ANGUS CHEMICAL COMPANY encourages and expects you to read and understand the entire (M)SDS, as there is important information throughout the document. We expect you to follow the precautions identified in this document unless your use conditions would necessitate other appropriate methods or actions.

1. PRODUCT AND COMPANY IDENTIFICATION

<table>
<thead>
<tr>
<th>Product name</th>
<th>TRIS AMINO® Ultra Pure USP/EP Gr Tris(hydroxymethyl)-aminomethane, Molecular Biology Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturer or supplier's details</td>
<td>ANGUS CHEMICAL COMPANY Address 1500 E. LAKE COOK ROAD Buffalo Grove IL 60089-6553</td>
</tr>
<tr>
<td>Customer Information</td>
<td>+1-847-808-3711</td>
</tr>
<tr>
<td>E-mail address</td>
<td><a href="mailto:NAR_CC@ANGUS.COM">NAR_CC@ANGUS.COM</a></td>
</tr>
<tr>
<td>Emergency telephone number</td>
<td>+1 800-424-9300</td>
</tr>
</tbody>
</table>

Recommended use of the chemical and restrictions on use

- Biological buffer.
- Pharmaceutical intermediate.
- For industrial use.

The ANGUS Chemical Company recommends that you use this product in a manner consistent with the listed use. If your intended use is not consistent with the stated use, please contact the Customer Information Group (see Section 1 of this data sheet).

2. HAZARDS IDENTIFICATION

GHS classification in accordance with 29 CFR 1910.1200

Not a hazardous substance or mixture.
GHS label elements
Not a hazardous substance or mixture.

Other hazards
None known.

3. COMPOSITION/INFORMATION ON INGREDIENTS

This product is a substance.
CAS-No. : 77-86-1

Components

<table>
<thead>
<tr>
<th>Chemical name</th>
<th>CAS-No.</th>
<th>Concentration (% w/w)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tris(hydroxymethyl)aminomethane</td>
<td>77-86-1</td>
<td>&gt;= 99</td>
</tr>
</tbody>
</table>

No hazardous ingredients

4. FIRST AID MEASURES

If inhaled Move person to fresh air; if effects occur, consult a physician.
In case of skin contact Wash off with plenty of water.
In case of eye contact Flush eyes thoroughly with water for several minutes.
Remove contact lenses after the initial 1-2 minutes and continue flushing for several additional minutes. If effects occur, consult a physician, preferably an ophthalmologist.
If swallowed No emergency medical treatment necessary.
Most important symptoms and effects, both acute and delayed Aside from the information found under Description of first aid measures (above) and Indication of immediate medical attention and special treatment needed (below), any additional important symptoms and effects are described in Section 11: Toxicology Information.
Protection of first-aiders If potential for exposure exists refer to Section 8 for specific personal protective equipment.
Notes to physician Treatment of exposure should be directed at the control of symptoms and the clinical condition of the patient.
No specific antidote.

5. FIREFIGHTING MEASURES

Suitable extinguishing media Water.
Carbon dioxide fire extinguishers.
Dry chemical fire extinguishers.
Specific hazards during firefighting Pneumatic conveying and other mechanical handling operations can generate combustible dust. To reduce the potential for dust explosions, do not permit dust to accumulate.
Container may rupture from gas generation in a fire situation.
Hazardous combustion products During a fire, smoke may contain the original material in addition to combustion products of varying composition which may be toxic and/or irritating.
Combustion products may include and are not limited to:
- Carbon dioxide.
- Carbon monoxide.
- Nitrogen oxides.

Further information
Hand held dry chemical or carbon dioxide extinguishers may be used for small fires.
Soak thoroughly with water to cool and prevent re-ignition.
Keep people away. Isolate fire and deny unnecessary entry.
Fight fire from protected location or safe distance. Consider the use of unmanned hose holders or monitor nozzles. Immediately withdraw all personnel from the area in case of rising sound from venting safety device or discoloration of the container.
Move container from fire area if this is possible without hazard.
Use water spray to cool fire exposed containers and fire affected zone until fire is out and danger of reignition has passed.

Special protective equipment for firefighters
Wear positive-pressure self-contained breathing apparatus (SCBA) and protective fire fighting clothing (includes fire fighting helmet, coat, trousers, boots, and gloves).
If protective equipment is not available or not used, fight fire from a protected location or safe distance.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures
Keep unnecessary and unprotected personnel from entering the area.
Use appropriate safety equipment. For additional information, refer to Section 8, Exposure Controls and Personal Protection.

Environmental precautions
Prevent from entering into soil, ditches, sewers, waterways and/or groundwater. See Section 12, Ecological Information.

Methods and materials for containment and cleaning up
Contain spilled material if possible.
Collect in suitable and properly labeled containers.
Use care to minimize generation of airborne dust.
See Section 13, Disposal Considerations, for additional information.

7. HANDLING AND STORAGE

Advice on safe handling
Avoid generating and breathing dust.
Good housekeeping and controlling of dusts are necessary for safe handling of product.
Keep container closed.
See Section 8, EXPOSURE CONTROLS AND PERSONAL PROTECTION.

Conditions for safe storage
Store in a dry place.
Do not store in:
- Zinc.
- Galvanized containers.
8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters
Contains no substances with occupational exposure limit values.

Engineering measures
Local exhaust ventilation may be necessary for some operations.
Use local exhaust ventilation, or other engineering controls to maintain airborne levels below exposure limit requirements or guidelines. If there are no applicable exposure limit requirements or guidelines, general ventilation should be sufficient for most operations.

Personal protective equipment

Respiratory protection
Respiratory protection should be worn when there is a potential to exceed the exposure limit requirements or guidelines. If there are no applicable exposure limit requirements or guidelines, wear respiratory protection when adverse effects, such as respiratory irritation or discomfort have been experienced, or where indicated by your risk assessment process.
In dusty or misty atmospheres, use an approved particulate respirator.
The following should be effective types of air-purifying respirators:
Particulate filter.

Hand protection
Use gloves chemically resistant to this material when prolonged or frequently repeated contact could occur.
Examples of preferred glove barrier materials include:
Neoprene. Polyvinyl chloride ("PVC" or "vinyl").
Nitrile/butadiene rubber ("nitrile" or "NBR"). NOTICE: The selection of a specific glove for a particular application and duration of use in a workplace should also take into account all relevant workplace factors such as, but not limited to:
Other chemicals which may be handled, physical requirements (cut/puncture protection, dexterity, thermal protection), potential body reactions to glove materials, as well as the instructions/specifications provided by the glove supplier.

Eye protection
Use safety glasses (with side shields).

Skin and body protection
Wear clean, body-covering clothing.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance
Crystals

Colour
White

Odour
Odorless
Odour Threshold  No test data available
pH  10.4
   Method: Literature
   1% aqueous solution.
Melting point/range  340 - 342 °F / 171 - 172 °C
   Method: Literature
Freezing point  340 - 342 °F / 171 - 172 °C
   Method: Literature
Boiling point/boiling range  Not applicable
Flash point  Method: closed cup
   Not applicable
Evaporation rate  No test data available
Upper explosion limit / Upper flammability limit  No test data available
Lower explosion limit / Lower flammability limit  No test data available
Vapour pressure  Method: Literature
   Nil
Relative vapour density  Not applicable
Relative density  No data available.
Water solubility  Method: Literature
   Soluble
Partition coefficient: n-octanol/water  log Pow: -2.31
   Method: Measured
   Bioconcentration potential is low (BCF < 100 or Log Pow < 3).
Auto-ignition temperature  No test data available
Decomposition temperature  No test data available
Viscosity  Not applicable
   Viscosity, kinematic
Molecular weight  121.14 g/mol
   Method: Calculated.

NOTE: The physical data presented above are typical values and should not be construed as a specification.

10. STABILITY AND REACTIVITY
Chemical stability

Hygroscopic
Stable under recommended storage conditions. See Storage, Section 7.

Possibility of hazardous reactions

Polymerization will not occur.

Conditions to avoid

Exposure to elevated temperatures can cause product to decompose.
Generation of gas during decomposition can cause pressure in closed systems.
Avoid moisture.

Incompatible materials

Avoid contact with:
Strong acids.
Strong oxidizers.
Avoid contact with metals such as:
Zinc.
Galvanized metals.
Aluminum.
Copper.
Copper alloys.
Avoid unintended contact with:
Halogenated hydrocarbons.

Hazardous decomposition products

Decomposition products depend upon temperature, air supply and the presence of other materials.

11. TOXICOLOGICAL INFORMATION

Toxicological information on this product or its components appear in this section when such data is available.

Acute toxicity

Product:

Acute oral toxicity
Remarks: Very low toxicity if swallowed.
Harmful effects not anticipated from swallowing small amounts.

LD50 (Rat): > 5,000 mg/kg
Symptoms: No deaths occurred at this concentration.

Acute inhalation toxicity
Remarks: Dust may cause irritation to upper respiratory tract (nose and throat).
Vapors are unlikely due to physical properties.

Remarks: The LC50 has not been determined.

Acute dermal toxicity
Remarks: Prolonged skin contact is unlikely to result in absorption of harmful amounts.

LD50 (Rat, male and female): > 5,000 mg/kg
Method: OECD 402 or equivalent
Symptoms: No deaths occurred at this concentration.

Skin corrosion/irritation

Product:
Remarks: Prolonged contact is essentially nonirritating to skin.
Brief contact is essentially nonirritating to skin.

**Serious eye damage/eye irritation**

**Product:**
Remarks : May cause slight temporary eye irritation. Corneal injury is unlikely.

**Respiratory or skin sensitisation**

**Product:**
Remarks : For skin sensitization:
Did not cause allergic skin reactions when tested in guinea pigs.
Remarks : For respiratory sensitization:
No relevant data found.

**Carcinogenicity**

**Product:**
No relevant data found.

**IARC**
No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

**OSHA**
No component of this product present at levels greater than or equal to 0.1% is on OSHA’s list of regulated carcinogens.

**NTP**
No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

**Teratogenicity**

**Product**
For similar material(s):
Did not cause birth defects or any other fetal effects in laboratory animals.

**Mutagenicity**

**Product**
In vitro genetic toxicity studies were negative.

**Reproductive toxicity**

**Product:**
In animal studies, did not interfere with reproduction.

**STOT - single exposure**

**Product:**
Assessment : Evaluation of available data suggests that this material is not an STOT-SE toxicant.
### 12. ECOLOGICAL INFORMATION

**Ecotoxicity**

**Product:**

**Toxicity to fish**

Remarks: Material is practically non-toxic to fish on an acute basis (LC50 > 100 mg/L).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Time</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>LC50 (zebra fish)</td>
<td>460 mg/l</td>
<td>96.0 h</td>
<td>For similar material(s):</td>
</tr>
</tbody>
</table>

**Toxicity to daphnia and other aquatic invertebrates**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Time</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC50 (Daphnia magna)</td>
<td>980.00 mg/l</td>
<td>48.0 h</td>
<td></td>
</tr>
</tbody>
</table>

**Toxicity to algae**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Time</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>ErC50 (Pseudokirchneriella subcapitata)</td>
<td>397 mg/l</td>
<td>72 h</td>
<td></td>
</tr>
</tbody>
</table>

**Toxicity to daphnia and other aquatic invertebrates (Chronic toxicity)**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Time</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOEC (water flea Daphnia magna)</td>
<td>3.99 mg/l</td>
<td>21 d</td>
<td>For similar material(s):</td>
</tr>
</tbody>
</table>

**Persistence and degradability**

**Product:**

**Biodegradability**

Result: Readily biodegradable.

Remarks: Material is readily biodegradable. Passes OECD test(s) for ready biodegradability.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Time</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biodegradation</td>
<td>100 %</td>
<td>28 d</td>
<td></td>
</tr>
<tr>
<td>Method: OECD Test Guideline 301F or Equivalent</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remarks: 10-day Window: Pass</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Biochemical Oxygen Demand (BOD) 0 %  Incubation time: 5 d
84%  Incubation time: 28 d

Photodegradation  Test Type: Half-life (indirect photolysis)
Sensitiser: OH radicals
Rate constant: 3.35E-11 cm3/s
Rate constant: Degradation half life: 0.32 d
Method: Estimated.

Bioaccumulative potential  Partition coefficient: n-octanol/water
Log Pow: -2.31
Method: Measured
Remarks: Bioconcentration potential is low (BCF < 100 or Log Pow < 3).

Components:
trometamol:
Partition coefficient: n-octanol/water
Log Pow: -2.31
Method: Measured
Remarks: Bioconcentration potential is low (BCF < 100 or Log Pow < 3).

Mobility in soil
Product:
Distribution among environmental compartments
Koc: 75
Method: Estimated.
Remarks: Potential for mobility in soil is high (Koc between 50 and 150).

Other adverse effects
Product:
Results of PBT and vPvB assessment
This substance is not considered to be persistent, bioaccumulating and toxic (PBT). This substance is not considered to be very persistent and very bioaccumulating (vPvB).

13. DISPOSAL CONSIDERATIONS

Disposal methods
Waste from residues
DO NOT DUMP INTO ANY SEWERS, ON THE GROUND, OR INTO ANY BODY OF WATER.
All disposal practices must be in compliance with all Federal,
State/Provincial and local laws and regulations.
Regulations may vary in different locations.
Waste characterizations and compliance with applicable laws are the responsibility solely of the waste generator.
THE INFORMATION PRESENTED HERE PERTAINS ONLY TO THE PRODUCT AS SHIPPED IN ITS INTENDED CONDITION AS DESCRIBED IN MSDS SECTION: Composition Information.
FOR UNUSED & UNCONTAMINATED PRODUCT, the preferred options include sending to a licensed, permitted: Incinerator or other thermal destruction device.
Landfill.
ANGUS HAS NO CONTROL OVER THE MANAGEMENT PRACTICES OR MANUFACTURING PROCESSES OF PARTIES HANDLING OR USING THIS MATERIAL.

14. TRANSPORT INFORMATION

International Regulations

IATA-DGR
Not regulated as a dangerous good

IMDG-Code
Not regulated as a dangerous good

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code
Not applicable for product as supplied.

National Regulations

49 CFR (DOT) - BULK
Not regulated as a dangerous good

49 CFR (DOT) – NON BULK
Not regulated as a dangerous good

This information is not intended to convey all specific regulatory or operational requirements/information relating to this product. Transportation classifications may vary by container volume and may be influenced by regional or country variations in regulations. Additional transportation system information can be obtained through an authorized sales or customer service representative. It is the responsibility of the transporting organization to follow all applicable laws, regulations and rules relating to the transportation of the material.

15. REGULATORY INFORMATION

OSHA Hazards
No OSHA Hazards

EPCRA - Emergency Planning and Community Right-to-Know Act

CERCLA Reportable Quantity
This material does not contain any components with a CERCLA RQ.
SARA 304 Extremely Hazardous Substances Reportable Quantity
This material does not contain any components with a section 304 EHS RQ.

SARA 302 Extremely Hazardous Substances Threshold Planning Quantity
This material does not contain any components with a section 302 EHS TPQ.

SARA 311/312 Hazards : No SARA Hazards

SARA 313 : This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

This product does not contain any chemicals listed under the U.S. Clean Air Act Section 111 SOCMI Intermediate or Final VOC’s (40 CFR 60.489).

Clean Water Act
This product does not contain any Hazardous Substances listed under the U.S. CleanWater Act, Section 311, Table 116.4A.
This product does not contain any Hazardous Chemicals listed under the U.S. CleanWater Act, Section 311, Table 117.3.
This product does not contain any toxic pollutants listed under the U.S. Clean Water Act Section 307

US State Regulations

Massachusetts Right To Know
No components are subject to the Massachusetts Right to Know Act.

Pennsylvania Right To Know
trometamol 77-86-1

Maine Chemicals of High Concern
Product does not contain any listed chemicals

Vermont Chemicals of High Concern
Product does not contain any listed chemicals

Washington Chemicals of High Concern
Product does not contain any listed chemicals

New Jersey Right To Know
trometamol 77-86-1

California Prop. 65
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

The components of this product are reported in the following inventories:
United States TSCA Inventory : All components of this product are on the TSCA Inventory or are exempt from TSCA Inventory requirements under 40 CFR 720.30
16. OTHER INFORMATION

Further information

NFPA:

<table>
<thead>
<tr>
<th>Flammability</th>
<th>Health</th>
<th>Instability</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Special hazard.

HMIS III:

- HEALTH: 0
- FLAMMABILITY: 0
- PHYSICAL HAZARD: 0

0 = not significant, 1 = Slight, 2 = Moderate, 3 = High, 4 = Extreme, * = Chronic

Revision Date: 11/27/2018
Version: 1.1
Identification Number: 000040004665

US / EN

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

Full text of other abbreviations

AICS - Australian Inventory of Chemical Substances; ASTM - American Society for the Testing of Materials; bw - Body weight; CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act; CMR - Carcinogen, Mutagen or Reproductive Toxicant; DIN - Standard of the German Institute for Standardisation; DOT - Department of Transportation; DSL - Domestic Substances List (Canada); ECx - Concentration associated with x% response; EHS - Extremely Hazardous Substance;
ELx - Loading rate associated with x% response; EmS - Emergency Schedule; ENCS - Existing and New Chemical Substances (Japan); ErCx - Concentration associated with x% growth rate response; ERG - Emergency Response Guide; GHS - Globally Harmonized System; GLP - Good Laboratory Practice; HMIS - Hazardous Materials Identification System; IARC - International Agency for Research on Cancer; IATA - International Air Transport Association; IBC - International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk; IC50 - Half maximal inhibitory concentration; ICAO - International Civil Aviation Organization; IECSC - Inventory of Existing Chemical Substances in China; IMDG - International Maritime Dangerous Goods; IMO - International Maritime Organization; ISHL - Industrial Safety and Health Law (Japan); ISO - International Organisation for Standardization; KECl - Korea Existing Chemicals Inventory; LC50 - Lethal Concentration to 50% of a test population; LD50 - Lethal Dose to 50% of a test population (Median Lethal Dose); MARPOL - International Convention for the Prevention of Pollution from Ships; MSHA - Mine Safety and Health Administration; n.o.s. - Not Otherwise Specified; NFPA - National Fire Protection Association; NO(A)EC - No Observed (Adverse) Effect Loading Rate; NO(A)EL - No Observed (Adverse) Effect Level; NOELR - No Observable Effect Loading Rate; NTP - National Toxicology Program; NZIoC - New Zealand Inventory of Chemicals; OECD - Organization for Economic Co-operation and Development; OPPTS - Office of Chemical Safety and Pollution Prevention; PBT - Persistent, Bioaccumulative and Toxic substance; PICCS - Philippines Inventory of Chemicals and Chemical Substances; (Q)SAR - (Quantitative) Structure Activity Relationship; RCRA - Resource Conservation and Recovery Act; REACH - Regulation (EC) No 1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals; RQ - Reportable Quantity; SADT - Self-Accelerating Decomposition Temperature; SARA - Superfund Amendments and Reauthorization Act; SDS - Safety Data Sheet; TCSI - Taiwan Chemical Substance Inventory; TSCA - Toxic Substances Control Act (United States); UN - United Nations; UNRTDG - United Nations Recommendations on the Transport of Dangerous Goods; vPvB - Very Persistent and Very Bioaccumulative