (TIGG, 2015). Water pH remains elevated until the carbon's adsorptive capacity for these compounds is used up.

The pH of groundwater from extraction well KAFB-106228 has ranged from 7.44 to 8.61, with an average of 8.13 and standard deviation of 0.33 since June 28, 2015. During GWTS start-up, this phenomenon will raise the pH of the initial GAC effluent close to, and possibly over, the pH discharge limit of 9. The New Mexico Environment Department Groundwater Quality Bureau Discharge Permit 1770 requires the discharge pH to fall between 6 and 9. According to the carbon vendor, this elevated pH will last until approximately 200 bed volumes of water have passed through the GAC vessels at the GWTS. Therefore, a total of approximately two million gallons of effluent groundwater from the treatment system will require pH reduction prior to discharge (see calculation in Appendix A), which will take approximately 14 days or two (2) weeks of operation at 100 gallons per minute (gpm).

The pH adjustment will be accomplished by adding National Sanitary Foundation (NSF) certified 20° Baume hydrochloric acid (32% HCl) solution to control the pH of the effluent water. Using the Rothberg, Tamburini and Winsor (RTW) Model 4 the acid dose of 51 milliliters (ml) of acid per 1,000 gallons of treated groundwater will be sufficient to keep the pH below 9 (Tetra Tech 2011; see calculation shown in Appendix A). At a groundwater feed rate of 100 gpm, the acid addition rate will be 306 ml per hour or 2 gallons per day at the beginning of water flow through the GAC (Tetra Tech 2011; see calculation in Appendix A), with the acid addition rate tapering off as anions adsorb to the GAC. If the groundwater feed rate increases from 100 gpm to 400 gpm, the acid addition rate will increase appropriately.

The pH adjustment system will add acid to the treated groundwater storage tank (TK-116), as shown on Figure 1. The acid addition system will continuously inject the required dose of HCl into tank TK-116 using a chemical metering pump. The metering pump will be a small solenoid-driven diaphragm pump. The HCl will be pumped from a 55-gallon plastic drum into an injection stinger inside of TK-116. A steel flange with a 2" x 24" length polyvinyl chloride (PVC) tubing guide will be inserted through a spare upper side wall nozzle in TK-116. The tubing guide will ensure that the tubing carrying acid is away from the tank wall. Acid transfer tubing will be inserted through the guide, extending a short distance past the

end of the guide pipe. The transfer line will include a spring-loaded check valve at the point of injection inside the tank and a shut-off valve near the metering pump. Figure 1 illustrates this system.

The chemical metering pump will be digitally controlled such that the acid flow rate can quickly and accurately be adjusted by the GWTS operator. The effluent pH will be measured twice daily, or more frequently, and the HCl addition rate will be adjusted as needed. Since the groundwater composition should not vary on a day-to-day basis and there is sufficient carbonate buffering relative to the amount of acid being added, the acid addition rate and pH of the groundwater after acid addition should be very stable. The acid pump will be controlled by a relay in the GWTS Programmable Logic Controller (PLC) that is tied to the groundwater treatment feed pumps (P-112A/B). The acid pump will be active only when the discharge pumps are running, and if any part of the system shuts down (from the extraction well pumps to the point of discharge), the discharge pump will automatically shut down. This will prevent addition of acid to TK-116 when any part of the GWTS is not operational. The acid pump will be located near the acid drum, both of which will be within their own secondary containment. All tubing, valves and pump materials having contact with acid will be constructed of PVC, Kynar (PVDF), Teflon, Viton or ceramic.

As noted above, the pH increase due to the fresh carbon will dissipate after approximately two (2) weeks of operation at 100 gpm. When acid addition is no longer required, the acid pump and tubing will be flushed with 10 gallons of clean water, drained, and stored for future use. If needed, remaining acid will be properly disposed of offsite.

References

Calgon, 2015. Activated Carbon Technical Information. http://www.reskem.com/activated-carbon-technical-information/

DESOTEC, 2015. Activated Carbon pH Acidity. http://www.desotec.com/activated-carbon/properties/ph-acidity.

Tetra Tech, 2011. RTW Model for Water Chemistry, Process and Corrosion Control Software.

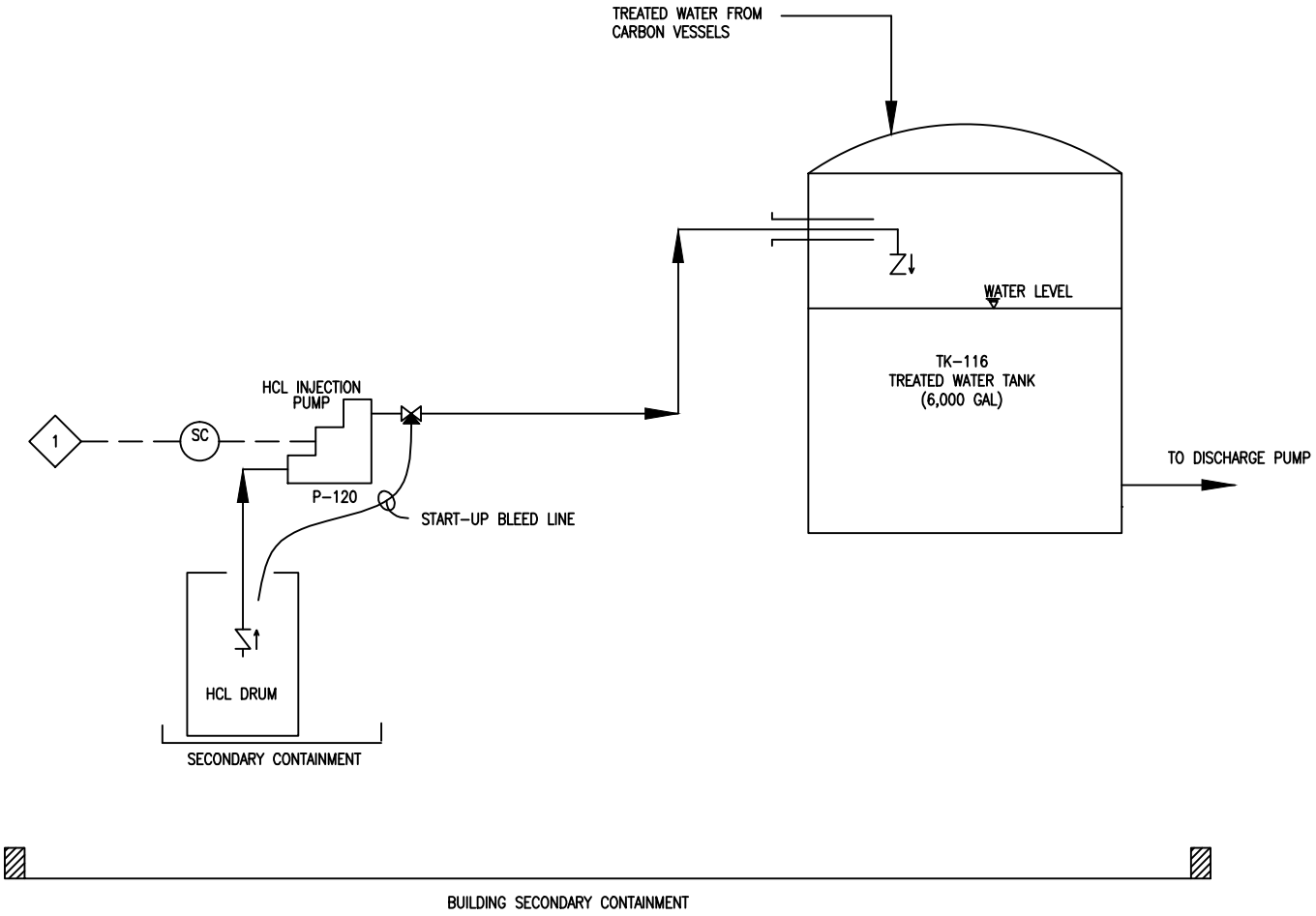
TIGG, 2015. Activated Carbon Prep Helps Ensure Full Bed Utilization. pH Rise Phenomenon. http://www.tigg.com/blame-game.html/

USACE, 2015. Kirtland Air Force Base Final Basis of Design – Mid-Plume Pump and Treat System. March.

USACE, 2014. Dissolved Phase Ethylene Dibromide (EDB) Interim Measure Work Plan, Bulk Fuels Facility Spill Solid Waste Management Units ST-106 and SS-111. August.

FIGURE

1 ACID INJECTION PUMP (P-120) WILL TURN ON WHEN CARBON FEED PUMP IS ACTIVATED.



NOTES:

1. START-UP BLEED LINE (VALVE) IS OPENED WHEN THE PUMP IS FIRST ONLINE TO BYPASS THE INJECTION LINE AND AID IN PRIMING THE PUMP.

CLIENT DWG NO: FIGURE 1

NO.	REVISION	DRAWN	CK'D	APPD	DATE

ACID INJECTION SYSTEM
FOR GWTS STARTUP

FOR: BASIS OF DESIGN ADDENDUM 1

DRAWN: RJT	CK'D: CBI-09	APPD: CBI-10	DATE: 11/30/15	SCALE: NONE	PROJECT NO: 140705	DWG NO: FIGURE1	REV:

APPENDIX A

Estimation of Acid Dose for pH Control of GWTS GAC Tank Effluent during System Startup

Appendix A - Calculation

Estimation of Total Volume of Water Requiring pH Adjustment

Assumptions

1) Carbon vendor expects that pH increase effect will last for 200 bed volumes.

2) Bulk density (loaded) of Tigg 5DC 1240 NSF carbon is 29 to 30 lb/ft3, use 30 in calc.

3) Each adsorber is loaded with 20,000 lbs of carbon

Calculate total volume of carbon in both carbon beds.

Carbon Bed Volume = $\frac{40{,}000 \text{ lb Carbon}}{} \cdot \frac{\text{ft3}}{30 \text{ lb C}} \cdot \frac{7.48 \text{ gal}}{\text{ft3}}$

Carbon Bed Volume = 9973 gallons of carbon

Calculate total volume of water requiring pH adjustment

Total Water Volume = $\frac{9973 \text{ gal}}{\text{Bed Volume}} \cdot \frac{200 \text{ Bed Volume}}{}$

Total Water Volume = 1,994,600 gallons

Calculate Run Time (days) for acid addition

Run Time = $\frac{1{,}994{,}600 \text{ gal}}{} \cdot \frac{\text{min}}{100 \text{ gal}} \cdot \frac{\text{hr}}{60 \text{ min}} \cdot \frac{\text{day}}{24 \text{ hr}}$

Run Time = 13.9 days

Appendix A - Calculation

Estimation of Acid Dose for pH Control of GAC Tank Effluent during System Startup

Assumptions

1) Based on average pH of groundwater from 228 fed into TTS, pH into carbon is 8.1.

2) Carbon supplier expects pH increase of 1 pH unit with fresh coconut shell carbon.

3) Use a pH of 9.1 as basis for calculating acid dose required to get pH back under 9

4) Base calculations on using 20 degree Baume NSF grade hydrochloric acid (32% w/w HCl) to adjust pH of groundwater leaving carbon beds. Spec for Brenntag NSF acid is attached.

Use RTW 4 spreadsheet to calculate acid dose required to drop pH below 9. spreadsheet printouts attached. (RTW4-Rothberg, Tamburini and Winsor Model for Corrosion Control and Process Chemistry, AWWA 1996)

*** RTW4 results show that an acid dose of 5 mg/L of 100% HCl will reduce pH from 9.1 to 8.4

Acid Dose Conversion from 5 mg/L of 100% HCl to ml of 32% HCl/1000 gal

Dose = $\frac{5\text{ mg}}{\text{L}} \cdot \frac{3785\text{ L}}{1000\text{ gal}} \cdot \frac{100\%}{32\%} \cdot \frac{\text{ml}}{1.16\text{ g}} \cdot \frac{1\text{ g}}{1000\text{ mg}}$

Dose = $\frac{51\text{ ml}}{1000\text{ gal}}$

Acid addition rate at 100 g

Acid rate = $\frac{100\text{ gal}}{\text{min}} \cdot \frac{60\text{ min}}{\text{hr}} \cdot \frac{51\text{ ml}}{1000\text{ gal}} = \frac{306\text{ ml}}{\text{hr}}$

Acid rate = $\frac{306\text{ ml}}{\text{hr}} \cdot \frac{24\text{ hr}}{\text{day}} \cdot \frac{1\text{ gal}}{3785\text{ ml}} = \frac{1.94\text{ gal}}{\text{day}}$

Check for potential to over shoot acid addition and drop pH below 7

*** RTW 4 (high dose) shows that a dose of 18 mg/L or almost 7 gallons/day (over 3X design rate) will result in a pH of 7.

Specify metering pump with max capacity of 5 gallons per day, so that pump does not have the capacity to overdose with acid.

TIGG 5DC 1240 NSF

Virgin Liquid Phase Coconut Based Activated Carbon

www.TIGG.com

DESCRIPTION

TIGG 5DC 1240 NFS is a coconut-based activated carbon specially designed to remove low concentrations of contaminants in potable water applications. This activated carbon combines high microporosity and high surface area to permit effective removal of THMs, chlorinated hydrocarbons and other contaminants.

TYPICAL PROPERTIES	TIGG 5DC 1240 NSF
U.S Sieve, 90 wt% min	12 x 40
Iodine Number, mg/g, min	1100
Apparent Density, (dense packing)	
g/cc	0.48 - 0.50
lbs/ft^3	29 - 31
Total Surface Area, m2/g	1150 - 1200
Ash (ASTM-2866), % w/w	3.0
Abrasion No. - min	85

TYPICAL APPLICATIONS

In TIGG liquid phase potable water treatment equipment, TIGG 5DC 1240 NSF will effectively remove organics listed above as well as chlorine, phenols, pesticides, taste & odor, etc. TIGG 5DC 1240 NSF meets AWWA Standard B-600-74, ANSI/NSF Standard 61 for drinking water applications.

Standard packaging of the activated carbon is in 1000 pound supersaks.

Wet drained activated carbon adsorbs oxygen from the air. Therefore, when workers need to enter a vessel containing wet activated carbon, they should follow confined space/low oxygen level procedures. Activated carbon dust does not present an explosion hazard.

800-925-0011
www.TIGG.com
www.TIGGtanks.com

TIGG Corporation
1 Willow Avenue
Oakdale, PA 15071

TIGG Corporation
Purifying Air & Water

BRENNTAG

Chandler Branch
6750 W. Boston St. Chandler, AZ 85226
(480) 961-4189 Fax (480) 961-4644

CERTIFICATE OF ANALYSIS

Product	Hydrochloric Acid 20 Be
Part Numbers	463773, 744674, 109258, 462458
Lot:	CH-362554
Date	11-13-15

Property	Limits	Results
Acidity, as HCl, % Wt.	31.45 min	32.20
Density 60F, g/ml.	1.1588 min.	1.1628
Specific Gravity 60/60F	1.1600 min.	1.1640
Degrees Baume 60F	20.0 min	20.43
Appearance	Clear	Pass
Color	Pale Yellow	Pass

NSF

Certified to NSF/ANSI Standard 60
Maximum Use for Potable Water is 40 mg/L
Product Function: Corrosion and Scale Control
pH Adjustment

Certification to NSF/ANSI Standard 60 applies only if product has been packaged by or shipped in bulk directly from Brenntag Pacific, Inc. in Chandler, Arizona.

Walt Chaney
Technical Services

VND: 100688

IMPORTANT: All information provided is believed to be accurate and complete. The data provided is representative of the product quality on the date of analysis for the lot number indicated. This certificate of analysis may not include all of the constituents of the product. Persons using this information should make their own determination regarding its suitability for their particular application. This certificate of analysis shall not in any way limit or preclude the operation and effect of the applicable terms and conditions of sale.

pH from Carbon (note 1)

The RTW Model Ver. 4.0 ID: **KAFB-106228 GWT Gibson - low acid dose**

STEP 1: Enter initial water characteristics.

Measured TDS	265	mg/L
Measured temperature	20	deg C
Measured pH	9.1	
Measured alk, as CaCO3	109	mg/L
Measured Ca, as CaCO3	97	mg/L
Measured Cl	14	mg/L
Measured SO4	37	mg/L

For CT and TTHM functions enter current:

Treated water pH	
Chlorine residual	mg/L
Chlorine or hypochlorite dose as chlorine equivalent	mg/L

STEP 2: Enter amount of each chemical to be added (expressed as 100% chemical). Press Ctrl+C to select chemicals for this list.

Acid Dose (note 2)

Calcium hypochlorite	0	mg/L
Caustic soda	0	mg/L
Chlorine gas	0	mg/L
Hydrochloric acid	5	mg/L
Lime (slaked)	0	mg/L
Soda ash	0	mg/L
Sodium bicarbonate	0	mg/L
Sodium hypochlorite	0	mg/L
Sulfuric Acid	0	mg/L
Magnesium hydroxide	0	mg/L

pH after acid addition (note 3)

STEP 3: Adjust at Step 2 until interim water characteristics meet your criteria.

Theoretical interim water characteristics			Desired	Theoretical interim water characteristics			Desired
Interim alkalinity	102	mg/L	> 40 mg/L	Interim pH	8.35		6.8-9.3
Interim Ca, as CaCO3	97	mg/L	> 40 mg/L	Precipitation potential	5.92	mg/L	4-10 mg/L
Alk/(Cl+SO4)	1.8		> 5.0	Langelier index	0.58		>0

Press PAGE DOWN for additional initial, interim and final water characteristics if desired.

Calculated initial water characteristics

Initial acidity	94	mg/L
Initial Ca sat, as CaCO3	5	mg/L
Initial DIC, as CaCO3	203	mg/L

Theoretical interim water characteristics

Interim acidity	101	mg/L
Interim Ca sat, as CaCO3	26	mg/L
Ryznar index	7.19	
Interim DIC, as CaCO3	203	mg/L
Aggressiveness Index	12.35	

Theoretical final water characteristics after CaCO3 precipitation

Final alkalinity	96	mg/L
Final Ca	91	mg/L
Final acidity	101	mg/L
Final pH	7.83	
Final DIC, as CaCO3	197	mg/L

Press PAGE UP to review measured initial water characteristics, chemical addition quantities and additional interim water characteristics.

CT and TTHM Results

Required chlorine residual to maintain current level of giardia inactivation	N/A	mg/L
Estimated maximum total trihalomethane concentration change from current level	N/A	%

Notes:

1) pH from carbon expected to be 9.1 based on initial pH from wells of 8.1 and 1 pH unit increase through carbon.

2)The hydrochloric acid (HCL) dose is 5 mg/L (100% acid).

3) The pH of the water after acid addition is 8.35.

APPENDIX B

Acid Injection System Pre-Operation Checklist

Acid Injection System Pre-Operation Checklist

1. Ensure Proper PPE is worn:
   a. Safety goggles
   b. Face Shield
   c. Rubber Apron
   d. Rubber Gloves
   e. Long Sleeve Shirt and Pants
2. Ensure that pump, valves, and HCl drum are within the chemical containment berm.
3. Unplug pump from power source if any repairs are needed on pump/tank connections or tubing.
4. Remove bung on HCl drum with drum wrench.
5. Drill hole through bung and insert suction tubing with foot valve through drum bung hole.
6. Check nut and ferrule on suction line inlet to pump and discharge line to GAC tank for tightness.
7. Bypass/priming line should be inserted back into drum bung hole (minimum 12” below acid surface to prevent spraying).
8. Check discharge tubing for kinks or other damage.
9. Check connection at tank for tightness.
10. Check control/signal connections are secure on pump face.
11. Plug pump cord into designated receptacle.

APPENDIX C

Hydrochloric Acid SDS and Spec

BRENNTAG

Chandler Branch
6750 W. Boston St. Chandler, AZ 85226
(480) 961-4189 Fax (480) 961-4644

CERTIFICATE OF ANALYSIS

Product	Hydrochloric Acid 20 Be
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Product Function: Corrosion and Scale Control
pH Adjustment

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Walt Chaney
Technical Services

VND: 100688

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BRENNTAG

SAFETY DATA SHEET

1. Identification

Product identifier HYDROCHLORIC ACID 20 BE NSF

Other means of identification None.

Recommended use ALL PROPER AND LEGAL PURPOSES

Recommended restrictions None known.

Manufacturer/Importer/Supplier/Distributor information

Manufacturer

Company name Brenntag Pacific Inc.

Address 10747 Patterson Place
Santa Fe Springs, CA 90670

Telephone 562-903-9626

E-mail Not available.

Emergency phone number 800-424-9300 CHEMTREC

2. Hazard(s) identification

Physical hazards Not classified.

Health hazards

Acute toxicity, oral	Category 4
Skin corrosion/irritation	Category 1A
Serious eye damage/eye irritation	Category 1

Environmental hazards Not classified.

OSHA defined hazards Not classified.

Label elements

Signal word Danger

Hazard statement Harmful if swallowed. Causes severe skin burns and eye damage. Causes serious eye damage.

Precautionary statement

Prevention Do not breathe mist or vapor. Wash thoroughly after handling. Do not eat, drink or smoke when using this product. Wear eye protection/face protection. Wear protective gloves/protective clothing/eye protection/face protection.

Response If swallowed: Rinse mouth. Do NOT induce vomiting. If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower. If inhaled: Remove person to fresh air and keep comfortable for breathing. If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a poison center/doctor. Wash contaminated clothing before reuse.

Storage Store locked up.

Disposal Dispose of contents/container in accordance with local/regional/national/international regulations.

Hazard(s) not otherwise classified (HNOC) None known.

Supplemental information None.

3. Composition/information on ingredients

Mixtures

Chemical name	Common name and synonyms	CAS number	%
HYDROCHLORIC ACID		7647-01-0	31.5
Other components below reportable levels			68.5

*Designates that a specific chemical identity and/or percentage of composition has been withheld as a trade secret.

4. First-aid measures

Inhalation	Move to fresh air. Call a physician if symptoms develop or persist.
Skin contact	Take off immediately all contaminated clothing. Rinse skin with water/shower. Call a physician or poison control center immediately. Chemical burns must be treated by a physician. Wash contaminated clothing before reuse.
Eye contact	Immediately flush eyes with plenty of water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Call a physician or poison control center immediately.
Ingestion	Call a physician or poison control center immediately. Rinse mouth. Do not induce vomiting. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs.
Most important symptoms/effects, acute and delayed	Burning pain and severe corrosive skin damage. Causes serious eye damage. Symptoms may include stinging, tearing, redness, swelling, and blurred vision. Permanent eye damage including blindness could result. Coughing.
Indication of immediate medical attention and special treatment needed	Provide general supportive measures and treat symptomatically. Chemical burns: Flush with water immediately. While flushing, remove clothes which do not adhere to affected area. Call an ambulance. Continue flushing during transport to hospital. Keep victim warm. Keep victim under observation. Symptoms may be delayed.
General information	Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves. Show this safety data sheet to the doctor in attendance.

5. Fire-fighting measures

Suitable extinguishing media	Water fog. Foam. Dry chemical powder. Carbon dioxide (CO2).
Unsuitable extinguishing media	Do not use water jet as an extinguisher, as this will spread the fire.
Specific hazards arising from the chemical	During fire, gases hazardous to health may be formed.
Special protective equipment and precautions for firefighters	Self-contained breathing apparatus and full protective clothing must be worn in case of fire.
Fire fighting equipment/instructions	Move containers from fire area if you can do so without risk.
Specific methods	Use standard firefighting procedures and consider the hazards of other involved materials.
General fire hazards	No unusual fire or explosion hazards noted.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures	Keep unnecessary personnel away. Keep people away from and upwind of spill/leak. Wear appropriate protective equipment and clothing during clean-up. Do not breathe mist or vapor. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Ensure adequate ventilation. Local authorities should be advised if significant spillages cannot be contained. For personal protection, see section 8 of the SDS.
Methods and materials for containment and cleaning up	Large Spills: Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible. Cover with plastic sheet to prevent spreading. Absorb in vermiculite, dry sand or earth and place into containers. Following product recovery, flush area with water. Small Spills: Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to remove residual contamination. Never return spills to original containers for re-use. For waste disposal, see section 13 of the SDS.
Environmental precautions	Avoid discharge into drains, water courses or onto the ground.

7. Handling and storage

Precautions for safe handling	Provide adequate ventilation. Do not breathe mist or vapor. Do not get in eyes, on skin, or on clothing. Avoid prolonged exposure. Do not taste or swallow. When using, do not eat, drink or smoke. Wear appropriate personal protective equipment. Wash hands thoroughly after handling. Observe good industrial hygiene practices.
Conditions for safe storage, including any incompatibilities	Store locked up. Store in original tightly closed container. Store away from incompatible materials (see Section 10 of the SDS).

8. Exposure controls/personal protection

Occupational exposure limits

US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)

Components	Type	Value
HYDROCHLORIC ACID (CAS 7647-01-0)	Ceiling	7 mg/m3
		5 ppm

US. ACGIH Threshold Limit Values

Components	Type	Value
HYDROCHLORIC ACID (CAS 7647-01-0)	Ceiling	2 ppm

US. NIOSH: Pocket Guide to Chemical Hazards

Components	Type	Value
HYDROCHLORIC ACID (CAS 7647-01-0)	Ceiling	7 mg/m3
		5 ppm

Biological limit values No biological exposure limits noted for the ingredient(s).

Appropriate engineering controls Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. Eye wash facilities and emergency shower must be available when handling this product.

Individual protection measures, such as personal protective equipment

Eye/face protection Wear safety glasses with side shields (or goggles) and a face shield.

Skin protection

Hand protection Wear appropriate chemical resistant gloves. Suitable gloves can be recommended by the glove supplier.

Other Wear appropriate chemical resistant clothing.

Respiratory protection In case of insufficient ventilation, wear suitable respiratory equipment.

Thermal hazards Wear appropriate thermal protective clothing, when necessary.

General hygiene considerations Keep away from food and drink. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

9. Physical and chemical properties

Appearance

Physical state Liquid.

Form Liquid.

Color COLORLESS TO SLIGHTLY YELLOW

Odor Pungent

Odor threshold Not available.

pH Not available.

Melting point/freezing point -63 °F (-52.78 °C)

Initial boiling point and boiling range 107.08 °F (41.71 °C) estimated

Flash point Not available.

Evaporation rate Not available.

Flammability (solid, gas) Not applicable.

Upper/lower flammability or explosive limits

Flammability limit - lower (%) Not available.

Flammability limit - upper (%) Not available.

Explosive limit - lower (%) Not available.

Explosive limit - upper (%)	Not available.
Vapor pressure	0.00001 hPa estimated
Vapor density	Not available.
Relative density	Not available.
Solubility(ies)	
Solubility (water)	Not available.
Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	Not available.
Decomposition temperature	Not available.
Viscosity	Not available.
Other information	
Density	9.68 lbs/gal
Explosive properties	Not explosive.
Oxidizing properties	Not oxidizing.
Percent volatile	68.5 % estimated
Specific gravity	1.16

10. Stability and reactivity

Reactivity	The product is stable and non-reactive under normal conditions of use, storage and transport.
Chemical stability	Material is stable under normal conditions.
Possibility of hazardous reactions	Hazardous polymerization does not occur.
Conditions to avoid	Contact with incompatible materials.
Incompatible materials	Amines.
Hazardous decomposition products	No hazardous decomposition products are known.

11. Toxicological information

Information on likely routes of exposure

Inhalation	May cause irritation to the respiratory system. Prolonged inhalation may be harmful.
Skin contact	Causes severe skin burns.
Eye contact	Causes serious eye damage.
Ingestion	Causes digestive tract burns. Harmful if swallowed.
Symptoms related to the physical, chemical and toxicological characteristics	Burning pain and severe corrosive skin damage. Causes serious eye damage. Symptoms may include stinging, tearing, redness, swelling, and blurred vision. Permanent eye damage including blindness could result. Coughing.

Information on toxicological effects

Acute toxicity Harmful if swallowed.

Components	Species	Test Results
HYDROCHLORIC ACID (CAS 7647-01-0)		
Acute		
Dermal		
LD50	Mouse	1449 mg/kg
Inhalation		
LC50	Mouse	1108 ppm, 1 Hours
	Rat	3124 ppm, 1 Hours
Oral		
LD50	Rabbit	900 mg/kg

* Estimates for product may be based on additional component data not shown.

Skin corrosion/irritation Causes severe skin burns and eye damage.

Serious eye damage/eye irritation Causes serious eye damage.

Respiratory or skin sensitization

Respiratory sensitization Not a respiratory sensitizer.

Skin sensitization This product is not expected to cause skin sensitization.

Germ cell mutagenicity No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.

Carcinogenicity This product is not considered to be a carcinogen by IARC, ACGIH, NTP, or OSHA.

IARC Monographs. Overall Evaluation of Carcinogenicity

HYDROCHLORIC ACID (CAS 7647-01-0) 3 Not classifiable as to carcinogenicity to humans.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not listed.

Reproductive toxicity This product is not expected to cause reproductive or developmental effects.

Specific target organ toxicity - single exposure Not classified.

Specific target organ toxicity - repeated exposure Not classified.

Aspiration hazard Not an aspiration hazard.

Chronic effects Prolonged inhalation may be harmful.

12. Ecological information

Ecotoxicity The product is not classified as environmentally hazardous. However, this does not exclude the possibility that large or frequent spills can have a harmful or damaging effect on the environment.

Components		Species	Test Results
HYDROCHLORIC ACID (CAS 7647-01-0)			
Aquatic			
Fish	LC50	Western mosquitofish (Gambusia affinis)	282 mg/l, 96 hours

* Estimates for product may be based on additional component data not shown.

Persistence and degradability No data is available on the degradability of this product.

Bioaccumulative potential No data available.

Mobility in soil No data available.

Other adverse effects No other adverse environmental effects (e.g. ozone depletion, photochemical ozone creation potential, endocrine disruption, global warming potential) are expected from this component.

13. Disposal considerations

Disposal instructions Collect and reclaim or dispose in sealed containers at licensed waste disposal site. Dispose of contents/container in accordance with local/regional/national/international regulations.

Local disposal regulations Dispose in accordance with all applicable regulations.

Hazardous waste code The waste code should be assigned in discussion between the user, the producer and the waste disposal company.

Waste from residues / unused products Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions).

Contaminated packaging Since emptied containers may retain product residue, follow label warnings even after container is emptied. Empty containers should be taken to an approved waste handling site for recycling or disposal.

14. Transport information

DOT

UN number UN1789

UN proper shipping name HYDROCHLORIC ACID

Transport hazard class(es)

Class 8

Subsidiary risk -

Packing group II

Special precautions for user Read safety instructions, SDS and emergency procedures before handling.

ERG number 157

DOT information on packaging may be different from that listed.

DOT

15. Regulatory information

US federal regulations This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

CERCLA Hazardous Substance List (40 CFR 302.4)

HYDROCHLORIC ACID (CAS 7647-01-0) Listed.

SARA 304 Emergency release notification

HYDROCHLORIC ACID (CAS 7647-01-0) 5000 LBS

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not listed.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories Immediate Hazard - Yes
Delayed Hazard - No
Fire Hazard - No
Pressure Hazard - No
Reactivity Hazard - No

SARA 302 Extremely hazardous substance

Chemical name	CAS number	Reportable quantity	Threshold planning quantity	Threshold planning quantity, lower value	Threshold planning quantity, upper value
HYDROCHLORIC ACID	7647-01-0	5000	500 lbs		

SARA 311/312 Hazardous chemical No

SARA 313 (TRI reporting)

Chemical name	CAS number	% by wt.
HYDROCHLORIC ACID	7647-01-0	31.5

Other federal regulations

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

HYDROCHLORIC ACID (CAS 7647-01-0)

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

HYDROCHLORIC ACID (CAS 7647-01-0)

Safe Drinking Water Act (SDWA) Not regulated.

Drug Enforcement Administration (DEA). List 2, Essential Chemicals (21 CFR 1310.02(b) and 1310.04(f)(2) and Chemical Code Number

HYDROCHLORIC ACID (CAS 7647-01-0) 6545

Drug Enforcement Administration (DEA). List 1 & 2 Exempt Chemical Mixtures (21 CFR 1310.12(c))

HYDROCHLORIC ACID (CAS 7647-01-0) 20 %WV

DEA Exempt Chemical Mixtures Code Number

HYDROCHLORIC ACID (CAS 7647-01-0) 6545

US state regulations

US. California Controlled Substances. CA Department of Justice (California Health and Safety Code Section 11100)

Not listed.

US. California. Candidate Chemicals List. Safer Consumer Products Regulations (Cal. Code Regs, tit. 22, 69502.3, subd. (a))

HYDROCHLORIC ACID (CAS 7647-01-0)

US. Massachusetts RTK - Substance List

HYDROCHLORIC ACID (CAS 7647-01-0)

US. New Jersey Worker and Community Right-to-Know Act

HYDROCHLORIC ACID (CAS 7647-01-0)

US. Pennsylvania Worker and Community Right-to-Know Law

HYDROCHLORIC ACID (CAS 7647-01-0)

US. Rhode Island RTK

HYDROCHLORIC ACID (CAS 7647-01-0)

US. California Proposition 65

California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65): This material is not known to contain any chemicals currently listed as carcinogens or reproductive toxins.

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	Yes
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other information, including date of preparation or last revision

Issue date	05-26-2015
Revision date	07-22-2015
Version #	03
HMIS® ratings	Health: 3 Flammability: 0 Physical hazard: 0
NFPA ratings	Health: 3 Flammability: 0 Instability: 0
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