



EHS Release Incident

Tabletop Exercise

Situation Manual
May 2024

PREFACE

The EHS Release Incident Tabletop Exercise (TTX) is sponsored by the Suburban Cook County Local Emergency Planning Committee (LEPC) with support from the U.S. Environmental Protection Agency (U.S. EPA). This Situation Manual (SitMan) was produced with input, advice, and assistance from the Planning Team (see Appendix B), which followed guidance set forth by the U.S. Department of Homeland Security (DHS) Homeland Security Exercise and Evaluation Program (HSEEP). The full HSEEP manual can be viewed at the following link: <https://www.fema.gov/media-library/assets/documents/32326>.

This SitMan provides exercise participants with the necessary tools for their roles in the exercise.

The exercise is unclassified. Control of exercise information is based on public sensitivity regarding the nature of the exercise rather than actual exercise content. Some exercise material is intended for the exclusive use of exercise planners, facilitators, and evaluators, but players may view other materials that are necessary to their performance. All exercise participants may view the SitMan prior to the TTX.

All exercise participants should use appropriate guidelines to ensure proper control of information within their areas of expertise and protect this material in accordance with current jurisdictional directives.

HANDLING INSTRUCTIONS

1. The title of this document is the *EHS Release Incident Tabletop Exercise (TTX) Situation Manual (SitMan)*.
2. Information gathered in this SitMan is designated For Official Use Only (FOUO).
3. For more information about the TTX, please contact:

Exercise Director:

Robert E. Dunne IPED, MPCP DHSEM
Cook County Department of Emergency Management & Regional Security
69 W. Washington Street, 26th Floor
Chicago, IL 60602
Robert.dunne@cookcountyil.gov
312-671-5333

EXERCISE OVERVIEW

Exercise Name	EHS Release Incident Tabletop Exercise
Exercise Date	May 22, 2024, 10:00 am – 3:00 pm
Scope	Tabletop Exercise
Mission Area(s)	Planning, Response
Core Capabilities	Public Information & Warning, Environmental Response/Health & Safety, Public Health, Healthcare, & Emergency Medical Services, Situational Assessment, Operational Communications, Operational Coordination
Objectives	<p>Discuss procedures to notify the public and the appropriate Federal, state, and local emergency response agencies.</p> <p>Discuss procedures and measures for emergency response including evacuations and medical treatment.</p> <p>Identify facility emergency response personnel and/or contractors and their responsibilities.</p> <p>Discuss coordination with local emergency responders.</p> <p>Discuss procedures for emergency response equipment deployment.</p>
Threat or Hazard	Release incident involving an extremely hazardous substance (EHS) (Hydrofluoric acid - aqueous solution).
Sponsor	Suburban Cook County LEPC
Participating Organizations	See Appendix B
Point of Contact	<p>Robert E. Dunne IPED, MPCP DHSEM Cook County Department of Emergency Management & Regional Security 69 W. Washington Street, 26th Floor Chicago, IL 60602 Robert.dunne@cookcountyil.gov 312-671-5333</p>

GENERAL INFORMATION

Core Capabilities

- Environmental Response / Health & Safety
- Public Information and Warning
- Public Health, Healthcare, and Emergency Medical Services
- Operational Communications
- Operational Coordination
- Situational Assessment

Participant Roles & Responsibilities

The term *participant* encompasses many groups of people, not just those playing in the exercise. Groups of participants involved in the exercise, and their respective roles and responsibilities, are as follows:

- **Panelists.** Panelists are personnel who have an active role in discussing or performing their regular roles and responsibilities during the exercise. Panelists discuss the questions and formulate responses to the discussion questions in each module.
- **Participants.** Participants will observe the panelists responding to the discussion questions and be afforded the opportunity to respond or ask clarifying questions of the panelists or Resource Participants.
- **Resource Participants.** Agency and industry representatives will directly participate in the exercise, serving as subject matter experts (SMEs) and providing information to help answer discussion questions. They may support the development of player responses to the situation during the discussions by asking relevant questions and providing subject matter expertise.
- **Facilitators/ Evaluators.** Moderate discussions and provide information or answer questions. Planning Team members may assist with evaluation during the exercise. Observe and document certain objectives, document player discussions, including how and if those discussions conform to Emergency Operations Plans (EOPs).

Structure

This exercise will be a facilitated tabletop drill. Players will participate in three modules. Each module may begin with a situation report (SitRep) that summarizes key events occurring at the (simulated) incident. After the SitRep, participants review the situation and engage in facilitated group discussion of appropriate protection, mitigation, response, communication issues outlined in the discussion questions provided for each module.

Guidelines

- This exercise will be held in a **low-stress, no-fault environment**. Varying viewpoints or disagreements are expected and encouraged.
- Respond to the scenario using your knowledge of current EOPs and capabilities (i.e., you may use only existing assets) and insights derived from your training.
- Decisions are not precedent setting and may not reflect your organization's final position on a given issue. This exercise is an opportunity to discuss and present multiple options and possible solutions.
- Issue identification is not as valuable as suggestions and recommended actions that could improve protection, mitigation, response, and communication efforts.
- An acronym list can be found in Appendix C.

Assumptions and Artificialities

In any exercise, assumptions and artificialities may be necessary to complete play in the time allotted and/or account for logistical limitations. TTX participants should accept that assumptions and artificialities are inherent in any exercise and should not allow these considerations to negatively impact their participation. During this exercise, the following apply:

- The exercise is conducted in a **no-fault learning environment** wherein capabilities, plans, systems, and processes will be evaluated.
- The exercise scenario is plausible, and events occur as they are presented.
- All players receive information at the same time.

Exercise Evaluation

Evaluation of the exercise is based on the exercise objectives and aligned capabilities, capability targets, and critical tasks, which are documented in Exercise Evaluation Guides (EEGs). Additionally, players will be asked to complete participant feedback forms immediately following the TTX. These documents, coupled with facilitator observations and notes, will be used to evaluate the exercise and compile the After-Action Report (AAR).

BACKGROUND INFORMATION

A tanker truck containing a 49% Hydrofluoric (HF) acid solution runs off the road at an intersection. The product is released onto the ground adjacent to a river. Details on the release location is found in the figure below; the Safety Data Sheet (SDS) for the spilled product is in Appendix D; a summary of toxicity information from Wireless Information System for Emergency Responders (WISER) is found in Appendix E; and the Emergency Response Guide (ERG) 157 is found in Appendix F.

The driver of the tanker and two Good Samaritans may be injured. The local fire department arrives to deal with the response. Odors are reported downwind neighborhood and residents are approaching the area to take pictures and live stream video.



Figure 1. Red star is incident location.

MODULE 1 : DISCOVERY / INITIAL RESPONSE

Notes:

- Cook County Emergency Operations Plan
- Safety Data Sheet (Appendix D)
- ERG Guide 157 (Appendix F)
- CAMEO chemical fact sheet

Questions :

- 1) What information is important for the initial situational assessment(s)?
 - a. Who is conducting the assessment(s)?
- 2) Are notifications necessary?
 - a. Who is responsible for making them?
 - b. To whom?
 - c. What information should be conveyed?
- 3) What are the initial response priorities?
 - a. What key decisions are being made?
 - b. What is the tactical plan? Who is going to do it?
- 4) What key decisions are being made?
 - a. On-site
 - b. Off-site

MODULE 2: EVACUATIONS / INJURIES

Notes:

- Agency for Toxic Substances and Disease Registry (ATSDR/ Centers for Disease Control and Prevention (CDC) ToxGuide HF Acid
- NIOSH pocket guide
- WISER toxicity summary
- Plume modeling outputs

Questions :

- 1) How is access to the site and neighborhood being controlled?
 - a. How is traffic being managed around the incident?
- 2) Who establishes any evacuation and/or shelter-in-place orders?
 - a. How are they carried out? (i.e., warning, notification, transport, destination for displaced)
 - b. How are local schools notified? How do schools react to such orders?
 - c. How is any assessment of vulnerable populations conducted?
 - d. What protective actions are being recommended?
- 3) What arrangements are being made for actual and potential injuries?
 - a. What is the hospital(s) capacity/capability?
 - b. How are victims (internal/external) being coordinated/tracked (from the site, at the hospital)?
- 4) What arrangements are being made for other potential community health impacts?
 - a. Schools

MODULE 3: RESPONSE / COMMUNICATIONS

Notes:

- Cook County Emergency Operations Plan

Questions :

- 1) Who is 'in-charge' of the overall response?
 - a. How are the on-site decisions being shared/coordinated with external responders (i.e., local police, fire)?
- 2) What information is needed to support decision-making for the ongoing response with respect to:
 - a. Incident stabilization
 - b. Public health impacts
 - c. Transportation impacts (+ school dismissal)
 - d. Environmental controls
- 3) Who is/are the authoritative source(s) for information?
 - a. How is/are the source(s) interacting with the response?
- 4) What information-sharing mechanisms are used to provide information to the press and the public?
 - a. What is the message(s)?
 - b. How is the message(s) delivered?
 - c. How are schools/parents notified of status?

APPENDIX A: EXERCISE SCHEDULE

Time	Activity
MORNING	
1000	Opening Remarks
1015	Suburban Cook County LEPC, Cook County EOP review
1030	HF overview
1115	Case Study
1200	Training Trailer, HazMat Unit, Wrecker Demo
1200	Lunch

Time	Activity
AFTERNOON	
1300	Module 1: Questions / Discussion
1330	Module 2: Questions/ Discussion
1400	Module 3: Questions / Discussion
1430	Hot Wash / Evaluation
1500	Closing Remarks


APPENDIX B: EXERCISE PLANNERS



Participating Organizations	
Federal	
U.S. Environmental Protection Agency, Region 5 (U.S. EPA)	
U.S. Department of Transportation, PHMSA	
State	
Illinois Emergency Management Agency (IEMA)	
Illinois Environmental Protection Agency (IEPA)	
Illinois Department of Transportation (IDOT)	
Illinois State Police (ISP)	
Illinois Department of Public Health (IDPH)	
County	
Cook County Health Department (HD)	
Cook County Emergency Management & Regional Security (EMRS)	
Suburban Cook County Local Emergency Planning Committee (LEPC)	
Cook County Sheriff's Office	
Local	
Glenview Police Department	
Glenview Fire Department	
MABAS Division 3	
RHCC	
Industry	
SET Environmental	
Honeywell	
Site Restoration Services (SRS)	


APPENDIX C: ACRONYMS


Acronym	Term
AAR	After Action Report
ATSDR	Agency for Toxic Substances & Disease Registry
CDC	Centers for Disease Control and Prevention
CEPP	Chemical Emergency Preparedness Plan
CISA	Cybersecurity & Infrastructure Security Agency
DHS	Department of Homeland Security
EEG	Exercise Evaluation Guideline
EMRS	Emergency Management & Regional Security
EMS	Emergency Medical Services
EOC	Emergency Operations Center
EOP	Emergency Operations Plan
ERG	Emergency Response Guide
FOUO	For Official Use Only
HF	Hydrofluoric Acid
HSEEP	Homeland Security Exercise and Evaluation Program
ICS	Incident Command System
IEMA	Illinois Emergency Management Agency
IEPA	Illinois Environmental Protection Agency
LEPC	Local Emergency Planning Committee
RHCC	Regional Hospital Coordination Center
SDS	Safety Data Sheet
SitMan	Situation Manual
SitRep	Situation Report
SME	Subject Matter Expert
TTX	Tabletop Exercise
UC	Unified Command
US EPA	United States Environmental Protection Agency
WISER	Wireless Information System for Emergency Responders


APPENDIX D: SDS – HYDROFLUORIC ACID


		Version: 1.3 Revision Date: 09-21-2017	
<h3>SAFETY DATA SHEET</h3> <p>According to US Regulation 29 CFR 1910.1200 (HazCom 2012)</p>			
1. Identification			
Product identifier: HYDROFLUORIC ACID			
Other means of identification Product No.: 9387, 9567, V179, V142, 6904, 2648, 2640, 5901, 5900, 5865, 5824, 9574, 9573, 9570, 9564, 9563, 9560, 72185, 72184, 37815, 9576, 9578			
Recommended restrictions Recommended use: Not available. Restrictions on use: Not determined.			
Details of the supplier of the safety data sheet			
Manufacturer			
Company Name:		Avantor Performance Materials, LLC.	
Address:		3477 Corporate Parkway Center Valley, PA 18034	
Telephone:		Customer Service: 855-282-6867	
Fax:		610-573-2610	
Contact Person:		Environmental Health & Safety	
E-mail:		info@avantormaterials.com	
Emergency telephone number: CHEMTREC: 1-800-424-9300 within US and Canada			
2. Hazard(s) identification			
Hazard Classification			
Physical Hazards			
Corrosive to metals		Category 1	
Health Hazards			
Acute toxicity (Oral)		Category 2	
Acute toxicity (Dermal)		Category 1	
Acute toxicity (Inhalation - vapor)		Category 2	
Skin Corrosion/Irritation		Category 1	
Serious Eye Damage/Eye Irritation		Category 1	
Specific Target Organ Toxicity - Single Exposure		Category 1 ¹ .	
Specific Target Organ Toxicity - Repeated Exposure		Category 1 ² .	
Target Organs			
1. Blood, Cardiovascular system, Respiratory system			
2. Bone, Endocrine system, Teeth			
SDS_US - SDSMIX000514		1/12	


		Version: 1.3 Revision Date: 09-21-2017
Unknown toxicity - Health		
Acute toxicity, oral	47 %	
Acute toxicity, dermal	47 %	
Acute toxicity, inhalation, vapor	47 %	
Acute toxicity, inhalation, dust or mist	47 %	
Label Elements		
Hazard Symbol:		
		
Signal Word: Danger		
Hazard Statement: May be corrosive to metals. Fatal if swallowed. Fatal in contact with skin. Fatal if inhaled. Causes severe skin burns and eye damage. Causes damage to organs. Causes damage to organs through prolonged or repeated exposure.		
Precautionary Statements		
Prevention: Keep only in original packaging. Do not get in eyes, on skin, or on clothing. Wash thoroughly after handling. Do not breathe dust/fume/gas/mist/vapors/spray. Use only outdoors or in a well-ventilated area. Do not eat, drink or smoke when using this product. Wear protective gloves/protective clothing/eye protection/face protection. [In case of inadequate ventilation] wear respiratory protection.		
Response: IF exposed: Call a POISON CENTER or doctor/physician. IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician. Rinse mouth. Do NOT induce vomiting. IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water [or shower]. Wash contaminated clothing before reuse. 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 or doctor/physician. Absorb spillage to prevent material damage.		
Storage: Store in a corrosion-resistant container with a resistant inner liner. Store in a well-ventilated place. Keep container tightly closed. Store locked up.		
Disposal: Dispose of contents/container to an appropriate treatment and disposal facility in accordance with applicable laws and regulations, and product characteristics at time of disposal.		
Hazard(s) not otherwise classified (HNOC): None.		
3. Composition/information on ingredients		
SDS_US - SDSMIX000514		2/12


	Version: 1.3 Revision Date: 09-21-2017						
<p>Mixtures</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Chemical Identity</th> <th style="text-align: left;">CAS number</th> <th style="text-align: left;">Content in percent (%)[*]</th> </tr> </thead> <tbody> <tr> <td>Hydrogen fluoride</td> <td>7664-39-3</td> <td>45 - 55%</td> </tr> </tbody> </table> <p><small>[*] All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.</small></p>		Chemical Identity	CAS number	Content in percent (%) [*]	Hydrogen fluoride	7664-39-3	45 - 55%
Chemical Identity	CAS number	Content in percent (%) [*]					
Hydrogen fluoride	7664-39-3	45 - 55%					
<p>4. First-aid measures</p>							
General information:	Immediate medical attention is required. If breathing is difficult, give oxygen. Keep victim warm. Ensure that emergency personnel are aware of the material involved, and take precautions to protect themselves.						
Ingestion:	Call a physician or poison control center immediately. Do not induce vomiting without advice from poison control center. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs.						
Inhalation:	Move to fresh air. Call a physician or poison control center immediately. If breathing is difficult, give oxygen. If breathing stops, provide artificial respiration.						
Skin Contact:	Immediately remove contaminated clothing under a shower. Flush exposed areas with large quantities of water for five minutes. Wash carefully behind ears, under nails and in skin folds. Get medical attention immediately. For those providing assistance, avoid further skin contact to yourself and others. Wear HF impervious clothing with face shield or goggles and HF impervious gloves. If available, apply calcium gluconate gel (2.5%) into burn area continuously for 15 minutes or until pain relief. For a larger area, use iced Benzalkonium Chloride 0.13% soaks until pain has resolved at least 30-40 minutes. If calcium gluconate gel or Benzalkonium Chloride is not available, continue to wash exposed areas with water until patient is seen by a physician and is taken to a hospital. Insure that contaminated clothing and shoes are properly bagged and discarded. Insure that jewelry is removed and soaked in calcium gluconate solution to decontaminate.						
Eye contact:	Immediately flush with plenty of water for at least 15 minutes. If easy to do, remove contact lenses. Call a physician or poison control center immediately. In case of irritation from airborne exposure, move to fresh air. Get medical attention immediately.						
<p>Most important symptoms/effects, acute and delayed</p> <table style="width: 100%;"> <tr> <td style="width: 30%;">Symptoms:</td> <td>Symptoms may be delayed.</td> </tr> <tr> <td>Hazards:</td> <td>None known.</td> </tr> </table>		Symptoms:	Symptoms may be delayed.	Hazards:	None known.		
Symptoms:	Symptoms may be delayed.						
Hazards:	None known.						
<p>Indication of immediate medical attention and special treatment needed</p> <table style="width: 100%;"> <tr> <td style="width: 30%;">Treatment:</td> <td>Injection of 5% calcium gluconate is indicated as the primary medical treatment for large burns. If benzalkonium chloride soaks or calcium gluconate gel do not provide significant relief of pain within 30 to 40 minutes, injection of calcium gluconate solution is indicated. For burns of large skin areas (>15%), for ingestion and for significant inhalation exposure, severe systemic effects may occur. Monitor and correct for hypocalcemia, cardiac arrhythmias, hypomagnesemia and hyperkalemia. Calcium supplements are essential for emergency response to large exposures.</td> </tr> </table>		Treatment:	Injection of 5% calcium gluconate is indicated as the primary medical treatment for large burns. If benzalkonium chloride soaks or calcium gluconate gel do not provide significant relief of pain within 30 to 40 minutes, injection of calcium gluconate solution is indicated. For burns of large skin areas (>15%), for ingestion and for significant inhalation exposure, severe systemic effects may occur. Monitor and correct for hypocalcemia, cardiac arrhythmias, hypomagnesemia and hyperkalemia. Calcium supplements are essential for emergency response to large exposures.				
Treatment:	Injection of 5% calcium gluconate is indicated as the primary medical treatment for large burns. If benzalkonium chloride soaks or calcium gluconate gel do not provide significant relief of pain within 30 to 40 minutes, injection of calcium gluconate solution is indicated. For burns of large skin areas (>15%), for ingestion and for significant inhalation exposure, severe systemic effects may occur. Monitor and correct for hypocalcemia, cardiac arrhythmias, hypomagnesemia and hyperkalemia. Calcium supplements are essential for emergency response to large exposures.						
<p>5. Fire-fighting measures</p>							
<div style="display: flex; justify-content: space-between;"> SDS_US - SDSMIX000514 3/12 </div>							


		Version: 1.3 Revision Date: 09-21-2017
<hr/>		
General Fire Hazards:	In case of fire and/or explosion do not breathe fumes. Product is highly acidic. Wear protective gear if spilled during fire fighting.	
Suitable (and unsuitable) extinguishing media		
Suitable extinguishing media:	Foam, carbon dioxide or dry powder.	
Unsuitable extinguishing media:	The product reacts with water and will generate heat.	
Specific hazards arising from the chemical:	Product is acidic. Wear appropriate protective gear if spilled during firefighting. Reacts with most metals to form flammable hydrogen gas. Fire may produce irritating, corrosive and/or toxic gases.	
Special protective equipment and precautions for firefighters		
Special fire fighting procedures:	Move containers from fire area if you can do so without risk. Use water spray to keep fire-exposed containers cool. Cool containers exposed to flames with water until well after the fire is out. In case of fire and/or explosion do not breathe fumes.	
Special protective equipment for fire-fighters:	Firefighters must use standard protective equipment including flame retardant coat, helmet with face shield, gloves, rubber boots, and in enclosed spaces, SCBA.	
<hr/> 6. Accidental release measures		
Personal precautions, protective equipment and emergency procedures:	Use personal protective equipment. See Section 8 of the SDS for Personal Protective Equipment. Keep unauthorized personnel away. Keep upwind. Ventilate closed spaces before entering them. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing.	
Methods and material for containment and cleaning up:	Neutralize spill area and washings with soda ash or lime. Absorb spill with vermiculite or other inert material, then place in a container for chemical waste. Clean surface thoroughly to remove residual contamination. Dike far ahead of larger spill for later recovery and disposal.	
Notification Procedures:	Dike for later disposal. Prevent entry into waterways, sewer, basements or confined areas. Stop the flow of material, if this is without risk. Inform authorities if large amounts are involved.	
Environmental Precautions:	Do not contaminate water sources or sewer. Prevent further leakage or spillage if safe to do so. Avoid discharge into drains, water courses or onto the ground.	
<hr/> 7. Handling and storage		
Precautions for safe handling:	Use personal protective equipment as required. Avoid contact with eyes, skin, and clothing. Avoid inhalation of vapors and spray mists. Do not taste or swallow. Use only with adequate ventilation. Wash thoroughly after handling. Do not eat, drink or smoke when using the product. Never add water to acid! Always add acid to water while stirring to prevent release of heat, steam and fumes.	
SDS_US - SDSMIX000514		4/12

	Version: 1.3 Revision Date: 09-21-2017																																											
<p>Conditions for safe storage, including any incompatibilities:</p>	<p>Do not store in metal containers. Keep in a cool, well-ventilated place. Store in a dry place.</p>																																											
<div style="border: 1px solid black; padding: 2px;">8. Exposure controls/personal protection</div>																																												
<p>Control Parameters</p> <p>Occupational Exposure Limits</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 30%;">Chemical Identity</th> <th style="width: 10%;">Type</th> <th style="width: 30%;">Exposure Limit Values</th> <th style="width: 30%;">Source</th> </tr> </thead> <tbody> <tr> <td rowspan="3">Hydrogen fluoride - as F</td> <td>TWA</td> <td>0.5 ppm</td> <td>US. ACGIH Threshold Limit Values (2011)</td> </tr> <tr> <td>Ceiling</td> <td>2 ppm</td> <td>US. ACGIH Threshold Limit Values (2011)</td> </tr> <tr> <td>SKIN_DES</td> <td>Can be absorbed through the skin.</td> <td>US. ACGIH Threshold Limit Values (2011)</td> </tr> <tr> <td rowspan="2">Hydrogen fluoride</td> <td>REL</td> <td>3 ppm 2.5 mg/m3</td> <td>US. NIOSH: Pocket Guide to Chemical Hazards (2010)</td> </tr> <tr> <td>Ceiling</td> <td>6 ppm 5 mg/m3</td> <td>US. NIOSH: Pocket Guide to Chemical Hazards (2010)</td> </tr> <tr> <td rowspan="4">Hydrogen fluoride - as F</td> <td>REL</td> <td>2.5 mg/m3</td> <td>US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02/2006)</td> </tr> <tr> <td>TWA</td> <td>3 ppm</td> <td>US. OSHA Table Z-1-A (29 CFR 1910.1000) (1989)</td> </tr> <tr> <td>STEL</td> <td>6 ppm</td> <td>US. OSHA Table Z-1-A (29 CFR 1910.1000) (1989)</td> </tr> <tr> <td>TWA</td> <td>3 ppm</td> <td>US. OSHA Table Z-2 (29 CFR 1910.1000) (02/2006)</td> </tr> </tbody> </table> <p>Biological Limit Values</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 30%;">Chemical Identity</th> <th style="width: 30%;">Exposure Limit Values</th> <th style="width: 40%;">Source</th> </tr> </thead> <tbody> <tr> <td>Hydrogen fluoride (Fluoride: Sampling time: Prior to shift.)</td> <td>2 mg/l (Urine)</td> <td>ACGIH BEL (03/2013)</td> </tr> <tr> <td>Hydrogen fluoride (Fluoride: Sampling time: End of shift.)</td> <td>3 mg/l (Urine)</td> <td>ACGIH BEL (03/2013)</td> </tr> </tbody> </table> <p>Appropriate Engineering Controls No data available.</p> <p>Individual protection measures, such as personal protective equipment</p> <p>General information: 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. An eye wash and safety shower must be available in the immediate work area.</p> <p>Eye/face protection: Wear safety glasses with side shields (or goggles) and a face shield.</p> <p>Skin Protection</p> <p> Hand Protection: Chemical resistant gloves</p> <p> Other: Wear suitable protective clothing.</p> <p>Respiratory Protection: In case of inadequate ventilation use suitable respirator. Chemical respirator with specific cartridge and full facepiece providing protection against the compound of concern.</p>		Chemical Identity	Type	Exposure Limit Values	Source	Hydrogen fluoride - as F	TWA	0.5 ppm	US. ACGIH Threshold Limit Values (2011)	Ceiling	2 ppm	US. ACGIH Threshold Limit Values (2011)	SKIN_DES	Can be absorbed through the skin.	US. ACGIH Threshold Limit Values (2011)	Hydrogen fluoride	REL	3 ppm 2.5 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards (2010)	Ceiling	6 ppm 5 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards (2010)	Hydrogen fluoride - as F	REL	2.5 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02/2006)	TWA	3 ppm	US. OSHA Table Z-1-A (29 CFR 1910.1000) (1989)	STEL	6 ppm	US. OSHA Table Z-1-A (29 CFR 1910.1000) (1989)	TWA	3 ppm	US. OSHA Table Z-2 (29 CFR 1910.1000) (02/2006)	Chemical Identity	Exposure Limit Values	Source	Hydrogen fluoride (Fluoride: Sampling time: Prior to shift.)	2 mg/l (Urine)	ACGIH BEL (03/2013)	Hydrogen fluoride (Fluoride: Sampling time: End of shift.)	3 mg/l (Urine)	ACGIH BEL (03/2013)
Chemical Identity	Type	Exposure Limit Values	Source																																									
Hydrogen fluoride - as F	TWA	0.5 ppm	US. ACGIH Threshold Limit Values (2011)																																									
	Ceiling	2 ppm	US. ACGIH Threshold Limit Values (2011)																																									
	SKIN_DES	Can be absorbed through the skin.	US. ACGIH Threshold Limit Values (2011)																																									
Hydrogen fluoride	REL	3 ppm 2.5 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards (2010)																																									
	Ceiling	6 ppm 5 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards (2010)																																									
Hydrogen fluoride - as F	REL	2.5 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02/2006)																																									
	TWA	3 ppm	US. OSHA Table Z-1-A (29 CFR 1910.1000) (1989)																																									
	STEL	6 ppm	US. OSHA Table Z-1-A (29 CFR 1910.1000) (1989)																																									
	TWA	3 ppm	US. OSHA Table Z-2 (29 CFR 1910.1000) (02/2006)																																									
Chemical Identity	Exposure Limit Values	Source																																										
Hydrogen fluoride (Fluoride: Sampling time: Prior to shift.)	2 mg/l (Urine)	ACGIH BEL (03/2013)																																										
Hydrogen fluoride (Fluoride: Sampling time: End of shift.)	3 mg/l (Urine)	ACGIH BEL (03/2013)																																										
<div style="display: flex; justify-content: space-between;"> SDS_US - SDSMIX000514 5/12 </div>																																												

		Version: 1.3 Revision Date: 09-21-2017																																																												
Hygiene measures:	Provide eyewash station and safety shower. 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. Avoid contact with eyes, skin, and clothing.																																																													
9. Physical and chemical properties																																																														
<table style="width: 100%; border-collapse: collapse;"> <tr> <td colspan="2">Appearance</td> </tr> <tr> <td style="width: 30%;">Physical state:</td> <td>Liquid</td> </tr> <tr> <td>Form:</td> <td>Liquid</td> </tr> <tr> <td>Color:</td> <td>Colorless</td> </tr> <tr> <td>Odor:</td> <td>Strong., Irritating.</td> </tr> <tr> <td>Odor threshold:</td> <td>No data available.</td> </tr> <tr> <td>pH:</td> <td>1 (0.1 molar aqueous solution)</td> </tr> <tr> <td>Melting point/freezing point:</td> <td>-36 °C</td> </tr> <tr> <td>Initial boiling point and boiling range:</td> <td>108 °C</td> </tr> <tr> <td>Flash Point:</td> <td>not applicable</td> </tr> <tr> <td>Evaporation rate:</td> <td>No data available.</td> </tr> <tr> <td>Flammability (solid, gas):</td> <td>No data available.</td> </tr> <tr> <td colspan="2">Upper/lower limit on flammability or explosive limits</td> </tr> <tr> <td>Flammability limit - upper (%):</td> <td>No data available.</td> </tr> <tr> <td>Flammability limit - lower (%):</td> <td>No data available.</td> </tr> <tr> <td>Explosive limit - upper (%):</td> <td>No data available.</td> </tr> <tr> <td>Explosive limit - lower (%):</td> <td>No data available.</td> </tr> <tr> <td>Vapor pressure:</td> <td>3.33 kPa</td> </tr> <tr> <td>Vapor density:</td> <td>No data available.</td> </tr> <tr> <td>Density:</td> <td>1.18 g/ml (20 °C)</td> </tr> <tr> <td>Relative density:</td> <td>1.18 (20 °C)</td> </tr> <tr> <td colspan="2">Solubility(ies)</td> </tr> <tr> <td>Solubility in water:</td> <td>Miscible with water.</td> </tr> <tr> <td>Solubility (other):</td> <td>No data available.</td> </tr> <tr> <td>Partition coefficient (n-octanol/water):</td> <td>No data available.</td> </tr> <tr> <td>Auto-ignition temperature:</td> <td>No data available.</td> </tr> <tr> <td>Decomposition temperature:</td> <td>No data available.</td> </tr> <tr> <td>Viscosity:</td> <td>No data available.</td> </tr> <tr> <td colspan="2">Other information</td> </tr> <tr> <td>Molecular weight:</td> <td>20.01 g/mol</td> </tr> </table>			Appearance		Physical state:	Liquid	Form:	Liquid	Color:	Colorless	Odor:	Strong., Irritating.	Odor threshold:	No data available.	pH:	1 (0.1 molar aqueous solution)	Melting point/freezing point:	-36 °C	Initial boiling point and boiling range:	108 °C	Flash Point:	not applicable	Evaporation rate:	No data available.	Flammability (solid, gas):	No data available.	Upper/lower limit on flammability or explosive limits		Flammability limit - upper (%):	No data available.	Flammability limit - lower (%):	No data available.	Explosive limit - upper (%):	No data available.	Explosive limit - lower (%):	No data available.	Vapor pressure:	3.33 kPa	Vapor density:	No data available.	Density:	1.18 g/ml (20 °C)	Relative density:	1.18 (20 °C)	Solubility(ies)		Solubility in water:	Miscible with water.	Solubility (other):	No data available.	Partition coefficient (n-octanol/water):	No data available.	Auto-ignition temperature:	No data available.	Decomposition temperature:	No data available.	Viscosity:	No data available.	Other information		Molecular weight:	20.01 g/mol
Appearance																																																														
Physical state:	Liquid																																																													
Form:	Liquid																																																													
Color:	Colorless																																																													
Odor:	Strong., Irritating.																																																													
Odor threshold:	No data available.																																																													
pH:	1 (0.1 molar aqueous solution)																																																													
Melting point/freezing point:	-36 °C																																																													
Initial boiling point and boiling range:	108 °C																																																													
Flash Point:	not applicable																																																													
Evaporation rate:	No data available.																																																													
Flammability (solid, gas):	No data available.																																																													
Upper/lower limit on flammability or explosive limits																																																														
Flammability limit - upper (%):	No data available.																																																													
Flammability limit - lower (%):	No data available.																																																													
Explosive limit - upper (%):	No data available.																																																													
Explosive limit - lower (%):	No data available.																																																													
Vapor pressure:	3.33 kPa																																																													
Vapor density:	No data available.																																																													
Density:	1.18 g/ml (20 °C)																																																													
Relative density:	1.18 (20 °C)																																																													
Solubility(ies)																																																														
Solubility in water:	Miscible with water.																																																													
Solubility (other):	No data available.																																																													
Partition coefficient (n-octanol/water):	No data available.																																																													
Auto-ignition temperature:	No data available.																																																													
Decomposition temperature:	No data available.																																																													
Viscosity:	No data available.																																																													
Other information																																																														
Molecular weight:	20.01 g/mol																																																													
10. Stability and reactivity																																																														
<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;">Reactivity:</td> <td>Reacts violently with strong alkaline substances.</td> </tr> <tr> <td>Chemical Stability:</td> <td>Material is stable under normal conditions.</td> </tr> <tr> <td>Possibility of hazardous reactions:</td> <td>Hazardous polymerization does not occur.</td> </tr> <tr> <td>Conditions to avoid:</td> <td>Heat, sparks, flames. Contact with incompatible materials.</td> </tr> </table>			Reactivity:	Reacts violently with strong alkaline substances.	Chemical Stability:	Material is stable under normal conditions.	Possibility of hazardous reactions:	Hazardous polymerization does not occur.	Conditions to avoid:	Heat, sparks, flames. Contact with incompatible materials.																																																				
Reactivity:	Reacts violently with strong alkaline substances.																																																													
Chemical Stability:	Material is stable under normal conditions.																																																													
Possibility of hazardous reactions:	Hazardous polymerization does not occur.																																																													
Conditions to avoid:	Heat, sparks, flames. Contact with incompatible materials.																																																													
SDS_US - SDSMIX000514		6/12																																																												

		Version: 1.3 Revision Date: 09-21-2017
Incompatible Materials:	Strong oxidizing agents. Acids. Strong bases. Ammonia. Organic compounds. Glass. Cyanides. Fluorine. Metals. May attack some plastics, rubber and coatings.	
Hazardous Decomposition Products:	Hydrogen fluoride.	
11. Toxicological information		
Information on likely routes of exposure		
Inhalation:	Fatal if inhaled.	
Skin Contact:	Fatal in contact with skin. Causes severe skin burns.	
Eye contact:	Causes serious eye damage.	
Ingestion:	Fatal if swallowed. May cause burns of the gastrointestinal tract if swallowed.	
Information on toxicological effects		
Acute toxicity (list all possible routes of exposure)		
Oral Product:	No data available.	
Dermal Product:	No data available.	
Inhalation Product:	Not classified for acute toxicity based on available data.	
Repeated dose toxicity Product:	No data available.	
Skin Corrosion/Irritation Product:	Causes severe skin burns.	
Serious Eye Damage/Eye Irritation Product:	Causes serious eye damage.	
Respiratory or Skin Sensitization Product:	Not a skin sensitizer.	
Carcinogenicity Product:	This substance has no evidence of carcinogenic properties.	
IARC Monographs on the Evaluation of Carcinogenic Risks to Humans: No carcinogenic components identified		
US. National Toxicology Program (NTP) Report on Carcinogens: No carcinogenic components identified		
US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050): No carcinogenic components identified		
SDS_US - SDSMIX000514		7/12

	Version: 1.3 Revision Date: 09-21-2017
Germ Cell Mutagenicity	
In vitro Product:	No mutagenic components identified
In vivo Product:	No mutagenic components identified
Reproductive toxicity	
Product:	No components toxic to reproduction
Specific Target Organ Toxicity - Single Exposure	
Product:	Blood. Cardiovascular system Respiratory system
Specific Target Organ Toxicity - Repeated Exposure	
Product:	Bones Endocrine system Teeth.
Target Organs Specific Target Organ Toxicity - Single Exposure: Blood, Cardiovascular system, Respiratory system Specific Target Organ Toxicity - Repeated Exposure: Bone, Endocrine system, Teeth	
Aspiration Hazard	
Product:	Not classified
Other effects:	None known.
12. Ecological information	
Ecotoxicity:	
Acute hazards to the aquatic environment:	
Fish Product:	No data available.
Aquatic Invertebrates Product:	No data available.
Chronic hazards to the aquatic environment:	
Fish Product:	No data available.
Aquatic Invertebrates Product:	No data available.
Toxicity to Aquatic Plants Product:	No data available.
Persistence and Degradability	
Biodegradation Product:	Expected to be readily biodegradable.
BOD/COD Ratio Product:	No data available.
SDS_US - SDSMIX000514 8/12	

	Version: 1.3 Revision Date: 09-21-2017
<p>Bioaccumulative potential Bioconcentration Factor (BCF) Product: No data available on bioaccumulation.</p> <p>Partition Coefficient n-octanol / water (log Kow) Product: No data available.</p> <p>Mobility in soil: The product is water soluble and may spread in water systems.</p> <p>Other adverse effects: The product may affect the acidity (pH-factor) in water with risk of harmful effects to aquatic organisms.</p>	
<p>13. Disposal considerations</p> <p>Disposal instructions: Discharge, treatment, or disposal may be subject to national, state, or local laws.</p> <p>Contaminated Packaging: Since emptied containers retain product residue, follow label warnings even after container is emptied.</p>	
<p>14. Transport information</p> <p>DOT UN Number: UN 1790 UN Proper Shipping Name: Hydrofluoric acid Transport Hazard Class(es) Class: 8 Label(s): 8, 6.1 Packing Group: II Marine Pollutant: No Special precautions for user: Not determined.</p> <p>IMDG UN Number: UN 1790 UN Proper Shipping Name: HYDROFLUORIC ACID (WITH NOT MORE THAN 60% ACID) Transport Hazard Class(es) Class: 8 Label(s): 8, 6.1 EmS No.: F-A, S-B Packing Group: II Marine Pollutant: No Special precautions for user: Not determined.</p> <p>IATA UN Number: UN 1790 Proper Shipping Name: Hydrofluoric acid Transport Hazard Class(es) Class: 8 Label(s): 8, 6.1 Packing Group: II Marine Pollutant: No Special precautions for user: Not determined.</p>	
<p>15. Regulatory information</p> <p>US Federal Regulations SDS_US - SDSMIX000514</p>	



Version: 1.3
Revision Date: 09-21-2017

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)
None present or none present in regulated quantities.

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)
None present or none present in regulated quantities.

CERCLA Hazardous Substance List (40 CFR 302.4):

<u>Chemical Identity</u>	<u>Reportable quantity</u>
Hydrogen fluoride	100 lbs.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories

- Reactive
- Immediate (Acute) Health Hazards
- Delayed (Chronic) Health Hazard
- Corrosive to metals
- Acute toxicity
- Skin Corrosion/Irritation
- Serious Eye Damage/Eye Irritation
- Specific Target Organ Toxicity - Single Exposure
- Specific Target Organ Toxicity - Repeated Exposure

SARA 302 Extremely Hazardous Substance

<u>Chemical Identity</u>	<u>Reportable quantity</u>	<u>Threshold Planning Quantity</u>
Hydrogen fluoride	100 lbs.	100 lbs.

SARA 304 Emergency Release Notification

<u>Chemical Identity</u>	<u>Reportable quantity</u>
Hydrogen fluoride	100 lbs.

SARA 311/312 Hazardous Chemical

<u>Chemical Identity</u>	<u>Threshold Planning Quantity</u>
Hydrogen fluoride	100 lbs.

SARA 313 (TRI Reporting)

<u>Chemical Identity</u>	<u>Reporting threshold for other users</u>	<u>Reporting threshold for manufacturing and processing</u>
Hydrogen fluoride	10000 lbs.	25000 lbs.

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

<u>Chemical Identity</u>	<u>Reportable quantity</u>
Hydrogen fluoride	1000 lbs.

Clean Water Act Section 311 Hazardous Substances (40 CFR 117.3):

<u>Chemical Identity</u>	<u>Reportable quantity</u>
Hydrogen fluoride	Reportable quantity: 100 lbs.


US State Regulations

US. California Proposition 65

No ingredient regulated by CA Prop 65 present.

SDS_US - SDSMIX000514

10/12



Version: 1.3
Revision Date: 09-21-2017

US. New Jersey Worker and Community Right-to-Know Act
Chemical Identity
 Hydrogen fluoride

US. Massachusetts RTK - Substance List
Chemical Identity
 Hydrogen fluoride

US. Pennsylvania RTK - Hazardous Substances
Chemical Identity
 Hydrogen fluoride

US. Rhode Island RTK
Chemical Identity
 Hydrogen fluoride

International regulations

Montreal protocol
not applicable

Stockholm convention
not applicable

Rotterdam convention
not applicable

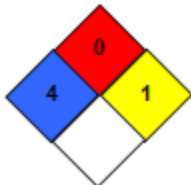
Kyoto protocol
not applicable

Inventory Status:

Australia AICS:	On or in compliance with the inventory
Canada DSL Inventory List:	On or in compliance with the inventory
EINECS, ELINCS or NLP:	On or in compliance with the inventory
Japan (ENCS) List:	On or in compliance with the inventory
Korea Existing Chemicals Inv. (KECI):	On or in compliance with the inventory
Philippines PICCS:	On or in compliance with the inventory
US TSCA Inventory:	On or in compliance with the inventory
New Zealand Inventory of Chemicals:	On or in compliance with the inventory
China Inv. Existing Chemical Substances:	On or in compliance with the inventory
Mexico INSQ:	On or in compliance with the inventory
Taiwan Chemical Substance Inventory:	On or in compliance with the inventory

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


NFPA Hazard ID



	Flammability
	Health
	Reactivity
	Special hazard.

SDS_US - SDSMIX000514

11/12

		Version: 1.3 Revision Date: 09-21-2017
Hazard rating: 0 - Minimal; 1 - Slight; 2 - Moderate; 3 - Serious; 4 - Severe; RNP - Rating not possible		
Issue Date:	09-21-2017	
Revision Information:	Not relevant.	
Version #:	1.3	
Further Information:	No data available.	
Disclaimer:	<p>The information provided in this Safety Data Sheet (SDS) was prepared based on data believed to be accurate as of the date of this SDS. TO THE GREATEST EXTENT PERMITTED BY LAW, AVANTOR PERFORMANCE MATERIALS ("AVANTOR") EXPRESSLY DISCLAIMS ANY AND ALL REPRESENTATIONS AND WARRANTIES REGARDING THE INFORMATION CONTAINED HEREIN INCLUDING, WITHOUT LIMITATION, AS TO ACCURACY, COMPLETENESS, FITNESS FOR PURPOSE OR USE, MERCHANTABILITY, NON-INFRINGEMENT, PERFORMANCE, SAFETY, SUITABILITY AND STABILITY. This SDS is intended as a guide to the appropriate use, handling, storage and disposal of the product to which it relates by properly trained personnel, and is not intended to be comprehensive. Users of Avantor's products are advised to perform their own tests and to exercise their own judgment to determine the safety, suitability and appropriate use, handling, storage and disposal of each product and product combination for their own purposes and uses. TO THE GREATEST EXTENT PERMITTED BY LAW, AVANTOR DISCLAIMS LIABILITY FOR, AND BY USING AVANTOR'S PRODUCTS PURCHASER AGREES THAT UNDER NO CIRCUMSTANCES SHALL AVANTOR BE LIABLE FOR, SPECIAL, INDIRECT, INCIDENTAL, PUNITIVE OR CONSEQUENTIAL DAMAGES OF ANY TYPE OR KIND, INCLUDING WITHOUT LIMITATION, FOR LOSS OF PROFITS, REPUTATIONAL DAMAGE, PRODUCT RECALL OR BUSINESS INTERRUPTION.</p>	
SDS_US - SDSMIX000514		12/12

APPENDIX E: WISER TOXICITY SUMMARY - HF

IDENTIFICATION AND USE: Hydrogen fluoride is a gas at room temperature, but it is available most frequently in aqueous solutions. Solutions up to 70% are available. It is used for etching glass and cleaning in the manufacture of glass, semiconductors, computer chips and ceramics and industrial applications. It can also be used for rust removal in commercial and home laundry operations, as well as in milling titanium, petroleum exploration, metallurgy laboratories, dental laboratories, janitorial products for tile cleaning, aluminum brighteners.

HUMAN STUDIES: Hydrogen fluoride is highly corrosive to all tissues. Systemic absorption occurs following skin exposure or ingestion; severe and rapid hypocalcemia may result with cardiac dysrhythmia and arrest. The effects on the heart are due to hypocalcemia. These include the prolongation of the QT interval, arrhythmias (ventricular tachycardia, fibrillation and electromechanical dissociation. These effects result in hypotension and cardiac arrest. After inhalation, severe pulmonary injury may occur with pulmonary edema and bronchopneumonia. Tetany may result due to hypocalcemia after systemic absorption. Severe and delayed injury can occur with burns may develop after a symptom free interval of 24 hours. This is particularly true of exposures of dilute (<20%) solutions. With concentrated solutions (>40%), the effects are more rapid and pronounced with immediate pain and skin damage. Eye contamination causes similarly severe toxicity. Fatal exposures to hydrogen fluoride have been reported. One case involved a death due to refractory hypocalcemia about 12 hours after exposure of 2.5% body surface area to anhydrous hydrogen fluoride. A death was reported after 13 hours from a 9%-10% body surface area burn from 70% hydrogen fluoride.

ANIMAL STUDIES: Experimental splash burns in rabbits have shown 20% solution to cause immediate damage with total corneal opacification with conjunctival ischemia, and corneal stromal edema within an hour, followed by necrosis of anterior ocular structures. An 8% solution produced ischemia and corneal stromal edema persisting for 40-65 days, accompanied by corneal vascularization. Even a 2% solution caused mild persistent stromal edema and vascularization, but after 0.5% solution there was recovery in 10 days. In one study rats exposed to hydrogen fluoride had hepatic centrilobular injury. When rats were exposed through inhalation to hydrogen fluoride, irritation of the mucous membranes of the eyes and nose, weakness, and a decrease in body weight were observed in the poisoned animals. Severe irritant to guinea pigs and rabbits. On exposure, the animals' eyes were kept closed, paroxysms of coughing and sneezing were frequent, respiration was slowed, and there were copious discharges from the eyes and nose. Pulmonary damage included massive hemorrhage, edema, congestion, and emphysema. Thirty day exposures of five laboratory animal species to hydrogen fluoride at levels that bracketed the maximal and minimal effects were performed at 8.6 and 30 ppm in 6-hr, daily exposures. Exposure at the higher concentration was lethal to all the rats and mice, but not to guinea pigs, rabbits, and dogs. Among the surviving animals, the rabbits showed a slight reduction in body weight, the dogs were apparently unaffected, and the guinea pigs began to lose weight after the third week of exposure. Exposure at 8.6 ppm for 6 hr/day failed to alter significantly normal weight gains in any of the animals except rabbits. Hydrogen fluoride was negative for dominant lethal mutations following inhalation exposure in mice. Increases in the occurrence of chromosome aberrations were found in the bone marrow cells of rats exposed by inhalation to 1.0 mg/cu m hydrogen fluoride 6 hours/day, 6 days/week for 1 month.

ECOTOXICITY STUDIES: Bufo gargarizans tadpoles were chronically exposed to waterborne fluoride at measured concentrations ranging from 0.4 to 61.2 mg F-/L for 70 days from Gosner stage 26 to completion of metamorphosis. The chronic exposure caused a concentration-dependent mortality in all tested fluoride concentrations. In adult zebrafish chronic fluoride exposure impairs the redox balance, affects DNA repair machinery with pro-apoptotic implications and suppresses pro-inflammatory cytokines expression abrogating host immunity to bacterial infections


Range of Toxicity

A) INGESTION: ADULT: Electrolyte imbalance, dysrhythmias and death have been reported after 2 to 3 ounces of 6 to 8% HF. CHILD: The minimum toxic dose for a 10 kg child is 50 mg.

B) INHALATION: 30 ppm is considered immediately dangerous to life and health. Estimates of the lowest lethal concentrations for HF range from 50 to 250 ppm for a 5 minute exposure.

C) DERMAL: Severe systemic toxicity and death have been reported following 2.5% body surface area (BSA) burns from 100% HF, 8% BSA burns from 70% HF, and 11% BSA burns from 23% HF.

APPENDIX F: ERG – GUIDE 157

GUIDE 157	SUBSTANCES - TOXIC AND/OR CORROSIVE (NON-COMBUSTIBLE/WATER-SENSITIVE)
POTENTIAL HAZARDS	
HEALTH	
<ul style="list-style-type: none">• TOXIC; inhalation, ingestion or contact (skin, eyes) with vapors, dusts or substance may cause severe injury, burns or death.• Reaction with water or moist air may release toxic, corrosive or flammable gases.• Reaction with water may generate much heat that will increase the concentration of fumes in the air.• Fire will produce irritating, corrosive and/or toxic gases.• Runoff from fire control or dilution water may be corrosive and/or toxic and cause environmental contamination.	
FIRE OR EXPLOSION	
<ul style="list-style-type: none">• Non-combustible, substance itself does not burn but may decompose upon heating to produce corrosive and/or toxic fumes.• UN1796, UN1802, UN1826, UN2032, UN3084, UN3085, and, at concentrations above 65%, UN2031 may act as oxidizers. Also consult GUIDE 140.• Vapors may accumulate in confined areas (basement, tanks, hopper/tank cars, etc.).• Substance may react with water (some violently), releasing corrosive and/or toxic gases and runoff.• Contact with metals may evolve flammable hydrogen gas.• Containers may explode when heated or if contaminated with water.	
PUBLIC SAFETY	
<ul style="list-style-type: none">• CALL 911. Then call emergency response telephone number on shipping paper. If shipping paper not available or no answer, refer to appropriate telephone number listed on the inside back cover.• Keep unauthorized personnel away.• Stay upwind, uphill and/or upstream.• Ventilate closed spaces before entering, but only if properly trained and equipped.	
PROTECTIVE CLOTHING	
<ul style="list-style-type: none">• Wear positive pressure self-contained breathing apparatus (SCBA).• Wear chemical protective clothing that is specifically recommended by the manufacturer when there is NO RISK OF FIRE.• Structural firefighters' protective clothing provides thermal protection but only limited chemical protection.	
EVACUATION	
Immediate precautionary measure	
<ul style="list-style-type: none">• Isolate spill or leak area in all directions for at least 50 meters (150 feet) for liquids and at least 25 meters (75 feet) for solids.	
Spill	
<ul style="list-style-type: none">• For highlighted materials: see Table 1 - Initial Isolation and Protective Action Distances.• For non-highlighted materials: increase the immediate precautionary measure distance, in the downwind direction, as necessary.	
Fire	
<ul style="list-style-type: none">• If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions.	
 In Canada, an Emergency Response Assistance Plan (ERAP) may be required for this product. Please consult the shipping paper and/or the ERAP Program Section (page 390).	
Page 250	ERG 2020

SUBSTANCES - TOXIC AND/OR CORROSIVE (NON-COMBUSTIBLE/WATER-SENSITIVE)		GUIDE 157
EMERGENCY RESPONSE		
FIRE		
<ul style="list-style-type: none">Note: Some foams will react with the material and release corrosive/toxic gases.		
Small Fire		
<ul style="list-style-type: none">CO₂ (except for Cyanides), dry chemical, dry sand, alcohol-resistant foam.		
Large Fire		
<ul style="list-style-type: none">Water spray, fog or alcohol-resistant foam.If it can be done safely, move undamaged containers away from the area around the fire.Avoid aiming straight or solid streams directly onto the product.Dike runoff from fire control for later disposal.		
Fire Involving Tanks or Car/Trailer Loads		
<ul style="list-style-type: none">Fight fire from maximum distance or use unmanned master stream devices or monitor nozzles.Do not get water inside containers.Cool containers with flooding quantities of water until well after fire is out.Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.ALWAYS stay away from tanks engulfed in fire.		
SPILL OR LEAK		
<ul style="list-style-type: none">ELIMINATE all ignition sources (no smoking, flares, sparks or flames) from immediate area.All equipment used when handling the product must be grounded.Do not touch damaged containers or spilled material unless wearing appropriate protective clothing.Stop leak if you can do it without risk.A vapor-suppressing foam may be used to reduce vapors.DO NOT GET WATER INSIDE CONTAINERS.Use water spray to reduce vapors or divert vapor cloud drift. Avoid allowing water runoff to contact spilled material.Prevent entry into waterways, sewers, basements or confined areas.		
Small Spill		
<ul style="list-style-type: none">Cover with DRY earth, DRY sand or other non-combustible material followed with plastic sheet to minimize spreading or contact with rain.Use clean, non-sparking tools to collect material and place it into loosely covered plastic containers for later disposal.		
FIRST AID		
<ul style="list-style-type: none">Call 911 or emergency medical service.Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.Move victim to fresh air if it can be done safely.Give artificial respiration if victim is not breathing.Do not perform mouth-to-mouth resuscitation if victim ingested or inhaled the substance; wash face and mouth before giving artificial respiration. Use a pocket mask equipped with a one-way valve or other proper respiratory medical device.Administer oxygen if breathing is difficult.Remove and isolate contaminated clothing and shoes.In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.In case of skin contact with Hydrofluoric acid (UN1790), if calcium gluconate gel is available, rinse 5 minutes, then apply gel. Otherwise, continue rinsing until medical treatment is available.For minor skin contact, avoid spreading material on unaffected skin.Keep victim calm and warm.Effects of exposure (inhalation, ingestion or skin contact) to substance may be delayed.		
ERG 2020		Page 251