Section 1. Identification of the Substance/Mixture and of the Company/Undertaking

1.1 Product Code: 14329
Product Name: TCEP (hydrochloride)
Synonyms: 3,3',3''-phosphinylidynetris-propanoic acid, monohydrochloride;
Tris(2-carboxyethyl)phosphine;

1.2 Relevant identified uses of the substance or mixture and uses advised against:
Relevant identified uses: For research use only, not for human or veterinary use.

1.3 Details of the Supplier of the Safety Data Sheet:
Company Name: Cayman Chemical Company
1180 E. Ellsworth Rd.
Ann Arbor, MI 48108
Web site address: www.caymanchem.com
Information: Cayman Chemical Company +1 (734)971-3335

1.4 Emergency telephone number:
Emergency Contact:
CHEMTREC Within USA and Canada: +1 (800)424-9300
CHEMTREC Outside USA and Canada: +1 (703)527-3887

Section 2. Hazards Identification

2.1 Classification of the Substance or Mixture:
2.1.1 Classification according to Regulation (EC) No 1272/2008 [CLP]:
Skin Corrosion/Irritation, Category 1B

2.1.2 Classification according to Directive 1999/45/EC:
C: Corrosive
Risk Phrases: R34
For full text of R-phrases: see SECTION 15.

2.2 Label Elements:
2.2.1 Labeling according to Regulation (EC) No 1272/2008 [CLP]:

GHS Signal Word: Danger
GHS Hazard Phrases:
H314: Causes severe skin burns and eye damage.

GHS Precaution Phrases:
P260: Do not breathe {dust/fume/gas/mist/vapours/spray}.
P264: Wash {hands} thoroughly after handling.
P280: Wear {protective gloves/protective clothing/eye protection/face protection}.

GHS Response Phrases:
P303+361+353: IF ON SKIN (or hair): Remove/take off immediately all contaminated clothing. Rinse skin with water/shower.
P363: Wash contaminated clothing before reuse.
P305+351+338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P301+330+331: IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
P304+340: IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P310: Immediately call a {POISON CENTER/doctor/...}.

GHS Storage and Disposal Phrases:
Please refer to Section 7 for Storage and Section 13 for Disposal information.
2.2.2 Labeling according to Directive 1999/45/EC:

C

2.3 Adverse Human Health: Causes severe skin burns and eye damage.
Effects and Symptoms: Material may be irritating to the mucous membranes and upper respiratory tract. May be harmful by inhalation, ingestion, or skin absorption. May cause eye, skin, or respiratory system irritation. To the best of our knowledge, the toxicological properties have not been thoroughly investigated.

Section 3. Composition/Information on Ingredients

<table>
<thead>
<tr>
<th>CAS # / RTECS #</th>
<th>Hazardous Components (Chemical Name)/REACH Registration No.</th>
<th>Concentration</th>
<th>EC No./EC Index No.</th>
<th>Risk Phrases/GHS Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>51805-45-9 NA</td>
<td>Tris(2-carboxyethyl)phosphine hydrochloride</td>
<td>100.0 %</td>
<td>NA/NA</td>
<td>C; R34 Skin Corr. 1B: H314</td>
</tr>
</tbody>
</table>

Section 4. First Aid Measures

4.1 Description of First Aid Measures:

In Case of Inhalation: Remove to fresh air. If not breathing, give artificial respiration or give oxygen by trained personnel. Get immediate medical attention.

In Case of Skin Contact: Immediately wash skin with soap and plenty of water for at least 15 minutes. Remove contaminated clothing. Get medical attention if symptoms occur. Wash clothing before reuse.

In Case of Eye Contact: Hold eyelids apart and flush eyes with plenty of water for at least 15 minutes. Have eyes examined and tested by medical personnel.

In Case of Ingestion: Wash out mouth with water provided person is conscious. Never give anything by mouth to an unconscious person. Get medical attention. Do NOT induce vomiting unless directed to do so by medical personnel.

Section 5. Fire Fighting Measures

5.1 Suitable Extinguishing Media: Use alcohol-resistant foam, carbon dioxide, water, or dry chemical spray.

Unsuitable Extinguishing Media: Use water spray to cool fire-exposed containers. A solid water stream may be inefficient.

5.2 Flammable Properties and Hazards:

Flash Pt: No data.

Explosive Limits: LEL: No data. UEL: No data.

Autoignition Pt: No data.

5.3 Fire Fighting Instructions: As in any fire, wear self-contained breathing apparatus pressure-demand (NIOSH approved or equivalent), and full protective gear to prevent contact with skin and eyes.
Section 6. Accidental Release Measures

6.1 Protective Precautions, Protective Equipment
Avoid raising and breathing dust, and provide adequate ventilation.

6.2 Environmental Precautions:
Take steps to avoid release into the environment, if safe to do so.

6.3 Methods and Material For Containment and Cleaning Up:
Contain spill and collect, as appropriate.
Transfer to a chemical waste container for disposal in accordance with local regulations.

Section 7. Handling and Storage

7.1 Precautions To Be Taken in Handling:
Avoid breathing dust/fume/gas/mist/vapours/spray.
Avoid prolonged or repeated exposure.

7.2 Precautions To Be Taken in Storing:
Keep container tightly closed.
Store in accordance with information listed on the product insert.

Section 8. Exposure Controls/Personal Protection

8.1 Exposure Parameters:

<table>
<thead>
<tr>
<th>CAS #</th>
<th>Partial Chemical Name</th>
<th>Britain EH40</th>
<th>France VL</th>
<th>Europe</th>
</tr>
</thead>
<tbody>
<tr>
<td>51805-45-9</td>
<td>Tris(2-carboxyethyl)phosphine hydrochloride</td>
<td>No data.</td>
<td>No data.</td>
<td>No data.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CAS #</th>
<th>Partial Chemical Name</th>
<th>OSHA TWA</th>
<th>ACGIH TWA</th>
<th>Other Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>51805-45-9</td>
<td>Tris(2-carboxyethyl)phosphine hydrochloride</td>
<td>No data.</td>
<td>No data.</td>
<td>No data.</td>
</tr>
</tbody>
</table>

8.2 Exposure Controls:

8.2.1 Engineering Controls (Ventilation etc.):
Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits.

8.2.2 Personal Protection Equipment:

Eye Protection: Safety glasses
Protective Gloves: Compatible chemical-resistant gloves
Other Protective Clothing: Lab coat

Respiratory Equipment: NIOSH approved respirator, as conditions warrant.

Work/Hygienic/Maintenance Practices:
Do not take internally.
Facilities storing or utilizing this material should be equipped with an eyewash and a safety shower.
Wash thoroughly after handling.
# Section 9. Physical and Chemical Properties

## 9.1 Information on Basic Physical and Chemical Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical States</td>
<td>[ ] Gas       [ ] Liquid       [X] Solid</td>
</tr>
<tr>
<td>Appearance and Odor</td>
<td>A crystalline solid</td>
</tr>
<tr>
<td>Melting Point</td>
<td>No data.</td>
</tr>
<tr>
<td>Boiling Point</td>
<td>No data.</td>
</tr>
<tr>
<td>Flash Pt</td>
<td>No data.</td>
</tr>
<tr>
<td>Evaporation Rate</td>
<td>No data.</td>
</tr>
<tr>
<td>Explosive Limits</td>
<td>LEL: No data.</td>
</tr>
<tr>
<td></td>
<td>UEL: No data.</td>
</tr>
<tr>
<td>Vapor Pressure (vs. Air or mm Hg)</td>
<td>No data.</td>
</tr>
<tr>
<td>Vapor Density (vs. Air = 1)</td>
<td>No data.</td>
</tr>
<tr>
<td>Specific Gravity (Water = 1)</td>
<td>No data.</td>
</tr>
<tr>
<td>Solubility in Water</td>
<td>No data.</td>
</tr>
<tr>
<td>Solubility Notes</td>
<td>~5 mg/ml in PBS (pH 7.2); ~3.3 mg/ml in DMSO; ~2 mg/ml in DMF;</td>
</tr>
<tr>
<td>Autoignition Pt</td>
<td>No data.</td>
</tr>
</tbody>
</table>

## 9.2 Other Information

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent Volatile</td>
<td>No data</td>
</tr>
<tr>
<td>Molecular Formula &amp; Weight</td>
<td>C9H15O6P • HCl</td>
</tr>
<tr>
<td></td>
<td>286.7</td>
</tr>
</tbody>
</table>

# Section 10. Stability and Reactivity

## 10.1 Reactivity: No data available.

## 10.2 Stability: Unstable [ ] Stable [X]

## 10.3 Stability Note(s): Stable if stored in accordance with information listed on the product insert.

## 10.4 Conditions To Avoid: No data available.

## 10.5 Incompatibility - Materials To Avoid:

- strong oxidizing agents

## 10.6 Hazardous Decomposition Or Byproducts:

- carbon dioxide
- carbon monoxide
- hydrogen chloride gas
- nitrogen oxides
- phosphorus oxides
Section 11. Toxicological Information

11.1 Information on Toxicological Effects:
The toxicological effects of this product have not been thoroughly studied.

Carcinogenicity:  NTP? No  IARC Monographs? No  OSHA Regulated? No

Section 12. Ecological Information

12.1 Toxicity:  Avoid release into the environment.  Runoff from fire control or dilution water may cause pollution.

Section 13. Disposal Considerations

13.1 Waste Disposal Method:  Dispose in accordance with local, state, and federal regulations.

Section 14. Transport Information

14.1 LAND TRANSPORT (US DOT):
DOT Proper Shipping Name:  Corrosive solid, acidic, organic, n.o.s. (Tris(2-carboxyethyl)phosphine hydrochloride)
DOT Hazard Class:  8  CORROSIVE
UN/NA Number:  3261  Packing Group:  II

14.1 LAND TRANSPORT (European ADR/RID):
ADR/RID Shipping Name:  Corrosive solid, acidic, organic, n.o.s. (Tris(2-carboxyethyl)phosphine hydrochloride)
UN Number:  3261  Packing Group:  II
Hazard Class:  8 - CORROSIVE

14.3 AIR TRANSPORT (ICAO/IATA):
ICAO/IATA Shipping Name:  Corrosive solid, acidic, organic, n.o.s. (Tris(2-carboxyethyl)phosphine hydrochloride)
UN Number:  3261  Packing Group:  II
Hazard Class:  8 - CORROSIVE  IATA Classification:  8

Additional Transport Information:
Transport in accordance with local, state, and federal regulations.  When sold in quantities of less than or equal to 1 mL, or 1 g, with an Excepted Quantity Code of E1, E2, E4, or E5, this item meets the De Minimis Quantities exemption, per IATA 2.6.10. Therefore packaging does not have to be labeled as Dangerous Goods/Excepted Quantity.

Section 15. Regulatory Information

EPA SARA (Superfund Amendments and Reauthorization Act of 1986) Lists

<table>
<thead>
<tr>
<th>CAS #</th>
<th>Hazardous Components (Chemical Name)</th>
<th>S. 302 (EHS)</th>
<th>S. 304 RQ</th>
<th>S. 313 (TRI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>51805-45-9</td>
<td>Tris(2-carboxyethyl)phosphine hydrochloride</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

Other US EPA or State Lists

- CAA HAP, ODC: No;
- CWA NPDES: No;
- TSCA: No;
- CA PROP.65: No
European Community Hazard Symbol codes:

C

European Community Risk and Safety Phrases:
R34   Causes burns.
S22   Do not breathe dust.
S24/25 Avoid contact with skin and eyes.
S26   In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
S36/37/39 Wear suitable protective clothing, gloves and eye/face protection.

Regulatory Information
This SDS was prepared in accordance with Regulation (EC) No.1272/2008 and European Directive 67/548/EEC as amended.

Section 16. Other Information

Revision Date: 01/17/2014
Additional Information About This Product: No data available.

Company Policy or Disclaimer:
DISCLAIMER: This information is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes.

N.A.=Not available, N.P.=Not applicable, N.D.=Not determined, N.E.=Not established, N.R.=Not required