NPDES/SDS Permit Application

Volume VI – Hydrometallurgical Residue Facility and Hydrometallurgical Plant

Prepared for Poly Met Mining, Inc.

July 2016 (initial submittal)

October 2017 (updated)
NPDES/SDS Permit Application
Volume VI – Hydrometallurgical Residue Facility and Hydrometallurgical Plant

July 2016 (initial submittal)

October 2017 (updated)

Contents

Application Forms .............................................................................................................................................. 1
   Permit Application Checklist for Industrial Wastewater .................................................................................. 1
   Municipal and Industrial Pond Attachment .................................................................................................... 4
   Industrial Chemical Additives Attachment .................................................................................................... 7
1.0  Introduction .................................................................................................................................................. 9
2.0  Hydrometallurgical Plant and Residue Facilities Water Management and Infrastructure ...................... 16
    2.1  Existing Conditions .................................................................................................................................. 16
    2.2  Hydrometallurgical Plant .......................................................................................................................... 17
       2.2.1  Facility Description .............................................................................................................................. 17
       2.2.2  Residue Characterization ..................................................................................................................... 17
       2.2.3  Chemical Additives ............................................................................................................................... 18
    2.3  Residue and Associated Water Management and Infrastructure .......................................................... 19
       2.3.1  Hydrometallurgical Residue Facility .................................................................................................... 19
       2.3.2  Double Liner and Leakage Collection System .................................................................................... 20
       2.3.3  Residue Transport and Deposition ....................................................................................................... 21
       2.3.4  Overview of the Reclamation, Closure, and Postclosure Maintenance Phases .................................... 22
    2.4  Stormwater Management and Infrastructure ............................................................................................ 22
       2.4.1  Significant Materials ............................................................................................................................ 24
       2.4.2  Stormwater Management System ........................................................................................................ 24
    2.5  Adaptive Management ............................................................................................................................. 25
3.0  Hydrometallurgical Residue Facility Monitoring .......................................................................................... 26
    3.1  Existing Baseline Monitoring .................................................................................................................. 26
    3.2  Proposed Monitoring Plan ....................................................................................................................... 26
4.0  Groundwater Nondegradation .................................................................................................................... 27
    4.1  Regulatory Context ...................................................................................................................................... 27
<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.2</td>
<td>Existing Groundwater Quality</td>
<td>27</td>
</tr>
<tr>
<td>4.3</td>
<td>Description of Engineering Controls to Protect Groundwater and Abate</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>Existing Groundwater Impacts</td>
<td></td>
</tr>
<tr>
<td>5.0</td>
<td>References</td>
<td>29</td>
</tr>
</tbody>
</table>
List of Tables

Table 1-1    Hydrometallurgical Plant and Hydrometallurgical Residue Facility Summary ................. 10
Table 1-2    Project Water Definitions ........................................................................................................ 12
Table 1-3    Volume VI of PolyMet’s NPDES/SDS Permit Application Cross-Reference ......................... 14

List of Large Tables

Large Table 1    Hydrometallurgical Plant Chemical Additives

List of Large Figures

Large Figure 1    Site Location
Large Figure 2    Hydrometallurgical Residue Facility and Plant Existing Conditions
Large Figure 3    Hydrometallurgical Residue Facility Layout – Phase 1
Large Figure 4    Hydrometallurgical Residue Facility Layout – Phase 3

List of Appendices

Appendix A    Waste Water Treatment System Terminology Changes
Appendix B    Hydrometallurgical Residue Facility Permit Application Support Drawings
Appendix C    Chemical Additives Safety Data Sheets
## List of Acronyms and Abbreviations

<table>
<thead>
<tr>
<th>Acronym or Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application</td>
<td>NPDES/SDS Permit Application</td>
</tr>
<tr>
<td>BMP</td>
<td>Best Management Practice</td>
</tr>
<tr>
<td>HRF</td>
<td>Hydrometallurgical Residue Facility</td>
</tr>
<tr>
<td>LLDPE</td>
<td>Linear Low Density Polyethylene</td>
</tr>
<tr>
<td>LTVSMC</td>
<td>LTV Steel Mining Company</td>
</tr>
<tr>
<td>MPCA</td>
<td>Minnesota Pollution Control Agency</td>
</tr>
<tr>
<td>NPDES</td>
<td>National Pollutant Discharge Elimination System</td>
</tr>
<tr>
<td>PolyMet</td>
<td>Poly Met Mining, Inc.</td>
</tr>
<tr>
<td>Project</td>
<td>NorthMet Project</td>
</tr>
<tr>
<td>Residue</td>
<td>Combined hydrometallurgical residue</td>
</tr>
<tr>
<td>SDS</td>
<td>State Disposal System</td>
</tr>
<tr>
<td>SWPPP</td>
<td>Stormwater Pollution Prevention Plan</td>
</tr>
<tr>
<td>WWTS</td>
<td>Waste Water Treatment System</td>
</tr>
</tbody>
</table>
Permit Application Checklist for Industrial Wastewater

NPDES/SDS Permit Program
National Pollutant Discharge Elimination System (NPDES)/State Disposal System (SDS)

Doc Type: Permit Application

Industrial Process Wastewater is wastewater which, during the manufacturing or processing, comes into direct contact with, or is left over from production of a raw material, intermediate product, finished product, byproduct or waste product.

This checklist is intended to help permit applicants determine the correct forms to submit as part of a complete permit application package. The Minnesota Pollution Control Agency (MPCA) will review the application materials for completeness and notify the applicant within 30 business days of receipt whether the application is incomplete or complete enough for processing.

Print or type application: Before submitting an application, make a photocopy of this form and all other application materials for your records. The MPCA will review the application for completeness and provide an official response to the permittees within 30 days of receipt of all necessary application materials.

Permit application assembly: To expedite the processing and review of your application, put this form and any other applicable permit application checklists for other waste types at the beginning of your submittal package. Please place all other application forms in order as listed on the back of this form. Do not place forms and checklists in an appendix as this makes it difficult and time consuming for staff to locate them.

Completeness instructions: The MPCA will not process an application without properly completed forms. All sections of required forms must be completed. If portions do not apply to this facility, please indicate using “n/a” or explain why it doesn’t apply. For permit reissuance, all forms information must also be completed in full even if the information requested is not changing from the existing permit. This allows the MPCA to quickly verify that the existing information is correct.

Facility name: NorthMet Hydrometallurgical Residue Facility (HRF) and Hydrometallurgical Plant
Permit No.: MN TBD

Reason for Application (check all that apply):
☑ New permit ☐ Permit Modification ☐ Permit Reissuance
☐ Resubmittal of an application determined to be incomplete.
(Include copies of all returned forms with a resubmittal.)

Does this action include construction activities:
☑ Construction is proposed as part of the permit action.
☐ No construction is proposed as part of this permit action.

Form Submittal
Submit two (2) complete copies of the permit application package. At least one (1) copy must be a hard copy. The other may be an electronic copy. The completed form is to be returned to:

Attn: Fiscal Services – 6th floor
Minnesota Pollution Control Agency
520 Lafayette Road North
St. Paul, MN 55155-4194

Assistance
If you have any questions regarding the selection of the proper forms or how to complete the required information, contact the MPCA staff assigned to your facility. Staff is assigned by regions and a director of regional staff can be located at: http://www.pca.state.mn.us/index.php/about-m pca/mpca-overview/agency-structure/mpca-offices/mpca- offices.html

You may also contact the MPCA at:
• In Metro Area 651-296-6300
• Outside Metro Area: 800-657-3864
• E-mail to: askpca@state.mn.us.
### Application Forms Selection

(Check all boxes that apply and include the completed form with the submittal.)

Listed below are application forms and required submittals that may be required for a typical industrial wastewater treatment facility application. All required forms must be completed in-full and included with the submittal. The MPCA cannot process an application that does not include all of the required application forms. All forms, instructions, and additional information can be found on the MPCA website at [http://www.pca.state.mn.us/enzq915](http://www.pca.state.mn.us/enzq915).

Check all boxes that apply. Include a copy of all completed application forms with the submittal.

<table>
<thead>
<tr>
<th>Required for all water quality permits</th>
<th>For Transmittal Form: Refer to Volume I of this Permit Application.</th>
</tr>
</thead>
<tbody>
<tr>
<td>☒ Application Fee as specified on the Transmittal Form</td>
<td></td>
</tr>
<tr>
<td>☒ Certification Signature as specified on Transmittal Form</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Required for all new permits and modifications with a change in design flow</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Major NPDES facilities and/or Categorical NPDES facilities</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Discharge to surface water (for major and minor facilities)</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Non-contact cooling water</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Discharge to land</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ Industrial Land Application of Industrial By-products Application (wq-wwprm7-27)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Discharge to municipal wastewater treatment facility</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Treatment facilities using stabilization ponds</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Stormwater management for wastewater treatment permit holders</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Additional attachments</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Supplemental information (This information may be information required on one, or more of the forms listed above, such as a map. A single map that provides all the information required from multiple forms may be acceptable. A separate copy of each form is not required.)</th>
<th></th>
</tr>
</thead>
</table>
☐ List any additional documents, reports, plans, or attachments included as part of the application package. (Common types of supplemental information may include maps, process flow diagrams, facility plans, engineering reports, plans and specifications, technical checklists and other reports related to the facility or proposed project.) Refer to Volume VI Table of Contents

**Other waste types** Some facilities may also include other waste types that are not covered by this checklist. Facilities with multiple types of wastes should review the other permit application checklists to determine if additional forms and attachments may be required.

☐ Permit Application Checklist for Municipal/Domestic Wastewater (wq-wwprm7-04a)
☐ Permit Application Checklist for Miscellaneous Waste Types (wq-wwprm7-04c)
☐ Permit Application Checklist for Water Treatment (wq-wwprm7-04d)
The National Pollutant Discharge Elimination System (NPDES)/State Disposal System (SDS) Permit Program regulates wastewater discharges to land and surface waters. This attachment applies to municipal and industrial facilities with a pond system (i.e. primary, secondary, polishing, equalization, anaerobic, contaminated runoff, etc.).

Complete the attachment by typing or printing in black ink. Attach additional sheets as necessary. For more information, please contact the Minnesota Pollution Control Agency (MPCA) at: In Metro Area: 651-296-6300 or Outside Metro Area: 800-657-3864.

Permittee name: Poly Met Mining, Inc.  Permit number: MN TBD

Geology/Hydrogeology Information

1. Provide a description of the soil beneath or in the vicinity of the ponds. Use information from soil surveys or from existing soil borings or well logs if available. (Ex.: 8 feet (ft.) of fine sand underlain by 10 ft. of silty clay.)

The footprint of the proposed Hydrometallurgical Residue Facility (HRF) is entirely underlain by granite. Above the granite is a blanket (0 to 25 feet) of glacial and post-glacial unsorted sand, silt, and clay with cobbles and boulders, overlain locally by peat. Additional surface materials have been built up either to support the former LTV Steel Mining Company facilities or where tailings or plant overflow materials have been deposited.

2. What is the depth below ground surface of the water table at the pond site? 0 ft.

How many feet below ground surface is the bottom of the pond? 0 ft.

3. What is the depth to bedrock at the pond site? □ < 10 ft. □ 10-20 ft. □ 20-50 ft. □ >50 ft.

4. What is the bedrock type (Ex.: limestone, sandstone, etc.)? Granite

5. What is the proximity to the ponds of private water supply wells? □ < ¼ mile □ ¼ - 1 mile □ >1 mile

6. Describe the approximate number, type and depth of private water wells in the general vicinity of the ponds (3 mile radius). (Ex.: most (#?) wells generally drilled to greater than 50 ft., however, several shallow (20 ft.) sand point wells also present.)

The Minnesota Well Index includes one well listed for public supply/non-community use within a 3-mile radius of the proposed HRF Pond: Unique Well ID 584559. This well was drilled for LTVSMC, is 406 ft deep, and is listed as sealed.

The Minnesota Well Index includes two wells listed for domestic use within a 3-mile radius of the proposed HRF Pond: Unique Well IDs 275348 and 665923. Well ID 665923 was drilled for LTVSMC, is 165 ft deep, and currently supplies potable water to PolyMet's administration building. Well ID 275348 is a private water well and is 12 ft deep.

There are no other known private water supply wells within a 3-mile radius of the proposed HRF Pond.

7. Are the ponds located in a designated Wellhead Protection Area? □ Yes □ No

8. Are monitoring wells present at the pond site? □ Yes □ No

If yes, please submit a topographic or equivalent map showing well locations with respect to the pond system.

Have any wells shown adverse impacts (Ex.: high nitrate or chloride concentrations)? □ Yes □ No

If yes, please describe the adverse impacts: Groundwater monitoring wells in the vicinity of the existing Plant Site show the following elevated parameters possibly influenced by previous industrial activity: boron, fluoride, iron, molybdenum, sulfate, TDS, and turbidity.

9. What is the proximity to the ponds of any nearby surface waters? (Ex.: Minnesota River located ¼ mile to the north.).

Wetlands located approximately 790 feet to the west and Second Creek located approximately 5,420 feet to the southeast.
Pond Information

10. Please indicate the types of ponds that are present at the facility. (Check all that apply)
   - Primary
   - Secondary
   - Polishing
   - Equalization
   - Aerated
   - Anaerobic
   - Cooling
   - Contaminated runoff
   - Irrigation holding
   - Ash handling
   - Other: Hydrometallurgical Residue Facility

11. Please complete the following table for each pond at the facility.

<table>
<thead>
<tr>
<th>Pond type</th>
<th>Max operating depth (ft.)</th>
<th>Min operating depth (ft.)</th>
<th>Mean operating depth (ft.)</th>
<th>Acreage at mean operating depth</th>
<th>Days of detention time (design flow)</th>
<th>Year each pond was constructed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other</td>
<td>76</td>
<td>0</td>
<td>38</td>
<td>50</td>
<td>650</td>
<td>Not yet constructed</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

12. What is the source of the acreage information in question 11 above? (Ex: as built plans and specs, engineering survey, etc.)
   - Hydrometallurgical Residue Facility Permit Application Support Drawings

13. Has the pond system ever been repaired or upgraded?  □ Yes  ☒ No  If yes, what year?  N/A
    If yes, please describe what the upgrade included:  N/A

14. Has the pond system ever been dredged?  □ Yes  ☒ No  If yes, what year?  N/A
    If yes, please describe the method of dredge material disposal:  N/A

15. What type of pond liner is present?  □ Clay  ☒ Synthetic/Vinyl  ☒ Bentonite  □ Other: N/A

16. Is the pond system ever operated at a depth so that the freeboard is less than 3 feet?  □ Yes  ☒ No
    If yes, please describe the situation and identify how often it occurs:  N/A

17. What is the relationship between current wastewater flows and pond designed hydraulic capacity?
    ☒ below capacity  □ at or near capacity  □ above capacity

18. Are there any drain tiles (designed or pre-existing) located in the vicinity of or beneath the pond system?  □ Yes  ☒ No
    If yes, please submit a topographic or equivalent map showing the drain tile locations and a description of each. (The map and description should include but not be limited to: the drain tile location in relation to the pond system; the drain tile location in relation to the irrigation field [if applicable]; each drain tile discharge location; and, each discharge location station identification code [if applicable].)

19. Please list the calendar month total influent and effluent flow in million gallons for each of the past 12 months (not applicable for municipal facilities).

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Influent</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Effluent</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

20. What is the average annual influent CBODs?  N/A  mg/L

21. Are there known or potential sources of toxic pollutants (metals, Volatile Organic Compounds [VOCs] such as, trichloroethylene, chloroform, methyl tert-butyl ether [MTBE]; benzene, etc.)?  ☒ Yes  □ No
    If yes, please describe:  Hydrometallurgical Residue includes elements common to rock including sodium, iron, sulfur, calcium, aluminum, silicon, magnesium, chlorine, hydrogen, and oxygen.
22. Is the pond system located in karst topography? □ Yes  ☒ No

If yes and if your facility is listed in the 1993 Administrative Order requiring the preparation of a contingency plan, please ensure your facility has an updated contingency plan on file.

Review the attachment and ensure all requested items are submitted with this attachment.
Please make a copy for your records.
Refer to the Transmittal Form for mailing instructions.
The National Pollutant Discharge Elimination System (NPDES)/State Disposal System (SDS) Permit Program regulates wastewater discharges to land and surface waters. This is an attachment to the Industrial Applications for facilities with multiple chemical additives.

Complete the attachment by typing or printing in black ink. Attach additional sheets as necessary. For more information, please contact the Minnesota Pollution Control Agency (MPCA) at: In Metro Area: 651-296-6300 or Outside Metro Area: 800-657-3864.

**Permittee name:** Poly Met Mining, Inc.  
**Permit number:** MN TBD

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Purpose</th>
<th>Location of chemical addition in process (e.g., to raw water supply, at greensand filter, before RO unit #2, etc.)</th>
<th>Amount/duration/frequency of addition</th>
<th>Average rate of use (weight or volume per day)</th>
<th>Maximum rate of use (weight or volume per day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium Hydrosulfide, 30% Solution (Primary)</td>
<td>Cementation of copper from solution as copper sulfide</td>
<td>Hydromet, specifically copper cementation</td>
<td>Continuous</td>
<td>3.17 tons/day (1,160 tons/year)</td>
<td>4.10 tons/day (1,750 tons/year)</td>
</tr>
<tr>
<td>Caustic Soda (Sodium Hydroxide, 50% Solution) (Primary)</td>
<td>Increase pH of off-gases by removing traces of H2S and SO2 in vent scrubbers</td>
<td>Hydromet, specifically the plant scrubber</td>
<td>Continuous</td>
<td>57.53 gallons/day (21,000 gallons/year)</td>
<td>82.19 gallons/day (30,000 gallons/year)</td>
</tr>
<tr>
<td>Sulfuric Acid, 93% Solution (Primary)</td>
<td>Used as wash water for leach residue filter</td>
<td>Hydromet, specifically the residue filter wash water</td>
<td>Continuous</td>
<td>0.47 tons/day (170 tons/year)</td>
<td>0.68 tons/day (250 tons/year)</td>
</tr>
<tr>
<td>Hydrochloric Acid, 32% Solution (Primary)</td>
<td>Addition of chloride used to promote mineral leaching</td>
<td>Hydromet, specifically the autoclave</td>
<td>Continuous</td>
<td>13.70 tons/day (5,000 tons/year)</td>
<td>20.55 tons/day (7,500 tons/year)</td>
</tr>
<tr>
<td>MagnaFloc 342 (Primary)</td>
<td>Flocculant: Promote flocculation of suspended particles in liquors</td>
<td>Hydromet, specifically mixed hydroxide precipitation</td>
<td>Continuous</td>
<td>0.06 tons/day (21 tons/year)</td>
<td>0.11 tons/day (40 tons/year)</td>
</tr>
<tr>
<td>NALCO 9877 PULV (Potential Substitute) (Primary)</td>
<td>Flocculant: Promote flocculation of suspended particles in liquors</td>
<td>Hydromet, specifically mixed hydroxide precipitation</td>
<td>Continuous</td>
<td>0.11 tons/day (40 tons/year)</td>
<td>0.21 tons/day (75 tons/year)</td>
</tr>
<tr>
<td>MagnaFloc 155 (Primary)</td>
<td>Flocculant: Promote flocculation of suspended particles in liquors</td>
<td>Hydromet, specifically mixed hydroxide precipitation</td>
<td>Continuous</td>
<td>0.11 tons/day (40 tons/year)</td>
<td>0.21 tons/day (75 tons/year)</td>
</tr>
<tr>
<td>Neo NS 6670</td>
<td>Flocculant: Promote flocculation of suspended particles in liquors</td>
<td>Hydromet, specifically mixed hydroxide precipitation</td>
<td>Continuous</td>
<td>0.11 tons/day</td>
<td>0.21 tons/day</td>
</tr>
<tr>
<td>(Potential Substitute)</td>
<td>(Primary)</td>
<td>(Secondary)</td>
<td>Continuous</td>
<td>(40 tons/year)</td>
<td>(75 tons/year)</td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>-----------------------------------------------</td>
<td>------------------------------------------------</td>
<td>------------</td>
<td>----------------</td>
<td>----------------</td>
</tr>
<tr>
<td>NALCO 8173 PULV (Potential Substitute)</td>
<td>Flocculant: Promotes flocculation of suspended</td>
<td>Hydromet, specifically mixed hydroxide</td>
<td>0.11 tons/day</td>
<td>0.21 tons/day</td>
<td></td>
</tr>
<tr>
<td></td>
<td>particles in liquors</td>
<td>precipitation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MagnaFloc 351 (Primary)</td>
<td>Flocculant: Promote flocculation of</td>
<td>Hydromet, specifically in the leach residue</td>
<td>0.27 tons/day</td>
<td>0.41 tons/day</td>
<td></td>
</tr>
<tr>
<td></td>
<td>suspended particles in liquors</td>
<td>thickener, PGM thickener, and copper sulfide</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neo NS 6500 (Potential Substitute)</td>
<td>Promote flocculation of suspended particles</td>
<td>Hydromet, specifically in the leach residue</td>
<td>0.41 tons/day</td>
<td>0.55 tons/day</td>
<td></td>
</tr>
<tr>
<td></td>
<td>in liquors</td>
<td>thickener, PGM thickener, and copper sulfide</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NALCO 9876 PULV (Potential Substitute)</td>
<td>Flocculant: Promote flocculation of</td>
<td>Hydromet, specifically in the leach residue</td>
<td>0.41 tons/day</td>
<td>0.68 tons/day</td>
<td></td>
</tr>
<tr>
<td></td>
<td>suspended particles in liquors</td>
<td>thickener, PGM thickener, and copper sulfide</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sulfur Dioxide (Liquid) (Primary)</td>
<td>Reduce ferric ions to ferrous ions</td>
<td>Hydromet, specifically iron reduction and PGM</td>
<td>4.14 tons/day</td>
<td>6.16 tons/day</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>precipitation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Limestone (Lump) (Primary)</td>
<td>Promote precipitation of Fe and Al</td>
<td>Hydromet, specifically in iron removal</td>
<td>276.71 tons/day</td>
<td>410.96 tons/day</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Limestone (Ground) (Potential Substitute)</td>
<td>Promote precipitation of Fe and Al</td>
<td>Hydromet, specifically in iron removal</td>
<td>276.71 tons/day</td>
<td>410.96 tons/day</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Magnesium Hydroxide, 60% Slurry (Primary)</td>
<td>Promote precipitation of Ni and Co sulfates</td>
<td>Hydromet, specifically mixed hydroxide</td>
<td>16.44 tons/day</td>
<td>24.66 tons/day</td>
<td></td>
</tr>
<tr>
<td></td>
<td>as Ni and Co hydroxides (mixed hydroxide</td>
<td>precipitation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>precipitate)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Magnesium Hydroxide (Dry) (Potential</td>
<td>Promote precipitation of Ni and Co sulfates</td>
<td>Hydromet, specifically mixed hydroxide</td>
<td>16.44 tons/day</td>
<td>24.66 tons/day</td>
<td></td>
</tr>
<tr>
<td>Substitute)</td>
<td>as Ni and Co hydroxides (mixed hydroxide</td>
<td>precipitation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>precipitate)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lime (Dry) (Potential Substitute)</td>
<td>Promote precipitation of Ni and Co sulfates</td>
<td>Hydromet, specifically mixed hydroxide</td>
<td>10.55 tons/day</td>
<td>16.44 tons/day</td>
<td></td>
</tr>
<tr>
<td></td>
<td>as Ni and Co hydroxides (mixed hydroxide</td>
<td>precipitation</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Remember to attach the Material Safety Data Sheets, complete product labels and any other information on chemical composition, aquatic toxicity, human health, and environmental fate for each chemical additive. Please make a copy for your records. Refer to the Transmittal Form for mailing instructions.

Chemicals listed as potential substitutes are not intended to be used at the average and maximum rates of use unless the primary chemical additive is unavailable.
1.0 Introduction

This volume, Volume VI of the National Pollutant Discharge Elimination System (NPDES) / State Disposal System (SDS) Permit Application (Application) for Poly Met Mining, Inc.’s (PolyMet) NorthMet Project (Project), focuses on the Hydrometallurgical Residue Facility (HRF) and Hydrometallurgical Plant at the Plant Site. The Project will use hydrometallurgical processing to recover metals from concentrate and the combined hydrometallurgical residue (Residue) will be placed in the HRF. Refer to Section 2.0 of Volume I for discussion of the permitting approach for this Application as it applies to the HRF and Hydrometallurgical Plant.

Table 1-1 provides a high-level overview of the Hydrometallurgical Plant and the HRF.
Table 1-1  Hydrometallurgical Plant and Hydrometallurgical Residue Facility Summary

| Purpose | To recover platinum-group elements, precious metals, and base metals from concentrates and to safely store the remaining Residue in a manner that results in virtually zero-leakage from the facility (treated as zero-leakage for modeling purposes). |
| Location | At the Project Plant Site. The Hydrometallurgical Plant will be located at the former LTV Steel Mining Company (LTVSMC) taconite process plant area, and the HRF will be located southwest of the Tailings Basin, on the former LTVSMC Emergency Basin (Large Figure 1). |
| Hydrometallurgical Plant description | The Hydrometallurgical Plant will use high pressure and temperature autoclave leaching followed by solution purification steps to extract and isolate platinum-group elements, precious metals, and base metals. Process water will be drawn from the HRF Pond and from the Plant Reservoir. |
| HRF description | New double-lined, approximately 90 acre surface impoundment with Leakage Collection System. HRF dams will be constructed using downstream methods. |
| HRF double liner system | Upper liner – 80-mil Linear Low Density Polyethylene (LLDPE) geomembrane Leakage collection layer – continuous layer of Geocomposite Drainage Net Lower composite liner – 60-mil LLDPE or High Density Polyethylene (HDPE) geomembrane above a Geosynthetic Clay Liner |
| Water management and discharge | HRF pond water will be recycled back to the Hydrometallurgical Plant and will not be discharged. Leakage will be collected and returned to the HRF Pond. |
| Estimated commission(1) | Several years after Mine Year 1(2) |
| Reclamation and closure phase plan(2) | The pond and Residue will be dewatered, with drainage routed to the Waste Water Treatment System (WWTS). After dewatering, a multi-layer cover system will be placed over the Residue. Once HRF dewatering is complete, WWTS treatment of HRF drainage will be discontinued. The Leakage Collection System will continue to operate and route collected water to the WWTS. |
| Postclosure maintenance phase plan(3) | The Leakage Collection System will continue to operate until all free water has drained from the Residue, at which time leakage collection will no longer be needed. The system will route collected water to the WWTS, or subsequently to a non-mechanical treatment system. |

Italicized terms are defined in Table 1-2.

[1] The timing of the construction and operation of the Hydrometallurgical Plant and HRF will depend on many factors, including customer requirements and overall Project economics.

[2] Mine Year 1 will begin on the first day of production blasting within the open pit at the Mine Site.

[3] The reclamation and closure phases are estimated to start in Mine Year 21 and 25, respectively.

[4] The postclosure maintenance phase is estimated to start in Mine Year 55, once the West Pit has flooded.

This volume is organized in four sections:

Section 1.0  Provides an overview of the HRF and Hydrometallurgical Plant and provides the water definitions specific to the volume.
Section 2.0  Describes the water management and infrastructure at the Hydrometallurgical Plant and HRF, including existing conditions, Residue and stormwater management and infrastructure, adaptive management, chemical additives, and an overview of the reclamation, closure, and postclosure maintenance phases.

Section 3.0  Summarizes the proposed monitoring plan for the HRF and Hydrometallurgical Plant.

Section 4.0  Describes how the HRF complies with the groundwater nondegradation rule (Minnesota Rules, part 7060.0500).

In accordance with Minnesota Rules, part 6132.0200, the HRF has been designed “to control possible adverse environmental effects of nonferrous metallic mineral mining, to preserve natural resources, and to encourage planning of future land utilization.” The design of the HRF includes systems for managing water in a manner that results in essentially zero-leakage from the facility. Monitoring of downgradient flow paths will be in place to confirm that the facility meets this design goal. Additionally, plans have been developed for adaptive management (Section 4.0 of Reference (1) and Section 6.4 of Reference (2)) and contingency mitigation (Section 6.5 of Reference (2)) as deemed necessary to maintain facility performance (refer to Section 2.5 of this volume for further discussion).

Water management includes collection and management of process water and HRF water within the facility. The flow of water associated with the HRF and Hydrometallurgical Plant is included on Large Figure 4 in Volume I, which depicts the general flow of water throughout the Project. Refer to Sections 2.3 and 2.4 of this volume for further details on the management of process water, HRF water, and stormwater.

Table 1-2 provides definitions for the terms process water, HRF water, plant reservoir water, industrial stormwater, construction stormwater, and non-contact stormwater, as well as notes regarding the definitions’ application to specific facets at the HRF and Hydrometallurgical Plant.

Separate applications will be submitted requesting:

- authorization to discharge stormwater associated with construction activities at the HRF and Hydrometallurgical Plant under the Minnesota NPDES/SDS Construction Stormwater General Permit (Construction Stormwater General Permit)

- authorization to discharge stormwater associated with industrial activities at the HRF under the Minnesota NPDES/SDS Industrial Stormwater General Permit (Industrial Stormwater General Permit)

Refer to Section 2.4 of this volume for further details on the management of stormwater during operations.
Table 1-2  Project Water Definitions

<table>
<thead>
<tr>
<th>Project-Specific Term</th>
<th>Project-Wide Definition(^{(1)})</th>
<th>Hydrometallurgical Residue Facility (HRF) Specifics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process Water</td>
<td>Water that has been used in the beneficiation process or hydrometallurgical process.</td>
<td>Water that has been used in the hydrometallurgical process.</td>
</tr>
</tbody>
</table>
| HRF Water             | Water collected and stored within the HRF, which includes the following:  
                        • process water resulting from the hydrometallurgical process and routed to the HRF as part of the residue slurry  
                        • precipitation and runoff from within the HRF dams | The primary water source for the Hydrometallurgical Plant. |
| Plant Reservoir Water | Water collected and stored within the Plant Reservoir, which includes the following:  
                        • water pumped from Colby Lake  
                        • precipitation that falls on the Plant Reservoir | The make-up water source for the Hydrometallurgical Plant. |
| Industrial Stormwater | Stormwater associated with industrial activities\(^{(2)}\). | Includes precipitation and runoff from the HRF dam exterior slopes if constructed of tailings. |
| Construction Stormwater | Stormwater associated with construction activities\(^{(3)}\). | (no additions to Project-Wide Definition) |
| Non-Contact Stormwater | Precipitation and runoff that contacts natural, stabilized, or reclaimed surfaces and has not been exposed to mining activities, construction activities\(^{(3)}\), or industrial activities\(^{(2)}\). | Does not include runoff from reclaimed HRF dam exterior slopes if constructed of tailings (refer to industrial stormwater). |

\(^{(1)}\) If two types of waters mix, the mixture is handled as the more actively managed type of water (e.g., a mixture of non-contact stormwater and process water is managed as process water). Management of water mixtures will be governed by regulatory requirements.

\(^{(2)}\) As defined in Minnesota Rules, part 7090.0080, subpart 6

\(^{(3)}\) As defined in Minnesota Rules, part 7090.0080, subpart 4

During environmental review, PolyMet developed numerous Management Plans to provide details of the design, construction, operations, reclamation, closure, and postclosure maintenance phases of the Project. The Management Plans rely on and incorporate the results of Data Packages, which are compilations of technical data and related supporting information.

Information from the above-referenced documents, as well as from this and other permit applications and issued permits, will be incorporated into an operations plan for use during the operations, reclamation, closure, and postclosure maintenance phases of the Project. Refer to Section 1.7 of Volume I for a description of the Project phases.

To help the reviewer navigate the supporting material for Volume VI of this Application, Table 1-3 cross references key HRF and Hydrometallurgical Plant-related topics, PolyMet Management Plans and Data Packages, sections of this narrative, and permit application requirements.
Note that some terminology associated with the Waste Water Treatment System (WWTS) has changed since the environmental review process was completed and the NPDES/SDS Permit Application was submitted in July 2016. Changes are associated with the relocation of the mine water treatment trains that were previously planned for the Mine Site Waste Water Treatment Facility, which will now be in the Plant Site WWTS, and the relocation of the Mine Site equalization basins, Central Pumping Station, and Construction Mine Water Basin south of Dunka Road. There is no change to the level of treatment planned for the Project as a result of these relocations. To facilitate the review of documents prepared for the NorthMet Mining Project and Land Exchange Final Environmental Impact Statement (Reference (3)) which are also referenced in this Application, Appendix A explains the WWTS terminology changes.
<table>
<thead>
<tr>
<th>Facility Topic</th>
<th>Management Plan / Data Package</th>
<th>NPDES/SDS Volume VI</th>
<th>Permit Application Form</th>
<th>Application Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing Conditions</td>
<td>NorthMet Project: Geotechnical Data Package Volume 2 – Hydrometallurgical Residue Facility (Reference (4))</td>
<td>Section 3.0</td>
<td>Section 2.1</td>
<td></td>
</tr>
<tr>
<td>Hydrometallurgical Plant</td>
<td>Facility Description</td>
<td>NorthMet Project: Project Description (Reference (5))</td>
<td>Section 4.3</td>
<td>Table 1-1, Section 2.2.1</td>
</tr>
<tr>
<td></td>
<td>Raw Material Consumed</td>
<td>NorthMet Project: Project Description (Reference (5))</td>
<td>Section 4.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Product Produced</td>
<td>NorthMet Project: Project Description (Reference (5))</td>
<td>Section 4.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Operation Initiated</td>
<td>NorthMet Project: Project Description (Reference (5))</td>
<td>Section 4.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Water Supply Source</td>
<td>NorthMet Project: Water Modeling Data Package Volume 2 – Plant Site (Reference (6))</td>
<td>Section 6.1.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Water Balance</td>
<td>NorthMet Project: Water Modeling Data Package Volume 2 – Plant Site (Reference (6))</td>
<td>Section 6.1.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chemical Additives</td>
<td></td>
<td></td>
<td>Section 2.2.3</td>
</tr>
<tr>
<td>Residue Characterization</td>
<td>Geochemical Characteristics</td>
<td>NorthMet Project: Waste Characterization Data Package (Reference (7))</td>
<td>Section 6.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Geotechnical Characteristics</td>
<td>NorthMet Project: Geotechnical Data Package Volume 2 – Hydrometallurgical Residue Facility (Reference (4))</td>
<td>Section 6.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Estimated Volume</td>
<td>NorthMet Project: Residue Management Plan (Reference (8))</td>
<td>Section 2.1</td>
<td></td>
</tr>
<tr>
<td>Process Water</td>
<td></td>
<td></td>
<td></td>
<td>Section 2.3</td>
</tr>
<tr>
<td>Facility Topic</td>
<td>Location of Relevant Details:</td>
<td>Permit Application Form</td>
<td>Application Question</td>
<td></td>
</tr>
<tr>
<td>----------------</td>
<td>-------------------------------</td>
<td>------------------------</td>
<td>---------------------</td>
<td></td>
</tr>
<tr>
<td><strong>Hydrometallurgical Residue Facility (HRF)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Facility Description</td>
<td>NorthMet Project: Project Description (Reference (5))</td>
<td>Table 1-1, Section 2.3.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operation Initiated</td>
<td>NorthMet Project: Residue Management Plan (Reference (8))</td>
<td>Section 1.0</td>
<td>Table 1-1, Section 2.3.1</td>
<td></td>
</tr>
<tr>
<td>HRF Permit Application Support Drawings</td>
<td>NorthMet Project: Residue Management Plan (Reference (8))</td>
<td>Appendix A</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Dams</strong></td>
<td>NorthMet Project: Residue Management Plan (Reference (8))</td>
<td>Section 2.2.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>NorthMet Project: Geotechnical Data Package Volume 2 – Hydrometallurgical Residue Facility (Reference (4))</td>
<td>Section 6.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HRF Pond</td>
<td>NorthMet Project: Residue Management Plan (Reference (8))</td>
<td>Section 2.2.2</td>
<td>Sections 2.3.1 and 2.3.2</td>
<td></td>
</tr>
<tr>
<td>Liner and Leakage Collection System</td>
<td>NorthMet Project: Residue Management Plan (Reference (8))</td>
<td>Sections 2.2.2 and 4.3</td>
<td>Table 1-1, Section 2.3.2</td>
<td></td>
</tr>
<tr>
<td>Residue Transport and Deposition and Return Water System</td>
<td>NorthMet Project: Residue Management Plan (Reference (8))</td>
<td>Sections 2.3 and 2.4</td>
<td>Section 2.3.3</td>
<td></td>
</tr>
<tr>
<td>Water Balance</td>
<td>NorthMet Project: Water Modeling Data Package Volume 2 – Plant Site (Reference (6))</td>
<td>Section 6.1.3</td>
<td>Section 2.3.1</td>
<td></td>
</tr>
<tr>
<td>Construction and Construction QA/QC</td>
<td>NorthMet Project: Residue Management Plan (Reference (8))</td>
<td>Attachments G and H</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operational Plan</td>
<td>NorthMet Project: Residue Management Plan (Reference (8))</td>
<td>Section 4.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overview of the Reclamation, Closure, and Postclosure Maintenance Phases</td>
<td>NorthMet Project: Residue Management Plan (Reference (8))</td>
<td>Sections 7.1, 7.2, and 7.3</td>
<td>Table 1-1, Section 2.3.4</td>
<td></td>
</tr>
</tbody>
</table>

| Stormwater Management and Infrastructure | | | |
| Overall | NorthMet Project: Residue Management Plan (Reference (8)) | Section 2.5 | Section 2.4 |
| Significant Materials | | | Section 2.4.1 |
| Receiving Waters | | | Sections 2.4 and 2.4.2 |

| Adaptive Management and Contingency Mitigation | NorthMet Project: Water Management Plan – Plant (Reference (2)) | Sections 6.4 and 6.5 | Section 2.5 |
| | NorthMet Project: Adaptive Water Management Plan (Reference (1)) | Section 4.0 |  |

| Monitoring | NorthMet Project: Adaptive Water Management Plan (Reference (1)) | Section 4.0 |  |
| Baseline Surface Water Monitoring | | |  |
| Baseline Groundwater Monitoring | | |  |
| Proposed Monitoring Plan | | |  |
| Groundwater Nondegradation | | |  |

**Gray shading** indicates no corresponding reference material.
2.0 Hydrometallurgical Plant and Residue Facilities
Water Management and Infrastructure

This section focuses on water management associated with the Hydrometallurgical Plant and HRF during operations, specifically during the period covered by this Application (approximately Mine Years 1 through 5). The following sub-sections describe:

- the existing site conditions (Section 2.1)
- the Hydrometallurgical Plant (Section 2.2), including chemical additives proposed for use at the Hydrometallurgical Plant (Section 2.2.3)
- the systems for managing Residue and associated water (Section 2.3), including an overview of plans for the reclamation, closure, and postclosure maintenance phases (Section 2.3.4)
- the stormwater management systems (Section 2.4)
- the adaptive management approach that can be used to modify HRF water management systems in response to site-specific conditions encountered during operations (Section 2.5)

Permit application support drawings for HRF water management systems are included in Appendix B.

2.1 Existing Conditions

The HRF will be constructed on the former LTV Steel Mining Company (LTVSMC) Emergency Basin (Emergency Basin) which is near the southwestern corner of the existing tailings basin, as shown on Large Figure 2. The Emergency Basin was originally designed to contain taconite tailings from the main LTVSMC tailings thickeners in the event of a power failure. Accidental overflows, spillage, and floor drainage from the LTVSMC concentrator along with water collected from concentrator foundation drains, french drains, and roof drains also reached the Emergency Basin. Existing materials in the Emergency Basin, which will serve as the foundation materials for portions of the HRF, have experienced relatively little consolidation since LTVSMC operations ended in 2001. This is due to the hydraulic placement of the material and hydrostatic pressures resulting from previously impounded water in the Emergency Basin. These materials will be compressed by placement of a preload fill prior to HRF construction. The Emergency Basin and its history are further described in Section 3.1 of Reference (4).

Two railroad tracks are located near the Emergency Basin. Along the southwestern perimeter runs a track that previously served industries located north of the site; this track has been decommissioned. Southeast of the Emergency Basin and extending into the former LTVSMC Plant Site is the Hinsdale Bridge Approach, a rail embankment that is above the planned HRF elevation. This track will not be affected by the HRF, nor is the track expected to affect operations at the HRF.

The Emergency Basin is in the Embarrass River watershed. It drains to the northwest, between Tailings Basin Cell 2W and the railroad grade along the western perimeter. Water occasionally ponds in this area.
during periods of extended wet weather but there is no permanent pond in the Emergency Basin. Currently, water from Plant Site building floor drains and roof drains is routed to the Emergency Basin. Large Figure 2 shows existing stormwater conditions at the Plant Site, including the Emergency Basin, where the HRF will be built.

2.2 Hydrometallurgical Plant

2.2.1 Facility Description

The Hydrometallurgical Plant will process nickel concentrates from the Beneficiation Plant, extracting copper concentrate, mixed nickel-cobalt (Ni/Co) hydroxide, and gold and platinum-group elements (Au/PGE) precipitate. PolyMet plans to build the plant several years after mining starts. Before the plant is built, PolyMet will ship the nickel concentrates from the Beneficiation Plant directly to customers. The timing for construction of the Hydrometallurgical Plant will depend on customer requirements and overall Project economics. Furthermore, once the plant is built, some amount of nickel concentrate may continue to be shipped without hydrometallurgical processing, depending on customer requirements and overall Project economics.

The hydrometallurgical process will involve high pressure and temperature autoclave leaching followed by several solution purification steps. Inputs will include the nickel concentrates from the Beneficiation Plant, water from the HRF Pond and the Plant Reservoir (HRF water and plant reservoir water), various process consumables as detailed in Section 4.3.3.8 of Reference (5), and chemical additives as described in Section 2.2.3 of this volume.

Hydrometallurgical Plant processes will require up to an annual average of approximately 407 gpm of water (Section 5.2.2.4.1 of Reference (6)). Of this, approximately 184 gpm will be lost to evaporation at the plant. The balance, approximately 223 gpm, will be piped with the Residue to the HRF.

Water for Hydrometallurgical Plant processes will include recycled HRF water from the HRF Pond (approximately 172 gpm) and make-up water from the Plant Reservoir (plant reservoir water). The Plant Reservoir will be supplied with raw water pumped from Colby Lake under terms of a water appropriation permit. The demand for make-up water from Colby Lake will be relatively constant at around 230 gpm, with minor variations due to Project operations and precipitation (Section 6.1.5 of Reference (6)).

If all nickel concentrate streams from the Beneficiation Plant are processed at the Hydrometallurgical Plant, annual production will total about 113,000 tons of copper concentrate, 18,000 tons of mixed nickel-cobalt (Ni/Co) hydroxide, and 500 tons of gold and platinum-group elements (Au/PGE) precipitate (Section 4.3 of Reference (5)). This will result in generation of approximately 313,000 tons of Residue per year (Section 4.3.7 of Reference (5)). These totals will decrease if some flotation concentrates are shipped directly to customers. Residue will be pumped as slurry to the HRF.

2.2.2 Residue Characterization

The hydrometallurgical process will generate several types of residues. During the pilot-plant processing, samples of each type of residue and the combined Residue were collected for laboratory testing to
determine geochemical and geotechnical parameters. The geochemical characteristics, geotechnical characteristics, and grain-size distribution of the pilot-plant residue sample are believed to be representative of that expected in Residue from the commercial plant.

The Residue will be primarily gypsum (calcium sulfate - \(\text{CaSO}_4\)), with other minerals as shown in Table 2-1 of Reference (8). Laboratory testing of individual residues and the combined Residue indicates that:

- individual residues and the combined Residue are not hazardous wastes
- residue is not considered lethal
- leach residue is acidic
- magnesium removal residue contains significant neutralizing material
- there is potential for acid generation to exceed neutralizing capacity in the long term, therefore lime or limestone will be blended with the Residue prior to disposal in the lined HRF

Additional details on the geochemical and geotechnical characteristics of the Residue are available in Section 6.0 of Reference (7) and Section 2.1 of Reference (8).

### 2.2.3 Chemical Additives

Chemical additives will be used at the Hydrometallurgical Plant to promote the efficacy of the hydrometallurgical process. Specifically each chemical additive will serve one of the following purposes:

- increase the pH of off-gases
- promote mineral leaching
- promote flocculation of suspended particles
- promote the reduction of metals
- promote precipitation of metals

Because the Hydrometallurgical Plant and the HRF are a closed-loop system, the proposed chemical additives will remain within the system with no discharge. Chemical additives that serve the purpose of promoting flocculation will attach to solids and be incorporated in the concentrate.

Additional information regarding each proposed chemical additive is included in Large Table 1. Additionally, Safety Data Sheets and product information labels for each proposed chemical additive are included in Appendix C. Based on Project economics and the availability of specific products, the same chemical additive may be acquired from multiple manufacturers provided that the chemical additive is commensurate with the chemical additive proposed within this Application.
2.3 Residue and Associated Water Management and Infrastructure

This section describes the design and operation of the infrastructure that will be used to manage Residue and HRF water in accordance with applicable regulations.

The HRF is designed as a closed system: no water from the HRF will be released to the environment through overflow or outlet structures. Leakage is not expected because, with the double liner and Leakage Collection System (as described in Section 2.3.2), the facility is designed to be virtually leak-free (treated as zero-leakage for modeling purposes). Water will be lost from this closed loop system to evaporation from the cell surface and entrainment within the pore spaces of the deposited Residue.

The following sections describe the design and operation of the major components of the Residue and water management systems, which include the HRF (Section 2.3.1), the double liner and Leakage Collection System (Section 2.3.2), and Residue transport and deposition system (Section 2.3.3). Plans for the reclamation, closure, and postclosure maintenance phases are summarized in Section 2.3.4.

2.3.1 Hydrometallurgical Residue Facility

The HRF is designed with the capacity to permanently store Residue generated over approximately 18 years of operation (Section 1.0 of Reference (8)). The cell is sized to accommodate up to 3 feet of freeboard, so that some wave run-up and water level bounce can safely occur.

Dams will be constructed using downstream construction methods: the interior segments of the dam are constructed first, then the dam is raised upward and outward from the cell perimeter as additional capacity is needed. Southeastern and southwestern segments of the HRF dam will abut existing high ground. The northern HRF dam will abut Tailings Basin Cell 2W. Dams will be constructed using soil borrow and possibly quarried rock from the hills adjoining the HRF to the southeast and southwest. LTVSMC coarse tailings may also be used if needed to supplement the other borrow sources. The HRF dams are designed to meet all required factors of safety (Section 6.2 of Reference (4)), and will be constructed and operated in accordance with Minnesota state dam safety regulations (Section 2.0 of Reference (4)).

The facility will be constructed in three phases, with Phase 1 completed before the Hydrometallurgical Plant begins operating in approximately Mine Year 3, Phase 2 completed in approximately Mine Year 6, and Phase 3 completed in approximately Mine Year 13. The maximum footprint of the HRF will be reached with Phase 3. The HRF Phase 1 and Phase 3 layouts are shown in Large Figure 3 and Large Figure 4, respectively. Permit application support drawings for the HRF are included in Appendix B; for additional detail on the design of the HRF, refer to Section 2.0 of Reference (8).

In addition to Residue from the Hydrometallurgical Plant, the HRF may also receive gypsum from the WWTS and if allowed under applicable law, coal combustion residuals (coal ash) from the existing Coal Ash Landfill, which was constructed near the existing tailings basin in connection with the former LTVSMC operations near the Tailings Basin. The Minnesota Pollution Control Agency (MPCA) compliance agreement governing the postclosure phase of the Coal Ash Landfill will be modified if necessary to allow...
the coal ash to be relocated to the HRF before any such relocation occurs. These additional materials, if placed in the HRF, will represent up to approximately 5% to 6% of the solids stored in the HRF (Sections 4.0 and 4.4 of Reference (4)).

The HRF Pond will receive water from three sources: process water to transport the Residue from the Hydrometallurgical Plant (Section 2.2.1); stormwater run-on and direct precipitation; and water collected by the HRF Leakage Collection System (Section 2.3.2). Decanted water from the pond will be pumped back to the Hydrometallurgical Plant for reuse in the process.

### 2.3.2 Double Liner and Leakage Collection System

The HRF will have a double liner and a Leakage Collection System. Leakage is water that penetrates the upper layer of the liner system. The liner and Leakage Collection System consists of two barrier layers separated by a leakage collection layer. The double liner and Leakage Collection System is designed to be virtually leak-free, as described below.

- **Upper Liner** – The upper geomembrane liner serves as the primary barrier to leakage from the HRF. Its thickness is selected for durability and to resist ice impacts in the event of any temporary shutdowns of the hydrometallurgical process in winter months. The upper liner will be subject to hydraulic head equal to the water level in the HRF. Leakage through any unintended defects in the upper liner will be driven by the defect size and frequency, and by the hydraulic head at the location of the defect.

- **Leakage Collection Layer** – The leakage collection layer will gather any water that passes through the upper liner. Collected leakage will be directed to a sump then pumped back to the HRF Pond. Together, the leakage collection layer and the associated sump, pumps, and piping comprise the Leakage Collection System. The Leakage Collection System keeps the hydraulic head on the lower liner system very low.

- **Lower Liner** – The lower composite liner provides a virtually leak free barrier to prevent water passing through the upper liner from leaving the HRF. This virtually leak free performance is achieved because the hydraulic head on the lower liner is so low that there is not enough force to drive leakage through any defects in the lower liner system. Leakage through the upper liner will be retained above the lower liner and collected by the Leakage Collection System.

Calculations based on typical defect size and frequency, expected hydraulic head, and measured hydraulic conductivity of system components indicate that no leakage is expected through the lower composite liner. Refer to Sections 2.2.2 and 4.3 of Reference (8) for additional information on the design and operation of the liner and Leakage Collection System.

The HRF will also have a Drainage Collection System, which will be installed during HRF construction but not be activated until after closure. Drainage is water that flows through the Residue and is collected above the upper layer of the liner system. The Drainage Collection System will be used during reclamation to speed Residue dewatering (Section 7.2.1 of Reference (8)).
As previously described in Section 2.1 and shown in the permit application support drawings for the HRF (Appendix B), portions of the HRF footprint will be constructed above the location of the former LTVSMC Emergency Basin. The materials previously deposited in the Emergency Basin will be prone to consolidation (settlement) in response to placement of the HRF above these foundation materials. Because the HRF liner system can tolerate some but not an uncontrolled amount of strain from this settlement, preloading of the Emergency Basin area is planned. The preloading will occur prior to HRF construction to pre-consolidate the previously deposited foundation materials, thereby inducing settlement of previously placed materials prior to HRF development rather than in response to HRF development.

The preloading will consist of incrementally placing layers of soil and/or rock fill above the existing foundation materials to compress them. Some of the soil and/or rock fill will be removed for HRF development. In this case, the removed preload materials will be utilized for HRF dam construction. This pre-consolidation of foundation soils through pre-loading will reduce or eliminate the potential for future settlement of the HRF liner system. Geotechnical Data Package – Volume 2 (Reference (4)) presents the analysis on which the currently planned preloading is based. The pre-loading will include five lifts of soil and/or rock fill, with each lift 10 feet in thickness. As settlement of the foundation soils ceases in response to one lift of preload, the next lift will be placed, and settlement will be measured until it ceases, and then the next preload lift will be placed until the entire five-lift sequence is complete.

The five-lift preload sequence described above represents a preliminary plan, the basis of which is viewed as a conservative analysis. It does not account for intrusion of the higher strength preload materials into the Emergency Basin materials; intrusion that should add some strength to the Emergency Basin materials and reduce HRF settlement.

Actual preload lift sequencing (number of lifts, duration of placement prior to next lift) will be determined in conjunction with preload construction on the basis of settlement-vs-time plots and the settlement magnitude data for each preload lift. The sequence will be terminated at the time at which there is little further consolidation of foundation soils in response to additional preload placement, as evidenced by a flattening of the settlement-vs-time plots and settlement magnitude data. A more detailed plan for preload construction and a detailed preload monitoring plan will be prepared prior to preload construction. This detailed pre-load implementation plan, in conjunction with detailed design plans for the initial lift of the HRF will be submitted for MPCA review prior to initiation of construction.

**2.3.3 Residue Transport and Deposition**

The HRF will function as a large-scale sedimentation basin. Residue will be pumped as slurry to the HRF, where it will settle out and be permanently stored. Residue slurry from the Hydrometallurgical Plant will be pumped to the HRF through a High Density Polyethylene pipe with multiple discharge ports into the HRF. A pond will be maintained within the cell such that the solid fraction of the slurry (the Residue) settles out, while the majority of the liquid fraction is recovered by the return water system and pumped back to the Hydrometallurgical Plant for reuse. The levels of both the solids and liquid within the cell will increase incrementally over time. Each discharge port will have a valve to control the solids deposition in
the cell, and connections to change the discharge configuration as the water and Residue levels rise in the cell.

The return water system will consist of a floating pump system coupled to adjustable pipe that can be shortened as the water level rises in the pond. It will be automated to balance water return from the HRF with the water demand at the Hydrometallurgical Plant. Any fluctuation in demand will be accommodated by temporary water level changes in the HRF and in the process water tank at the Hydrometallurgical Plant. Water level in the HRF will also be managed as needed to facilitate Residue deposition at the desired locations within the HRF and to achieve the desired water clarity for process water at the Hydrometallurgical Plant. Additional information on the Residue transport and deposition systems is available in Section 2.3 of Reference (8).

### 2.3.4 Overview of the Reclamation, Closure, and Postclosure Maintenance Phases

While the activities described in this section are beyond the scope of the first NPDES/SDS permit term, an overview of the activities associated with the reclamation, closure, and postclosure maintenance phases, which are estimated to begin in Mine Years 21, 25, and 55, respectively, are provided here as additional background.

In the reclamation and closure phases, the HRF will be dewatered, then closed with a multi-layer cover system. Dewatering will involve pumping the remaining HRF Pond water to the WWTS and activating the Drainage Collection System. The Drainage Collection System, which will be installed above the liner and Leakage Collection System during facility construction, will draw down the water stored in the Residue pore spaces and pump the drainage to the WWTS. The HRF will have a temporary cover in place during Residue dewatering. Overall, dewatering will create a stable surface for reclamation and minimize the hydraulic head on the liner system, limiting the potential for leakage. The Leakage Collection System will remain in service as long as necessary and any water that is collected will be pumped to the WWTS or subsequently to non-mechanical treatment (Sections 7.2 and 7.3 of Reference (8)).

The multilayer cover system (described in Section 7.2.2 of Reference (8)), will include a composite cover, composed of a geosynthetic clay liner overlain by a 40-mil low density polyethylene or similar MPCA-approved geomembrane barrier layer. The final grading will create a gently sloping closure surface that sheds surface water runoff, accommodates future differential settlement of the underlying Residue, and minimizes ponding of water on the closed HRF surface. It is estimated that reclamation activities will be completed approximately 10 years after the end of operations.

### 2.4 Stormwater Management and Infrastructure

This section describes the management of stormwater at the HRF, including best management practices (BMPs) and the design and operation of the infrastructure that will be used to manage stormwater in accordance with applicable regulations. Stormwater associated with the Hydrometallurgical Plant is included in the discussion of Plant Site stormwater in Section 2.3 of Volume IV.
Consistent with the overall Project approach (Table 1-2 of this volume), stormwater at the HRF is defined in three categories:

- **construction stormwater**, which consists of stormwater associated with construction activities
- **industrial stormwater**, which consists of stormwater associated with industrial activities
- **non-contact stormwater**, which consists of precipitation and runoff that contacts natural, stabilized, or reclaimed surfaces and has not been exposed to mining activities, construction activities, or industrial activities

As discussed in Section 1.0 of this volume, a separate application is being submitted requesting authorization to discharge stormwater associated with construction activities at the HRF and Hydrometallurgical Plant under the Construction Stormwater General Permit. While these activities will be associated with the separate Construction Stormwater General Permit program, an overview of PolyMet’s plan for management of construction stormwater is included here as additional background. Stormwater associated with construction activities will be managed with controls and BMPs, including erosion and sediment control measures, construction water management control measures, dust control measures, and construction site restoration practices. Prior to the start of each phase of construction activities, these management measures will be incorporated into a Construction Stormwater Pollution Prevention Plan (SWPPP) based on detailed construction plans and in accordance with Construction Stormwater General Permit requirements. In order to meet the permanent stormwater management requirements of the Construction Stormwater General Permit, additional stormwater features beyond those discussed herein may be included in final engineering designs and subsequently added to the Construction SWPPP.

Also, as discussed in Section 1.0 of this volume, a separate application will be submitted requesting authorization to discharge stormwater associated with industrial activities at the HRF under the Industrial Stormwater General Permit. While these activities will be associated with the separate Industrial Stormwater General Permit program, an overview of PolyMet’s plan for management of industrial stormwater is included here as additional background. PolyMet will develop and implement an Industrial SWPPP in accordance with Industrial Stormwater General Permit requirements, which will incorporate and expand upon the discussions in this section.

Precipitation and runoff within the interior of the HRF will be collected in the HRF Pond and managed as HRF water, as described in Section 2.3.1 of this volume. Runoff from the HRF dam exteriors will be managed as industrial stormwater as described in Section 2.4.2.

Subwatershed divides at the Plant Site during operations, including those associated with the HRF, are shown on Large Figure 3 and Large Figure 4. Stormwater conditions during operations will be changed from existing conditions as follows:

- Most of the former subwatershed area of the Emergency Basin will become the HRF subwatershed. The HRF subwatershed will be defined by the system of HRF dams and by the high ground areas to the west and south.
• Construction of the HRF will modify the local divide between the Embarrass River watershed and the Partridge River watershed because the HRF will block existing flow patterns from the south side of the Tailings Basin toward the northwest within the Embarrass River watershed (Unnamed Creek subwatershed) (Section 2.6.3.2 of Reference (2)). The stormwater management around the HRF will be developed during the final design of the HRF.

Stormwater infrastructure associated with the HRF (described in Section 2.4.2) will take into account these changes to existing stormwater conditions, natural drainage patterns, and the potential for stormwater to contact significant materials (Section 2.4.1).

2.4.1 Significant Materials

Significant materials are defined by 40 CFR § 122.26(b)(12) as including, but not limited to:

“raw materials; fuels; materials such as solvents, detergents, and plastic pellets; finished materials such as metallic products; raw materials used in food processing or production; hazardous substances designated under Section 101(14) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA); any chemical the facility is required to report pursuant to Section 313 of the Emergency Planning and Community Right-to-Know Act (EPCRA); fertilizers; pesticides; and waste products such as ashes, slag, and sludge that have the potential to be released with stormwater discharges.”

Stormwater may come into contact with significant materials at the HRF and will be managed throughout the life of the Project using appropriate BMPs, including engineered controls and spill prevention and response procedures, to reduce or eliminate contact or exposure of pollutants to stormwater or remove pollutants from stormwater.

2.4.2 Stormwater Management System

Stormwater management measures will be put in place to manage potential surface water run-on into the HRF Pond from parts of the South Dam of Tailings Basin Cell 2W, the railroad embankment (Hinsdale Bridge Approach), and portions of the land area located to the northeast of the HRF. Diversion swales will be installed in these areas to redirect surface water away from the HRF Pond. During initial phases of the HRF development, a land-locked area may develop immediately east of the HRF. Surface water runoff in this area may be allowed to flow into the HRF Pond until elevations accommodate development of a stormwater pond that will divert runoff from this area away from the HRF Pond through the railroad embankment to the Plant Site, where it will be managed with Plant Site industrial stormwater as described in Section 2.3.2 of Volume IV. Similarly, minor ditch improvements will be performed along the railroad embankment to direct runoff from the exterior surface of the South Dam of the HRF and the contributing surrounding drainage area outside the HRF to the Plant Site. Section 2.5 of Reference (8) provides additional information on HRF stormwater management.

Runoff from the exterior slopes of the HRF dams will be managed as industrial stormwater as follows:
• runoff from the exterior slopes of the East Dam and the South Dam will drain south, where it will be routed through the West Plant stormwater system with Plant Site industrial stormwater as described in Section 2.3.2 of Volume IV

• runoff from the north, northwest, and southwest HRF dam exteriors will be routed either west or northwest through future stormwater infrastructure (Section 2.6.3.2 of Reference (2))

Prior to operation, management measures for stormwater associated with the HRF will be incorporated into an Industrial SWPPP based on detailed construction plans.

2.5 Adaptive Management

The HRF water management systems have been designed to achieve compliance based on projected performance of the double liner and Leakage Collection System. As described in Section 1.6 of Volume I, if water quality objectives are not met by these engineering controls, PolyMet will use an adaptive management approach, as necessary, to improve performance. As part of the adaptive management approach at the HRF, studies will first be undertaken to determine the root cause of the problem. Second, the design or operation of existing (or planned) Project engineering controls will be modified to remedy the root cause. Third, if modifying the design or operation of Project engineering controls is not sufficient, then contingency mitigation actions will be taken. Fourth, outcomes will be monitored and may be evaluated with water modeling. This process is meant to be iterative and will be repeated as necessary. The process for implementing adaptive management at the HRF is described in Section 6.4 of Reference (2) and Section 4.0 of Reference (1).
3.0 Hydrometallurgical Residue Facility Monitoring

Monitoring of baseline water quality and quantity has been ongoing in the vicinity of the HRF. As the Project commences, monitoring will continue at specific locations for a variety of purposes, including compliance with this permit.

3.1 Existing Baseline Monitoring

Section 3.1 of Volume V discusses existing baseline monitoring of surface water and groundwater in the vicinity of the Tailings Basin, which, due to proximity, is also representative of existing baseline conditions in the vicinity of the HRF. Existing monitoring stations are shown on Large Figure 2.

3.2 Proposed Monitoring Plan

Monitoring proposed as part of the permit requirements for the HRF and Hydrometallurgical Plant is included in the integrated Plant Site monitoring plan presented in Section 3.0 of Volume I. The proposed Plant Site monitoring plan includes groundwater monitoring stations, surface water monitoring stations, and internal waste stream monitoring stations associated with the HRF and Hydrometallurgical Plant; these proposed monitoring stations are shown on Large Figure 3 and Large Figure 4.
4.0 Groundwater Nondegradation

PolyMet evaluated the anticipated effects of the HRF on groundwater quality. Section 4.1 describes how Minnesota’s rules governing protection of underground waters apply to groundwater downgradient of the HRF. Section 4.2 documents that groundwater downgradient of the HRF has been discernably impacted by previous ferrous mining activities and does not reflect natural quality. Section 4.3 summarizes Project activities, including the use of engineering controls and mitigation measures, designed to protect groundwater and abate existing groundwater impacts in accordance with Minnesota’s groundwater protection requirements. Existing groundwater quality downgradient of the HRF is described in Section 3.1 of this volume, and PolyMet’s plan for ongoing groundwater monitoring is presented in Section 3.2 of this volume.

4.1 Regulatory Context

The State of Minnesota has policies to protect groundwater, including a groundwater nondegradation policy that states that certain waste "shall be controlled as may be necessary to ensure that to the maximum practicable extent the underground waters of the state are maintained at their natural quality" unless MPCA determines that a change is justifiable on certain specified grounds (Minnesota Rules, part 7060.0500). The State’s policy on groundwater further states that groundwater should be "protected as nearly as possible in its natural condition." (Minnesota Rules, part 7060.0200). The MPCA rules provide that "[n]atural conditions exist where there is no discernable impact from point or nonpoint source pollutants attributable to human activity or from a physical alteration of wetlands." (Minnesota Rules, part 7050.0170).

Downgradient of the future location of the HRF, groundwater does not exist in its natural condition as a result of seepage of pollutants from decades of ferrous mining activities at the site, including in particular ferrous seepage from the LTVSMC Emergency Basin where the HRF will be constructed. Section 4.2 demonstrates, based on available water quality monitoring data, that these previous ferrous mining activities have had a discernable impact on groundwater at various locations across the Plant Site. Under these circumstances, the Minnesota groundwater nondegradation policy of maintaining the natural quality of groundwater to the maximum practicable extent is not applicable. Where groundwater in its natural condition is not present to be protected against degradation, the State’s groundwater policy focuses instead on "abating [existing] pollution" and "maximiz[ing] the possibility of rehabilitating degraded waters." (Minnesota Rules, part 7060.0400). The Project’s design will have the effect of rehabilitating currently degraded groundwater at and around the HRF in accordance with the policies set forth in Minnesota Rules, chapter 7060 (Section 4.3).

4.2 Existing Groundwater Quality

Groundwater quality at the Plant Site, including groundwater downgradient of the existing LTVSMC Emergency Basin which will be the future location of the HRF, has been affected by previous ferrous mining activities (Section 4.3.4.1 of Reference (6)). Section 4.2 of Volume V of this Application describes
existing groundwater quality at the Plant Site and documents that groundwater is not in a natural
condition at the future location of the HRF.

4.3 Description of Engineering Controls to Protect Groundwater and
Abate Existing Groundwater Impacts

PolyMet will construct the HRF with a double liner and Leakage Collection System, as summarized in
Section 2.3.2 of this volume and detailed in Section 2.2.2 of Reference (8), to eliminate discharge of HRF
water. The design of the HRF will also abate ongoing infiltration through the existing LTVSMC Emergency
Basin. Over time, these engineering controls are expected to rehabilitate existing groundwater impacts in
the immediate vicinity of the HRF. With respect to potential groundwater impacts associated with the
Project, the effect of the engineering controls associated with the residue and water management plans
(Residue Management Plan [Reference (8)] and the Plant Site Water Management Plan [Reference (2)]) will
be that no exceedances of groundwater quality standards are expected at the property boundary (Section
6.5 of Reference (9)). Groundwater concentrations of some parameters that are currently above Class 1
Standards or existing Cliffs Erie permit limits will decrease as a result of the Project engineering controls
(for example, iron, boron, fluoride, and sulfate; see Attachment H of Reference (6)). These actions by
PolyMet will meet the groundwater protection and pollution abatement policies of Minnesota Rules,
chapter 7060.
5.0 References


5. —. NorthMet Project Project Description (v9). February 2015.


Large Tables
<p>| Chemical | Purpose | Location of chemical addition in process | Amount/duration/frequency of addition | Average rate of use | Maximum rate of use | Storage Location | Storage Capacity | Tank Description | Secondary Containment | Fate and Transport |
|----------|---------|------------------------------------------|---------------------------------------|---------------------|--------------------|------------------|-----------------|----------------|-------------------|------------------|-----------------|
| Sodium Hydrosulfide, 30% Solution (Primary) | Cementation of copper from solution as copper sulfide | Hydromet, specifically copper cementation | Continuous | 3.17 tons/day (1,160 tons/year) | 4.10 tons/day (1,750 tons/year) | Hydromet Reagents Area | AST (30% concentration in water) | 25,000 gal | Building Containment | This additive is part of the Hydromet circuit, which is a closed-loop system with no discharge. |
| Caustic Soda (Sodium Hydroxide, 50% Solution) (Primary) | Increase pH of off-gases by removing traces of HCl and SO₂ in vent scrubbers | Hydromet, specifically the plant scrubber | Continuous | 57.53 gallons/day (21,000 gallons/year) | 82.19 gallons/day (30,000 gallons/year) | Hydromet Reagents Area | AST (50% concentration in water) | 7,000 gal | Building Containment | This additive is part of the Hydromet circuit, which is a closed-loop system with no discharge. |
| Sulfuric Acid, 93% Solution (Primary) | Used as wash water for leach residue filter | Hydromet, specifically the residue filter wash water | Continuous | 0.47 tons/day (170 tons/year) | 0.68 tons/day (250 tons/year) | Hydromet Reagents Area | AST (93% concentration in water) | 12,500 gal | Yes, and building containment | This additive is part of the Hydromet circuit, which is a closed-loop system with no discharge. |
| Hydrochloric Acid, 32% Solution (Primary) | Addition of chloride used to promote mineral leaching | Hydromet, specifically the autoclave | Continuous | 13.70 tons/day (5,000 tons/year) | 20.55 tons/day (7,500 tons/year) | Hydromet Reagents Area | AST (32% concentration in water) | 60,000 gal | Yes, and building containment | This additive is part of the Hydromet circuit, which is a closed-loop system with no discharge. |
| MagnaFloc 342 (Primary) | Flocculant: Promote flocculation of suspended particles in liquors | Hydromet, specifically the autoclave | Continuous | 0.06 tons/day (21 tons/year) | 0.11 tons/day (40 tons/year) | Hydromet Reagents Area | Bulk (&lt;5 ton, 100% reagent), AST (&lt;1% concentration in water) | 7,000 gal | Building Containment | This additive is part of the Hydromet circuit, which is a closed-loop system, with no discharge. The flocculant will attach to the solids and end up in the concentrates. |
| NALCO 9877 PULV (Potential Substitute) | Flocculant: Promote flocculation of suspended particles in liquors | Hydromet, specifically mixed hydroxide precipitation | Continuous | 0.11 tons/day (40 tons/year) | 0.21 tons/day (75 tons/year) | Hydromet Reagents Area | Bulk (&lt;5 ton, 100% reagent), AST (&lt;1% concentration in water) | 7,000 gal | Building Containment | This additive is part of the Hydromet circuit, which is a closed-loop system, with no discharge. The flocculant will attach to the solids and end up in the concentrates. |
| MagnaFloc 155 (Primary) | Flocculant: Promote flocculation of suspended particles in liquors | Hydromet, specifically mixed hydroxide precipitation | Continuous | 0.11 tons/day (40 tons/year) | 0.21 tons/day (75 tons/year) | Hydromet Reagents Area | Bulk (&lt;5 ton, 100% reagent), AST (&lt;1% concentration in water) | 7,000 gal | Building Containment | This additive is part of the Hydromet circuit, which is a closed-loop system, with no discharge. The flocculant will attach to the solids and end up in the concentrates. |
| Neo NS 6670 (Potential Substitute) | Flocculant: Promote flocculation of suspended particles in liquors | Hydromet, specifically mixed hydroxide precipitation | Continuous | 0.11 tons/day (40 tons/year) | 0.21 tons/day (75 tons/year) | Hydromet Reagents Area | Bulk (&lt;5 ton, 100% reagent), AST (&lt;1% concentration in water) | 7,000 gal | Building Containment | This additive is part of the Hydromet circuit, which is a closed-loop system, with no discharge. The flocculant will attach to the solids and end up in the concentrates. |
| NALCO 8173 PULV (Potential Substitute) | Flocculant: Promote flocculation of suspended particles in liquors | Hydromet, specifically mixed hydroxide precipitation | Continuous | 0.11 tons/day (40 tons/year) | 0.21 tons/day (75 tons/year) | Hydromet Reagents Area | Bulk (&lt;5 ton, 100% reagent), AST (&lt;1% concentration in water) | 7,000 gal | Building Containment | This additive is part of the Hydromet circuit, which is a closed-loop system, with no discharge. The flocculant will attach to the solids and end up in the concentrates. |</p>
<table>
<thead>
<tr>
<th>Chemical</th>
<th>Purpose</th>
<th>Location of chemical addition in process</th>
<th>Amount/duration/frequency of addition</th>
<th>Average rate of use</th>
<th>Maximum rate of use</th>
<th>Storage Location</th>
<th>Storage Capacity</th>
<th>Tank Description</th>
<th>Secondary Containment</th>
<th>Fate and Transport</th>
</tr>
</thead>
<tbody>
<tr>
<td>MagnaFloc 351 (Primary)</td>
<td>Flocculant: Promote flocculation of suspended particles in liquors</td>
<td>Hydromet, specifically in the leach residue thickener, PGM thickener, and copper sulfide cementation thickener</td>
<td>Continuous</td>
<td>0.27 tons/day (100 tons/year)</td>
<td>0.41 tons/day (150 tons/year)</td>
<td>Hydromet Reagents Area</td>
<td>Bulk (&lt; 10 ton, 100% concentration in water)</td>
<td>17,500 gal AST</td>
<td>Building Containment</td>
<td>This additive is part of the Hydromet circuit, which is a closed-loop system with no discharge.</td>
</tr>
<tr>
<td>Neo NS 6500 (Potential Substitute)</td>
<td>Flocculant: Promote flocculation of suspended particles in liquors</td>
<td>Hydromet, specifically in the leach residue thickener, PGM thickener, and copper sulfide cementation thickener</td>
<td>Continuous</td>
<td>0.41 tons/day (150 tons/year)</td>
<td>0.55 tons/day (200 tons/year)</td>
<td>Hydromet Reagents Area</td>
<td>Bulk (&lt; 10 ton, 100% reagent), AST (&lt; 1% concentration in water)</td>
<td>17,500 gal AST</td>
<td>Building Containment</td>
<td>This additive is part of the Hydromet circuit, which is a closed-loop system with no discharge.</td>
</tr>
<tr>
<td>NALCO 9876 PEV (Potential Substitute)</td>
<td>Flocculant: Promote flocculation of suspended particles in liquors</td>
<td>Hydromet, specifically in the leach residue thickener, PGM thickener, and copper sulfide cementation thickener</td>
<td>Continuous</td>
<td>0.41 tons/day (150 tons/year)</td>
<td>0.68 tons/day (250 tons/year)</td>
<td>Hydromet Reagents Area</td>
<td>Bulk (&lt; 10 ton, 100% reagent), AST (&lt; 1% concentration in water)</td>
<td>17,500 gal AST</td>
<td>Building Containment</td>
<td>This additive is part of the Hydromet circuit, which is a closed-loop system with no discharge.</td>
</tr>
<tr>
<td>Sulfur Dioxide (Liquid) (Primary)</td>
<td>Reduce ferric ions to ferrous ions</td>
<td>Hydromet, specifically iron reduction and PGM precipitation</td>
<td>Continuous</td>
<td>4.14 tons/day (1,510 tons/year)</td>
<td>6.16 tons/day (2,250 tons/year)</td>
<td>Hydromet Reagents Area - outside</td>
<td>AST</td>
<td>17,500 gal AST</td>
<td>Yes</td>
<td>This additive is part of the Hydromet circuit, which is a closed-loop system with no discharge.</td>
</tr>
<tr>
<td>Limestone (Lump) (Primary)</td>
<td>Promote precipitation of Fe and Al</td>
<td>Hydromet, specifically in iron removal</td>
<td>Continuous</td>
<td>276.71 tons/day (101,000 tons/year)</td>
<td>410.96 tons/day (150,000 tons/year)</td>
<td>Outdoor Stockpile near Concentrate Loadout</td>
<td>Stockpile (50,000 tons), Silo (500 tons), AST (20% concentration)</td>
<td>150,000 gal AST</td>
<td>Building Containment</td>
<td>This additive is part of the Hydromet circuit, which is a closed-loop system, with no discharge.</td>
</tr>
<tr>
<td>Limestone (Ground) (Potential Substitute)</td>
<td>Promote precipitation of Fe and Al</td>
<td>Hydromet, specifically in iron removal</td>
<td>Continuous</td>
<td>276.71 tons/day (101,000 tons/year)</td>
<td>410.96 tons/day (150,000 tons/year)</td>
<td>Outdoor Stockpile near Concentrate Loadout</td>
<td>Stockpile (50,000 tons), Silo (500 tons), AST (25% concentration)</td>
<td>150,000 gal AST</td>
<td>Building Containment</td>
<td>This additive is part of the Hydromet circuit, which is a closed-loop system, with no discharge.</td>
</tr>
<tr>
<td>Magnesium Hydroxide, 60% Slurry (Primary)</td>
<td>Promote precipitation of Ni and Co sulfates as Ni and Co sulfates (mixed hydroxide precipitate)</td>
<td>Hydromet, specifically mixed hydroxide precipitation</td>
<td>Continuous</td>
<td>16.44 tons/day (6,000 tons/year)</td>
<td>24.66 tons/day (9,000 tons/year)</td>
<td>Hydromet Reagents Area</td>
<td>AST (received as 60-65% slurry, diluted to 30%)</td>
<td>85,000 gal AST</td>
<td>Building Containment</td>
<td>This additive is part of the Hydromet circuit, which is a closed-loop system with no discharge.</td>
</tr>
<tr>
<td>Magnesium Hydroxide (Dry) (Potential Substitute)</td>
<td>Used to promote precipitation of Ni and Co sulfates as Ni and Co sulfates (mixed hydroxide precipitate)</td>
<td>Hydromet, specifically mixed hydroxide precipitation</td>
<td>Continuous</td>
<td>16.44 tons/day (6,000 tons/year)</td>
<td>24.66 tons/day (9,000 tons/year)</td>
<td>Hydromet Reagents Area</td>
<td>Bulk (received as dry, diluted to 30%)</td>
<td>85,000 gal AST</td>
<td>Building Containment</td>
<td>This additive is part of the Hydromet circuit, which is a closed-loop system with no discharge.</td>
</tr>
<tr>
<td>Lime (Dry) (Potential Substitute)</td>
<td>Promote precipitation of Ni and Co sulfates as Ni and Co sulfates (mixed hydroxide precipitate)</td>
<td>Hydromet, specifically mixed hydroxide precipitation</td>
<td>Continuous</td>
<td>10.55 tons/day (3,850 tons/year)</td>
<td>16.44 tons/day (6,000 tons/year)</td>
<td>Hydromet Reagents Area</td>
<td>Bulk (&lt; 40 ton dry lime, 100% concentration), AST (22% concentration in water)</td>
<td>20,000 gal AST</td>
<td>Building Containment</td>
<td>This additive is part of the Hydromet circuit, which is a closed-loop system with no discharge.</td>
</tr>
</tbody>
</table>

(1) Product label is currently unavailable and therefore not included in Appendix B.
Large Figures
These are provisional representations of PWI watercourses found on the current paper regulatory maps.

1. The NHD is a feature-based database that interconnects and uniquely identifies the stream segments or reaches that make up the nation’s surface water drainage system. NHD features are created from MnDNR 24K Streams and 1:24,000 USGS quadrangle maps.

Note: Due to previous disturbance, both data sources may show watercourses that no longer exist.
This figure only shows existing monitoring stations associated with the HRF and Hydrometallurgical Plant. Additional existing monitoring stations are shown in Large Figure 3 of Volume II, Large Figure 2 of Volume IV, Large Figure 2 of Volume V, and Large Figure 2 of Volume VII.

These are provisional representations of PWI watercourses found on the current paper regulatory maps. The NHD is a feature-based dataset that interconnects and uniquely identifies the stream segments or reaches that make up the nation’s surface water drainage system. NHD features are created from MnDNR 24K Streams and 1:24,000 USGS quadrangle maps.

Note: Due to previous disturbance, both data sources may show watercourses that no longer exist. The historic monitoring station is not currently being monitored. Refer to Table 3 (for surface water monitoring stations) and Large Table 4 (for surficial aquifer monitoring stations) in Volume V for water quality monitoring years.
This figure only shows proposed monitoring stations associated with the HRF and Hydrometallurgical Plant. Additional proposed monitoring stations are shown in Large Figures 6, 7, 8, 10, and 11 of Volume I.

Residue transport piping and HRF water return piping not shown. Refer to Permit Application Support Drawings.

These are provisional representations of PWI watercourses found on the current paper regulatory maps. The NHD is a feature-based database that interconnects and uniquely identifies the stream segments or reaches that make up the nation's surface water drainage system. NHD features are created from MnDNR 24K Streams and 1:24,000 USGS quadrangle maps.

Note: Due to previous disturbance, both data sources may show watercourses that no longer exist.
Notes:
This figure only shows proposed monitoring stations associated with the HRF and Hydrometallurgical Plant. Additional proposed monitoring stations are shown in Large Figures 6, 7, 8, 10, and 11 of Volume I. Residue transport piping and HRF water return piping not shown. Refer to Permit Application Support Drawings.

Imagery Source: FSA, 2015.

Barr Footer: ArcGIS 10.4, 2017-09-11 11:18 File: I:\Client\PolyMet_Mining\Work_Orders\Permitting\NPDES_Permit_Application\Maps\Report\HRF_HydroMetPlant\Large Figure 4 Hydrometallurgical Residue Facility Layout Lift 3.mxd User: arm2

These are provisional representations of PWI watercourses found on the current paper regulatory maps. The NHD is a feature-based database that interconnects and uniquely identifies the stream segments or reaches that make up the nation's surface water drainage system. NHD features are created from MnDNR 24K Streams and 1:24,000 USGS quadrangle maps. Note: Due to previous disturbance, both data sources may show watercourses that no longer exist.
Appendices
Appendix A

Waste Water Treatment System Terminology Changes
# Appendix A  Waste Water Treatment System Terminology Changes

Some terminology associated with the Waste Water Treatment System (WWTS) has changed since the environmental review process was completed and the NPDES/SDS Permit Application was submitted in July 2016. Changes are associated with the relocation of the mine water treatment trains that were previously planned for the Mine Site Waste Water Treatment Facility (WWTF), which will now be in the Plant Site WWTS, and the relocation of the Mine Site equalization basins, Central Pumping Station (CPS), and Construction Mine Water Basin south of Dunka Road. There is no change to the level of treatment planned for the Project as a result of these relocations.

To facilitate the review of documents prepared for the NorthMet Mining Project and Land Exchange Final Environmental Impact Statement (FEIS) which are also referenced in this NPDES/SDS Permit Application, the following table explains WWTS terminology changes.

<table>
<thead>
<tr>
<th>Former Name</th>
<th>New Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waste Water Treatment Plant (WWTP) and Waste Water Treatment Facility (WWTF)</td>
<td>Waste Water Treatment System (WWTS)&lt;sup&gt;(1)&lt;/sup&gt;</td>
</tr>
<tr>
<td>Treated Water Pipeline</td>
<td>As a whole:</td>
</tr>
<tr>
<td></td>
<td>- Mine to Plant Pipelines (MPP)</td>
</tr>
<tr>
<td></td>
<td>- Three individual pipes:</td>
</tr>
<tr>
<td></td>
<td>- Construction Mine Water Pipeline</td>
</tr>
<tr>
<td></td>
<td>- Low Concentration Mine Water Pipeline</td>
</tr>
<tr>
<td></td>
<td>- High Concentration Mine Water Pipeline</td>
</tr>
<tr>
<td>Construction Mine Water Basin</td>
<td>Construction Mine Water Basin</td>
</tr>
<tr>
<td>West Equalization Basin</td>
<td>High Concentration Equalization Basin (HCEQ Basin)</td>
</tr>
<tr>
<td>East Equalization Basin 1</td>
<td>Low Concentration Equalization Basin 1 (LCEQ Basin 1)</td>
</tr>
<tr>
<td>East Equalization Basin 2</td>
<td>Low Concentration Equalization Basin 2 (LCEQ Basin 2)</td>
</tr>
<tr>
<td>WWTP effluent (discharged to receiving waters)</td>
<td>WWTS discharge</td>
</tr>
<tr>
<td>WWTF effluent (sent to the FTB via the Central Pumping Station)</td>
<td>Treated mine water&lt;sup&gt;(3)&lt;/sup&gt; (WWTS stream pumped to the FTB)</td>
</tr>
<tr>
<td>Treated mine water&lt;sup&gt;(2)&lt;/sup&gt;</td>
<td>Treated mine water&lt;sup&gt;(3)&lt;/sup&gt;</td>
</tr>
<tr>
<td>Central Pumping Station</td>
<td>Central Pumping Station</td>
</tr>
<tr>
<td>--</td>
<td>Equalization Basin Area&lt;sup&gt;(4)&lt;/sup&gt;</td>
</tr>
<tr>
<td>Splitter Structure</td>
<td>This structure will be integrated into the Central Pumping Station.</td>
</tr>
<tr>
<td>Central Pumping Station (CPS) Pond</td>
<td>This pond no longer exists.</td>
</tr>
</tbody>
</table>

<sup>(1)</sup> The two sets of treatment trains that were previously at two locations will now be housed under one roof at the Plant Site.

<sup>(2)</sup> “Treated mine water” formerly included WWTF effluent, OSLA runoff, and construction mine water and was all sent to the FTB.

<sup>(3)</sup> “Treated mine water” now consists of effluent from the chemical precipitation and membrane filtration portion of the WWTS that are sent to the FTB.

<sup>(4)</sup> New term describing pond area south of Dunka Road.
Appendix B

Hydrometallurgical Residue Facility Permit Application Support
Drawings
NOTES
1. SEE FIG. HRF-004 FOR SECTION LOCATIONS.
NOTES:
1. SEE SHEETS HRF-024 FOR SECTION LOCATIONS.
Appendix C

Chemical Additives Safety Data Sheets
Appendix C
Chemical Additives Safety Data Sheets
July 2016

Contents

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium Hydrosulfide, 30% Solution</td>
<td>C-1</td>
</tr>
<tr>
<td>Caustic Soda (Sodium Hydroxide, 50% Solution)</td>
<td>C-11</td>
</tr>
<tr>
<td>Sulfuric Acid, 93% Solution</td>
<td>C-20</td>
</tr>
<tr>
<td>Hydrochloric Acid, 32% Solution</td>
<td>C-40</td>
</tr>
<tr>
<td>MagnaFloc 342</td>
<td>C-49</td>
</tr>
<tr>
<td>NALCO 9877 PULV</td>
<td>C-56</td>
</tr>
<tr>
<td>MagnaFloc 155</td>
<td>C-67</td>
</tr>
<tr>
<td>Neo NS 6670</td>
<td>C-77</td>
</tr>
<tr>
<td>NALCO 8173 PULV</td>
<td>C-83</td>
</tr>
<tr>
<td>MagnaFloc 351</td>
<td>C-95</td>
</tr>
<tr>
<td>Neo NS 6500</td>
<td>C-106</td>
</tr>
<tr>
<td>NALCO 9876 PULV</td>
<td>C-111</td>
</tr>
<tr>
<td>Sulfur Dioxide (Liquid)</td>
<td>C-122</td>
</tr>
<tr>
<td>Limestone (Lump)</td>
<td>C-130</td>
</tr>
<tr>
<td>Limestone (Ground)</td>
<td>C-138</td>
</tr>
<tr>
<td>Magnesium Hydroxide, 60% Slurry</td>
<td>C-151</td>
</tr>
<tr>
<td>Magnesium Hydroxide (Dry)</td>
<td>C-157</td>
</tr>
<tr>
<td>Lime (Dry)</td>
<td>C-163</td>
</tr>
</tbody>
</table>
Section 1: Identification Of the Substance/Mixture And Of The Supplier

Supplier
TDC, LLC
1916 Farmerville Hwy
Ruston, LA 71270

Company Contact: Customer Service
Telephone Number: (800) 422-6274
E-Mail: TDCcustomerservice@genlp.com
Web Site: www.genesisenergy.com

Manufacturer
TDC, LLC
1916 Farmerville Hwy
Ruston, LA 71270

Company Contact: Customer Service
Telephone Number: (800) 422-6274
E-Mail: TDCcustomerservice@genlp.com
Web Site: www.genesisenergy.com

Supplier Emergency Contacts & Phone Number
Customer Service: 800-422-6274
CHEMTREC: 800-424-9300

Manufacturer Emergency Contacts & Phone Number
Customer Service: 800-422-6274
CHEMTREC: 800-424-9300

Issue Date: 06/10/2015
Product Name: Sodium Hydrosulfide Solution
CAS Number: NA
Chemical Family: inorganic salt solution

Product/Material Uses
Product is a unique alkaline material, playing a vital role in many industrial processes.

Section 2: Hazards Identification

Hazard Classification(s)

HAZARD CLASSIFICATION(S):
Eye Damage/Irritation - Category 1
Corrosive to Metals - Category 1
Skin Corrosion/Irritation - Category 1B
Acute Aquatic Hazard - Category 1
Acute Toxicity - Category 3 (oral)
Acute Toxicity - Category 4 (inhalation)
There is insufficient information to assess Acute Dermal Toxicity

SIGNAL WORD: DANGER

HAZARD STATEMENTS:
Causes serious eye damage (H318)
Causes severe skin burns and eye damage (H314)
May be corrosive to metals (H290)
Very toxic to aquatic life (H400)
Toxic if swallowed (H301)
Harmful if inhaled (H332)

PRECAUTIONARY STATEMENTS:
P234 - Keep only in original container.
P260 - Do not breathe mist, vapor or spray.
P264 - Wash thoroughly after handling.
S A F E T Y  D A T A  S H E E T
Sodium Hydrosulfide Solution

Section 2: Hazards Identification - Continued

Hazard Classification(s) - Continued

- P270 - Do not eat, drink or smoke when using this product.
- P271 - Use only outdoors or in a well-ventilated area.
- P273 - Avoid release to the environment
- P280 - Wear protective gloves.
- P301+P330+P331 - IF SWALLOWED: Rinse mouth. Do NOT induce vomiting. Immediately call a Poison Control Center.
- P303+P361+P353 - IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
- P304+P340 - IF INHALED: remove person to fresh air and keep comfortable for breathing.
- P305+P351+P338 - IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists, get medical attention.
- P310 - Immediately call a poison center or physician.
- P363 - Wash contaminated clothing before reuse.
- P390 - Absorb spillage to prevent material damage.
- P391 - Collect spillage
- P405 - Store locked up.
- P406 - Store in corrosive resistant container with a resistant inner liner.
- P501- Dispose of contents/container in accordance with local, state, federal and international regulation.

Section 3: Composition/Information On Ingredients

<table>
<thead>
<tr>
<th>Ingredient Name</th>
<th>CAS Number</th>
<th>Percent Of Total Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>sodium hydrosulfide</td>
<td>16721-80-5</td>
<td>20 - 49</td>
</tr>
<tr>
<td>sodium carbonate</td>
<td>497-19-8</td>
<td>&lt; 3</td>
</tr>
<tr>
<td>sodium sulfide</td>
<td>1313-82-2</td>
<td>&lt; 1</td>
</tr>
<tr>
<td>water</td>
<td>7732-18-5</td>
<td>50 - 79</td>
</tr>
</tbody>
</table>

Section 4: First Aid Measures

**Eye**

In case of contact, immediately flush eyes with plenty of water for at least 20 minutes. Get medical attention immediately. Person may be kept in a dark room with ice compresses applied to eyes and forehead until medical treatment is available. Speed in treatment may prevent permanent eye damage.

**Skin**

Immediately remove contaminated clothing and shoes. In case of contact, immediately flush skin with soap and plenty of water. Get medical attention immediately if irritation (redness, rash, blistering) develops and persists.

**Ingestion**

Call a physician or a poison control center immediately. If vomiting occurs, keep head low so that stomach contents do not enter the lungs.

If conscious, rinse the mouth out several times with cold water and spit out. Give one or two cups of water or milk. This may be followed by gastric antacids, such as milk of magnesia or aluminum hydroxide. Stop if victim becomes nauseated. DO NOT INDUCE VOMITING unless instructed to do so by medical personnel. Never give anything by mouth to an unconscious person.

If the victim stops breathing: administer artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device.
**SAFETY DATA SHEET**

**Sodium Hydrosulfide Solution**

### Section 4: First Aid Measures - Continued

**Inhalation**

Call a Poison Center or doctor/physician if exposed or you feel unwell. Remove person from source of exposure to fresh air. If breathing is difficult, give oxygen. If not breathing, give artificial respiration using a pocket mask or resuscitation device. Direct mouth contact should be avoided if possible due to the potential for residual corrosive liquid around the person's mouth and airways.

**Note To Physician**

Some medical protocols prescribe the use of amyl nitrite as part of first aid treatment. Do not use amyl nitrite treatment if oxygen is not available. Amyl nitrite is only a useful adjunct during the first 10 to 15 minutes following exposure. Once breathing is restored, provide a high flow of oxygen and amyl nitrite if appropriate.

Symptoms of pulmonary edema may be delayed for 24 to 72 hours after initial exposure. Therefore, hospitalization and medical observation is advisable during this period.

### Section 5: Fire Fighting Measures

**Fire And Explosion Hazards**

Product solution is non-flammable. However, trace levels of flammable hydrogen sulfide gas are continuously released in air, especially when product is heated or exposed to acids. Gas may form explosive mixtures in air. Do not cut open or apply heat sources to containers. Thermal decomposition ("burning") may evolve toxic and irritating combustion byproducts - hydrogen sulfide.

**Extinguishing Media**

In case of fire, use water spray or foam or as appropriate for combustibles involved in fire.

**Fire Fighting Instructions**

Avoid breathing vapors, gases and fumes. Do not touch, handle or walk-through spilled liquid. Firefighters should wear a positive pressure-demand self-contained breathing apparatus (SCBA) and full protective gear. Containers may build up pressure if exposed to radiant heat. Water can be used to cool and protect exposed material. Do not allow runoff to enter sewers or waterways. Move containers away from fire area if safe to do so.

### Section 6: Accidental Release Measures

Refer to North American Emergency Response Guide (NAERG) # 154. Do not allow to come in contact with acids or incompatible materials. Prevent release to the environment, such as runoff to drains, sewers, waterways, basements or confined spaces. Provide maximum exhaust or dilution ventilation. Spills exceeding 5,000 lbs are reportable to the National Response Center (800-424-8802).

**Small releases:** Isolate 100 feet in all directions. Protect persons downwind - at least 0.1 mile (528 ft) during day; 0.2 miles (1,056 ft) at night. Confine area to qualified response personnel. Wear proper Personnel Protective Equipment (See Section 8). Confine release material by berming or diverting its path. Absorb with sand, earth or other inert dry absorbent. Do not allow into sewer, storm drains or any waterway. Oxidize residual reactive sulfides with a weak (3-5%) hydrogen peroxide solution to stop the release of toxic hydrogen sulfide. Remove contaminated soil and dispose of in accordance with all governmental regulations. Contain and/or absorb spill with inert material (e.g. sand, fly ash, cement powder). Soda ash may be used to neutralize.

**Large releases:** First isolate 1,000 feet. Protect persons downwind - at least 1.0 mile during day; 3.5 miles at night. Confine area to qualified response personnel. Wear proper Personnel Protective Equipment (See Section 8). Shut off release, if safe to do so. Dike spill area to prevent runoff into sewers, drains (potential toxic and explosive mixtures of hydrogen sulfide in confined spaces) or surface waterways (potential aquatic toxicity). Recover as much of the solution as possible. Treat remaining material as a small release.
Section 7: Handling And Storage

**Handling Precautions**

Wear proper Personal Protective Equipment (PPE) as indicated in Section 8. Avoid breathing vapor, gas or mist. Prevent contact with eyes and skin. Use only with adequate ventilation.

Cautionary Note: Handling may result in potential exposure to hydrogen sulfide. Wear PPE as indicated in section 8 of this SDS.

Do not cut open, puncture or reuse the container - may contain potentially flammable or explosive residual material. Keep away from heat and flame. Avoid contact with acids and other incompatible materials.

Dilute product only in enclosed containers. Always add product to water - not water to product.

**Storage Precautions**

Keep away from acids and incompatible materials. Do not store combustibles (e.g., paper, wood, oil) in area of storage containers. Keep away from heat or flame. Store in a cool, dry, well-ventilated area out of direct sunlight (<104 deg F, 40 deg C). Keep container tightly closed. Keep away from children.

Not compatible with copper, zinc, aluminum or their alloys (e.g., brass, bronze, galvanized metals, etc.). Corrosive to steel above 150 deg F (65.5 deg C).

**Work/Hygienic Practices**

Wash thoroughly after handling, and before eating, drinking, smoking and using toilet facilities.

Section 8: Exposure Controls/Personal Protection

**Engineering Controls**

Use outdoors or indoors only with adequate general and local exhaust ventilation. Maintain exposures to hydrogen sulfide below occupational exposure limits.

The use of hydrogen sulfide air monitoring detectors with alarms is recommended for poorly ventilated areas and confined spaces.

**Eye/Face Protection**

At a minimum, chemical splash goggles or faceshield over safety glasses or goggles should be worn at all times when handling. A full facepiece should be worn with SCBA or air-line respirator.

**Skin Protection**

The use of chemical-resistant gloves made of neoprene rubber are recommended as minimum industrial skin protection when handling product or performing spill cleanup. Chemical resistant apron, and/or suit and boots should be worn to prevent skin contact. Chemical protective clothing constructed of DuPont Tychem Responder or equivalent material may be used for spill cleanup.

Wash/decontaminate clothing prior to reuse. Contaminated leather shoes cannot be cleaned and should be discarded.

**Respiratory Protection**

Engineering controls should be implemented preferentially to reduce exposures. If working near open container, storage vessel opening or open tank truck dome cover, wear self-contained breathing apparatus, or positive pressure demand air-line respirator if there is a potential for exposure. Air-purifying (cartridge) respirators should not be used, except for escape purposes, due to the possible presence of hydrogen sulfide.

**Other/General Protection**

Eyewash and safety shower should be available in areas of handling or storage.

Installation of H2S ventilation systems alarms is recommended where hazardous concentrations may occur, such
### Section 8: Exposure Controls/Personal Protection - Continued

**Other/General Protection - Continued**

as areas of storage. Design storage tank vents to minimize the potential for worker exposure.

### Section 9: Physical And Chemical Properties

**Appearance**

A yellow to red to dark green or black liquid.

**Odor**

A characteristic rotten egg or mercaptan odor. DO NOT INHALE - EXTREMELY HAZARDOUS. May be fatal.

**Odor Threshold**

not available

**Chemical Type:** Mixture  
**Physical State:** Liquid  
**Melting Point:** not available °F  
**Boiling Point:** 253-269 °F 122.8-131.7 °C  
**Specific Gravity:** 1.152-1.331 (9.6-11.1 lbs/gal)  
**Packing Density:** not available  
**Vapor Pressure:** 17 mm Hg @ 68 deg F  
**Vapor Density:** 1.17  
**pH Factor:** 11.5-12.5  
**Solubility:** complete (water)  
**Viscosity:** not available  
**Evaporation Rate:** not available  
**Flash Point:** not available  
**Flammability (solid, gas):** non-flammable  
**Lower Explosive Limit (LEL %):** 4% (hydrogen sulfide)  
**Upper Explosive Limit (UEL %):** 46% (hydrogen sulfide)  
**Autoignition Temperature:** not available  
**Decomposition Temperature:** not available  
**Partition Coefficient (n-octanol/water):** not available

### Section 10: Stability And Reactivity

**Stability:** stable  
**Hazardous Polymerization:** will not occur.

**Conditions To Avoid (Stability)**

Avoid exposure to sources of heat and flame. Store away from incompatible materials.

**Incompatible Materials**

Incompatible with acids, amides, organic anhydrides, isocyanates, alkylene oxides, epichlorhydrin, aldehydes, alcohols, glycols, phenols, cresols, caprolactam solution, and oxidizers. Contact with acids will cause the release of highly toxic hydrogen sulfide gas. Reacts violently with diazonium salts. sodium Hydrosulfide Solution is not compatible with copper, zinc, aluminum or their alloys (i.e. bronze, brass, galvanized metals, etc.). Corrosive to steel above 150°F (65.5°C).

**Hazardous Decomposition Products**

Heating this product will evolve toxic fumes of hydrogen sulfide, sulfoxides and Na2O. Fire conditions will also cause the production of sulfur dioxide. Contact with acids increases the formation of hydrogen sulfide. Hydrogen sulfide may form flammable mixtures with air. Heating to decomposition emits toxic fumes of sulfoxides and Na2O.
Section 11: Toxicological Information

**Eye Effects**
Corrosive and irritating. Vapors, mist and spray may cause severe eye irritation and burns to the conjunctiva and cornea. Permanent eye damage may occur.

Exposure to hydrogen sulfide at low concentrations over several hours or days may result in "gas eyes" or "sore eyes", with symptoms of scratchiness, irritation, tearing, and burning. Symptoms are likely to disappear when the exposure ends. Prolonged exposures to concentrations over 50 ppm may cause permanent damage or intense tearing, blurring of vision, and pain when looking at bright light.

**Skin Effects**
Corrosive and irritating to skin and mucous membranes. Skin contact with liquid, mist or spray may cause severe irritation, pain, redness (erythema), and burns to skin and mucous membranes. These effects may be delayed.

**Acute Oral Effects**
Very toxic. May be fatal by ingestion. Corrosive and irritating to skin and mucous membranes of the mouth and throat. Ingestion of small amounts in a single dose may produce irritation or burning of the esophagus. Ingesting larger quantities, or small quantities over an extended period, may seriously damage the gastrointestinal tract.

Aspiration hazard. Sodium hydrosulfide that mixes with stomach acids produces hydrogen sulfide, which may cause irritation, pulmonary edema and other health effects related to inhalation of H2S. Pulmonary edema may be delayed and fatal.

**Acute Inhalation Effects**
Corrosive and irritating. Inhalation of vapors or mist may cause severe irritation to the nose, throat, and respiratory system. Symptoms include runny nose, coughing, sneezing, hoarseness, headache, nausea, shortness of breath and severe lung damage.

The gases released by the product may contain high levels of hydrogen sulfide. High concentrations of H2S may produce olfactory fatigue (i.e., the inability to smell H2S), a build up of fluid in the lungs (pulmonary edema), severe shortness of breath, and even death. Possible death may occur in 4 to 8 hours at high concentrations. At very high concentrations, severe toxicity to the central nervous system, respiratory paralysis and nerve damage may occur.

**Chronic/Carcinogenicity**
Neither the product overall nor any of its ingredients are known to be listed as potentially carcinogenic by NTP, IARC, OSHA or ACGIH.

**Reproductive Effects**
No human information available for any ingredients of this product.

**Mutagenicity (Genetic Effects)**
Sodium hydrosulfide is positive in the Ames Test at high concentrations. No information is available regarding the germ cell mutagenicity of this product or its ingredients.

**Ingredient(s) - Toxicological Data**

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>LD50 (dermal, rabbit):</th>
<th>LD50 (oral, rat):</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium hydrosulfide</td>
<td>&gt;200 mg/kg</td>
<td>58.4 mg/kg</td>
</tr>
<tr>
<td>Sodium carbonate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LC50 (inhale, guinea pig):</td>
<td>800 mg/m3 (2 hrs)</td>
<td></td>
</tr>
<tr>
<td>LD50 (oral, rat):</td>
<td></td>
<td>2300 mg/m3 (2 hrs)</td>
</tr>
<tr>
<td>Sodium sulfide</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LD50 (oral, rat):</td>
<td></td>
<td>2800 mg/kg</td>
</tr>
</tbody>
</table>

Page 6 of 9
Section 11: Toxicological Information - Continued

Ingredient(s) - Toxicological Data - Continued

LD50 (oral, mouse): 205 mg/kg

Section 12: Ecological Information

Ecotoxicological Information

Very toxic to fish and aquatic organisms. Do not allow to enter sewers and waterways.

Static acute 96 hour-LC50 for mosquito fish is 206 mg/L. (TLm - fresh water)
LC50 fly inhalation 1,500 mg/m3, 7 minutes
TLm Gammarus 0.84 mg/L, 96 hours (hydrogen sulfide)
TLm Ephemera 0.316 mg/L, 96 hours (hydrogen sulfide)
TLm Flathead minnow 0.071 - 0.55 mg/L @ 6-24°C, 96 hour flow through bioassay (hydrogen sulfide)
TLm Bluegill 0.0090 - 0.0140 mg/L @ 20-22°C, 96 hour flow through bioassay (hydrogen sulfide)
TLm Brook trout 0.0216 - 0.0308 mg/L @ 8-12.5°C, 96 hour flow through bioassay (hydrogen sulfide)

Section 13: Disposal Considerations

Dispose in accordance with applicable federal, state and local government regulations. Waste materials may be required to be disposed of as hazardous waste. Do not allow into any sewer, on the ground, or into any body of water.

RCRA Information

Waste solutions may meet the RCRA Corrosive characteristic (D003). RCRA waste classification D002 may apply if pH is greater than 12.5.

Section 14: Transport Information

Proper Shipping Name
Corrosive liquids, toxic, n.o.s. (sodium hydrosulfide solution)

Hazard Class
8 (PGII)

Secondary Hazard Class
6.1

DOT Identification Number
UN2922

DOT Shipping Label
Corrosive, Toxic

Section 15: Regulatory Information

U.S. Regulatory Information

This product is listed as a hazardous substance under criteria defined in the Federal OSHA Hazard Communication Standard, 29 CFR 1910.1200.

Toxic Substance Control Act (TSCA): All ingredients of this product are listed on the TSCA 8(b) Chemical Substance Inventory or are exempt.

CERCLA/Superfund Hazardous Substance (49 CFR 172.101 App A): RQ = 5,000 lbs (2,270 kg)

SARA 302 - Product does not contain ingredients that are listed as Extremely Hazardous Substances.
Section 15: Regulatory Information - Continued

**SARA Hazard Classes**
- Acute Health Hazard
- Fire Hazard
- Reactivity Hazard

**SARA Section 313 Notification**
This product does not contain any ingredients regulated under Section 313 of the Emergency Planning and Community Right-To-Know Act of 1986 or 40 CFR 372.

**Ingredient(s) - U.S. Regulatory Information**
- sodium hydrosulfide
  - SARA Title III - EPA Part 355 Extremely Hazardous Substance
  - RCRA Hazardous Waste

**State Regulations**
Sodium hydrosulfide is listed on the following U.S. State Right-To-Know lists -
- California
- Florida
- Illinois
- Massachusetts
- New Jersey
- Pennsylvania
- Rhode Island

Sodium sulfide is listed on the following U.S. State & local Right-To-Know lists -
- Massachusetts
- New Jersey
- New York City

**Canadian Regulatory Information**
This product contains more than 1% of a known, controlled ingredient regulated under WHMIS.

WHMIS Hazard Classifications:
- Class E - Corrosive Material
- Class D, Div 1 - Poisonous or Infectious Material: immediate and serious toxic effects

**Ingredient(s) - Canadian Regulatory Information**
- sodium hydrosulfide
- WHMIS - Ingredient Disclosure List

Section 16: Other Information

**NFPA Rating**
- Health: 3
- Fire: 2
- Reactivity: 1

**Revision/Preparer Information**
This SDS Supercedes A Previous (M)SDS Dated: 06/08/2015

**Disclaimer**
Although reasonable care has been taken in the preparation of this document, we extend no warranties and make no representations as to the accuracy or completeness of the information contained therein, and assume no responsibility regarding the suitability of this information for the user's intended purposes or for the consequences of its use. Each individual should make a determination as to the suitability of the information for their particular...
**Disclaimer - Continued**

<table>
<thead>
<tr>
<th>purpose(s).</th>
</tr>
</thead>
<tbody>
<tr>
<td>TDC, LLC</td>
</tr>
</tbody>
</table>

Printed Using MSDS Generator™ 2000
Sodium Hydrosulfide Solution

May be corrosive to metals - Causes severe skin burns and eye damage - Causes serious eye damage - Very toxic to aquatic life

Keep only in original container. - Do not breathe dust/fume/gas/mist/vapours/spray. - Wash thoroughly after handling. - Do not eat, drink or smoke when using this product. - Use only outdoors or in a well-ventilated area. - Avoid release to the environment. - Wear protective gloves/protective clothing/eye protection/face protection. - IF SWALLOWED: Rinse mouth. Do NOT induce vomiting. - IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower. - IF INHALED: Remove victim to fresh air and keep at rest in a position 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. - Wash contaminated clothing before reuse. - Absorb spillage to prevent material damage. - Collect spillage. - Store locked up. - Store in corrosive resistant container with a resistant inner liner. - Dispose of contents/container in accordance with local, state, federal and international regulation.

Please refer to the original SDS for more information
SAFETY DATA SHEET

1. Identification of the Substance / Preparation and of the Company / Undertaking

Product Name: Sodium Hydroxide 50% Diaphragm
UN/ID No: UN1824
Synonyms: Sodium Hydroxide, 50%
Formula: NaOH in water
Molecular Weight: 40.00

Company Name: Hawkins, Inc. 3100 E. Hennepin Avenue Minneapolis, MN 55413 (612-331-6910)

Emergency Telephone: CHEMTREC (US): 1-800-424-9300

2. Hazards Identification

GHS - Classification

<table>
<thead>
<tr>
<th></th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute toxicity - Oral</td>
<td>4</td>
</tr>
<tr>
<td>Skin corrosion/irritation</td>
<td>1 Category 1A</td>
</tr>
<tr>
<td>Serious eye damage/eye irritation</td>
<td>1</td>
</tr>
<tr>
<td>Specific target organ toxicity (single exposure)</td>
<td>1</td>
</tr>
<tr>
<td>Acute aquatic toxicity</td>
<td>3</td>
</tr>
</tbody>
</table>

Signal Word: Danger

Hazard Statements:
- Harmful if swallowed
- May be harmful in contact with skin
- Causes severe skin burns and eye damage
- Causes damage to organs
- Harmful to aquatic life

Physical Hazards

<table>
<thead>
<tr>
<th></th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrosive to metals</td>
<td>1</td>
</tr>
</tbody>
</table>

Precautionary Statements:
- May be corrosive to metals
3. Composition / Information on Ingredients

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>CAS No</th>
<th>Weight-%</th>
<th>EC No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium Hydroxide</td>
<td>1310-73-2</td>
<td>50</td>
<td>215-185-5</td>
</tr>
</tbody>
</table>

4. First Aid Measures

General Advice: Immediate medical attention is required.

Eye Contact: Immediate medical attention is required. Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Keep eye wide open while rinsing. Do not rub affected area.

Skin Contact: Immediate medical attention is required. Wash off immediately with soap and plenty of water while removing all contaminated clothes and shoes.

Inhalation: Move to fresh air. Call a physician or poison control center immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.

Ingestion: Immediate medical attention is required. Do NOT induce vomiting. Drink plenty of water. Never give anything by mouth to an unconscious person. Remove from exposure, lie down. Clean mouth with water and drink afterwards plenty of water. Call a physician or poison control center immediately.

Note to Physicians: Product is a corrosive material. Use of gastric lavage or emesis is contraindicated. Possible perforation of stomach or esophagus should be investigated. Do not give chemical antidotes. Asphyxia from glottal edema may occur. Marked decrease in blood pressure may occur with moist rales, frothy sputum, and high pulse pressure. Treat symptomatically.

Self-protection of the First Aider: Use personal protective equipment as required. Avoid contact with skin, eyes or clothing.

5. Fire-fighting Measures

Flammable Properties: Not considered to be a fire hazard
813655 Sodium Hydroxide 50% Diaphragm

Explosive Properties:
Not considered to be an explosion hazard

Suitable Extinguishing Media:
Use extinguishing measures that are appropriate to local circumstances and the surrounding environment; Adding water to caustic solution generates large amounts of heat

Unsuitable Extinguishing Media:
No information available

Specific Hazards Arising from the Chemical:
The product causes burns of eyes, skin and mucous membranes; Thermal decomposition can lead to release of irritating and toxic gases and vapors; In the event of fire and/or explosion do not breathe fumes

Protective Equipment and Precautions for Firefighters:
In the event of a fire, wear full protective clothing and MSHA/NIOSH (approved or equivalent) self-contained breathing apparatus with full facepiece operated in the pressure-demand or other positive pressure mode

6. Accidental Release Measures

Personal Precautions: Evacuate personnel to safe areas. Use personal protective equipment as required. Avoid contact with skin, eyes or clothing. Keep people away from and upwind of spill/leak.

Environmental Precautions: Do not allow into any sewer, on the ground or into any body of water. Should not be released into the environment. Prevent further leakage or spillage if safe to do so. Prevent product from entering drains.

Methods for Cleaning Up: Dike far ahead of liquid spill for later disposal. Soak up with inert absorbent material. Take up mechanically, placing in appropriate containers for disposal. Clean contaminated surface thoroughly. Prevent product from entering drains. Dam up. After cleaning, flush away traces with water.

Other Information: Not applicable.

7. Handling and Storage

Advice on Safe Handling: Use personal protective equipment as required. Avoid contact with skin, eyes or clothing. Use only with adequate ventilation. In case of insufficient ventilation, wear suitable respiratory equipment. Use only with adequate ventilation and in closed systems.

Storage Conditions: Keep container tightly closed in a dry and well-ventilated place. Keep out of the reach of children. Keep containers tightly closed in a dry, cool and well-ventilated place. Keep in properly labeled containers.

Incompatible Materials: Strong acids and bases; Oxidizing agents; Aluminum; Tin; Zinc

8. Exposure Controls / Personal Protection

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>ACGIH TLV</th>
<th>OSHA PEL</th>
<th>Ontario TWA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium Hydroxide</td>
<td>Ceiling: 2 mg/m³</td>
<td>2 mg/m³ Ceiling</td>
<td>CEV: 2 mg/m³</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>European Union</th>
<th>China</th>
<th>Japan</th>
<th>Korea</th>
<th>Australia</th>
<th>Taiwan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium Hydroxide</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Exposure Guidelines: Vacated limits revoked by the Court of Appeals decision in AFL-CIO v. OSHA, 965 F.2d 962 (11th Cir., 1992)

Engineering Controls: Ensure adequate ventilation, especially in confined areas

Personal protective equipment (PPE)
813655 Sodium Hydroxide 50% Diaphragm

**Eye/Face Protection:**
Tight sealing safety goggles. Face protection shield.

**Body Protection:**
Gloves made of plastic or rubber. Rubber boots. Suitable protective clothing. Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact. Wear chemical resistant clothing such as gloves, apron, boots or whole bodysuits made from neoprene, as appropriate.

**General Hygiene Considerations:**
Wash contaminated clothing before reuse. When using do not eat, drink or smoke. Keep away from food, drink and animal feeding stuffs. Contaminated work clothing should not be allowed out of the workplace. Regular cleaning of equipment, work area and clothing is recommended. Avoid contact with skin, eyes or clothing. Take off all contaminated clothing and wash it before reuse. Wear suitable gloves and eye/face protection.

## 9. Physical and Chemical Properties

### 9.1. Information on basic physical and chemical properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Values</th>
<th>Remarks • Method</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physical State:</strong></td>
<td>Liquid</td>
<td></td>
</tr>
<tr>
<td><strong>Appearance:</strong></td>
<td>Clear liquid</td>
<td></td>
</tr>
<tr>
<td><strong>Color:</strong></td>
<td>Clear Colorless</td>
<td></td>
</tr>
<tr>
<td><strong>Odor:</strong></td>
<td>Odorless</td>
<td></td>
</tr>
<tr>
<td><strong>Odor Threshold:</strong></td>
<td>No information available</td>
<td></td>
</tr>
<tr>
<td><strong>pH:</strong></td>
<td>14.0</td>
<td>No information available</td>
</tr>
<tr>
<td><strong>“Salt Out” Point (°F):</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Melting Point/Freezing Point:</strong></td>
<td>10 °C / 50 °F</td>
<td>No information available</td>
</tr>
<tr>
<td><strong>Boiling Point/Boiling Range:</strong></td>
<td>143 °C / 289 °F</td>
<td>No information available</td>
</tr>
<tr>
<td><strong>Flash Point:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Evaporation Rate (BuAc=1):</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Flammability (solid, gas):</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Flammability Limits in Air:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Upper Flammability Limit:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Lower Flammability Limit:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Vapor Pressure (mm Hg):</strong></td>
<td></td>
<td>No information available</td>
</tr>
<tr>
<td><strong>Vapor density (Air =1)</strong></td>
<td></td>
<td>No information available</td>
</tr>
<tr>
<td><strong>Specific Gravity (H₂O=1):</strong></td>
<td></td>
<td>No information available</td>
</tr>
<tr>
<td><strong>Specific Gravity (2nd value):</strong></td>
<td></td>
<td>No information available</td>
</tr>
<tr>
<td><strong>Water Solubility:</strong></td>
<td>Miscible in water</td>
<td></td>
</tr>
<tr>
<td><strong>Solubility(ies):</strong></td>
<td></td>
<td>No information available</td>
</tr>
<tr>
<td><strong>Partition Coefficient</strong></td>
<td></td>
<td>No information available</td>
</tr>
<tr>
<td>(n-octanol/water)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Autoignition Temperature:</strong></td>
<td></td>
<td>No information available</td>
</tr>
<tr>
<td><strong>Decomposition Temperature:</strong></td>
<td></td>
<td>No information available</td>
</tr>
<tr>
<td><strong>Kinematic Viscosity:</strong></td>
<td></td>
<td>No information available</td>
</tr>
<tr>
<td><strong>Dynamic Viscosity:</strong></td>
<td></td>
<td>No information available</td>
</tr>
<tr>
<td><strong>Oxidizing Properties:</strong></td>
<td>No information available</td>
<td></td>
</tr>
<tr>
<td><strong>Explosive Properties:</strong></td>
<td>Not considered to be an explosion hazard</td>
<td></td>
</tr>
<tr>
<td><strong>Softening Point:</strong></td>
<td>No information available</td>
<td></td>
</tr>
<tr>
<td><strong>Molecular Weight:</strong></td>
<td>40.00</td>
<td></td>
</tr>
<tr>
<td><strong>VOC Content(%):</strong></td>
<td>No information available</td>
<td></td>
</tr>
<tr>
<td><strong>Density:</strong></td>
<td>1.53</td>
<td></td>
</tr>
<tr>
<td><strong>Bulk Density:</strong></td>
<td>No information available</td>
<td></td>
</tr>
</tbody>
</table>

### 9.2. Other information

<table>
<thead>
<tr>
<th><strong>Property</strong></th>
<th><strong>Values</strong></th>
<th><strong>Remarks • Method</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Kinematic Viscosity:</strong></td>
<td></td>
<td>No information available</td>
</tr>
<tr>
<td><strong>Dynamic Viscosity:</strong></td>
<td></td>
<td>No information available</td>
</tr>
<tr>
<td><strong>Oxidizing Properties:</strong></td>
<td></td>
<td>No information available</td>
</tr>
<tr>
<td><strong>Explosive Properties:</strong></td>
<td></td>
<td>Not considered to be an explosion hazard</td>
</tr>
</tbody>
</table>

## 10. Stability and Reactivity

**Stability:**
Stable under normal conditions of use and storage

**Conditions to Avoid:**
Exposure to air or moisture over prolonged periods; Incompatibles; Heat

**Incompatible Materials:**
Strong acids and bases; Oxidizing agents; Aluminum; Tin; Zinc
813655 Sodium Hydroxide 50% Diaphragm

Hazardous Decomposition Products: Thermal decomposition can lead to release of irritating and toxic gases and vapors

Possibility of Hazardous Reactions: None under normal processing

11. Toxicological Information

Product Information
Acute Toxicity: 0% of the mixture consists of ingredient(s) of unknown toxicity.

The following values are calculated based on chapter 3.1 of the GHS document

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Oral LD₅₀</th>
<th>Dermal LD₅₀</th>
<th>LC₅₀ (Lethal Concentration)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium Hydroxide</td>
<td></td>
<td>1350 mg/kg (Rabbit)</td>
<td></td>
</tr>
</tbody>
</table>

Chronic Toxicity:
Carcinogenicity: This product does not contain any carcinogens or potential carcinogens as listed by OSHA, IARC or NTP

Target Organ Effects: Eyes, Respiratory system, Skin

12. Ecological Information

Ecotoxicity
0% of the mixture consists of components(s) of unknown hazards to the aquatic environment

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Toxicity to algae</th>
<th>Toxicity to fish</th>
<th>Toxicity to daphnia and other aquatic invertebrates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium Hydroxide</td>
<td></td>
<td>45.4: 96 h Oncorhynchus mykiss mg/L LC₅₀ static</td>
<td></td>
</tr>
</tbody>
</table>

Persistence and Degradability: No information available.
Bioaccumulation: No information available.
Mobility: No information available.

13. Disposal Considerations

Waste from Residues/Unused Products: Disposal should be in accordance with applicable regional, national and local laws and regulations

Contaminated Packaging: Do not reuse container.

14. Transport Information

DOT
- Proper shipping name: SODIUM HYDROXIDE SOLUTION
- Hazard Class: 8
- UN/ID No: UN1824
- Packing Group: II
- Reportable Quantity (RQ): 1000 lbs
15. Regulatory Information

International Inventories
All of the components in the product are on the following Inventory lists: TSCA (United States); Canada (DSL/NDSL), Europe (EINECS/ELINCS/NLP), Australia (AICS), South Korea (KECL); China (IECSC), Philippines (PICCS).
This product contains a substance not listed on international inventories - it is for research and development use only.

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>AICS</th>
<th>TSCA</th>
<th>DSL</th>
<th>NDSL</th>
<th>EINECS</th>
<th>ELINCS</th>
<th>ENCS</th>
<th>IECSC</th>
<th>KECL</th>
<th>PICCS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium Hydroxide</td>
<td>Listed</td>
<td>Listed</td>
<td>Listed</td>
<td>-</td>
<td>Listed</td>
<td>-</td>
<td>(2)-1972 (1)-410</td>
<td>Listed</td>
<td>KE-31487</td>
<td>Listed</td>
</tr>
</tbody>
</table>

Inventory Legend
AICS - Australian Inventory of Chemical Substances
TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List
EINECS/ELINCS - European Inventory of Existing Chemical Substances/European List of Notified Chemical Substances
ENCS - Japan Existing and New Chemical Substances
IECSC - China Inventory of Existing Chemical Substances
KECL - Korean Existing and Evaluated Chemical Substances
PICCS - Philippines Inventory of Chemicals and Chemical Substances

RESTRICTIONS - REACH TITLE VII  No information available

US Federal Regulations

CERCLA
This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material.

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>CERCLA Hazardous Substances and the Reportable Quantities</th>
<th>SARA Extremely Hazardous Substances EPCRA RQ</th>
<th>SARA Extremely Hazardous Substances TPQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium Hydroxide</td>
<td>1000 lb 454 kg</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

SARA 313
Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372.
SARA 311/312 Hazard Categories

- Acute health hazard: Yes
- Chronic health hazard: No
- Fire hazard: No
- Sudden release of pressure hazard: No
- Reactive hazard: No

U.S. State Right-to-Know Regulations

California Proposition 65:
This product does not contain any Proposition 65 chemicals

16. Other Information

National Fire Protection Association (NFPA) Ratings

![NFPA Ratings]

NSF Certification

Certified to NSF/ANSI 60

Maximum Use (mg/L unless otherwise indicated): 100

Prepared By: HSE Department

Issue Date: 08-May-2012

Revision Date: 24-Jul-2013

Revision Note: Product name has been changed
Disclaimer:
Please be advised that it is your responsibility to inform your employees of the hazards of this substance, to advise them of what these properties mean and be sure they understand exposure information. 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 presented herein, while not guaranteed, was prepared by competent technical personnel and is true and accurate to the best of our knowledge. No warranty or guaranty, express or implied, is made regarding performance, stability, or otherwise. This information is not intended to be all-inclusive as to the manner and conditions of use, handling, and storage. Other factors may require additional safety or performance considerations. While our technical personnel will be happy to respond to questions regarding safe handling and use procedures, the handling and use remains the responsibility of the consumer. No suggestions are intended as, and should not be constructed as, a recommendation to infringe on any existing patents or to violate any Federal, State, or local laws.

End of Safety Data Sheet
Sodium Hydroxide 50% Diaphragm

May be harmful in contact with skin - Causes severe skin burns and eye damage - Harmful to aquatic life - Harmful if swallowed

IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell. - IF SWALLOWED: Rinse mouth. Do NOT induce vomiting. - IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower. - Rinse mouth.

Hawkins, Inc.

Please refer to the original SDS for more information
SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifier
Trade name: SULFURIC ACID 93% WATER WHITE

1.2 Relevant identified uses of the substance or mixture and uses advised against
no data available

1.3 Details of the supplier of the safety data sheet
Company: Solvay USA Inc.,
ECO SERVICES
8 Cedar Brook Drive
Cranbury, NJ, 08512-7500, US
Telephone number: 609-860-4000

1.4 Emergency telephone
USA: FOR EMERGENCIES INVOLVING A SPILL, LEAK, FIRE, EXPOSURE OR ACCIDENT CONTACT:
CHEMTREC (800-424-9300 within the United States or 703-527-3887 for International collect calls) or
Solvay CAERS (Communication and Emergency Response System at 800-916-3232)

SECTION 2: Hazards identification

Although OSHA has not adopted the environmental portion of the GHS regulations, this document may include information on environmental effects.

2.1 Classification of the substance or mixture
HCS 2012 (29 CFR 1910.1200)

Skin corrosion, Category 1A
Serious eye damage, Category 1
Specific target organ systemic toxicity - single exposure, Category 3, Respiratory system

H314: Causes severe skin burns and eye damage.
H318: Causes serious eye damage.
H335: May cause respiratory irritation.

2.2 Label elements
HCS 2012 (29 CFR 1910.1200)

Pictogram:
Signal Word: Danger

Hazard Statements:
H314: Causes severe skin burns and eye damage.
H335: May cause respiratory irritation.

Precautionary Statements:

Prevention
P261: Avoid breathing dust/ fume/ gas/ mist/ vapors/ spray.
P264: Wash skin thoroughly after handling.
P271: Use only outdoors or in a well-ventilated area.
P280: Wear protective gloves/ protective clothing/ eye protection/ face protection.

Response
P301 + P330 + P331: IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
P303 + P361 + P353: IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/ shower.
P304 + P340: IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P305 + P351 + P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P310: Immediately call a POISON CENTER or doctor/ physician.
P363: Wash contaminated clothing before reuse.

Storage
P403 + P233: Store in a well-ventilated place. Keep container tightly closed.
P405: Store locked up.

Disposal
P501: Dispose of contents/ container to an approved waste disposal plant.

2.3 Other hazards which do not result in classification

Water Reactive

H402: Harmful to aquatic life.
H411: Toxic to aquatic life with long lasting effects.

SECTION 3: Composition/information on ingredients

3.1 Substance

Not applicable, this product is a mixture.

3.2 Mixture

Hazardous Ingredients and Impurities

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Identification number CAS-No.</th>
<th>Concentration [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfuric acid</td>
<td>7664-93-9</td>
<td>93</td>
</tr>
</tbody>
</table>
Non Hazardous Ingredients and Impurities

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Identification number CAS-No.</th>
<th>Concentration [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>7732-18-5</td>
<td>7</td>
</tr>
</tbody>
</table>

SECTION 4: First aid measures

4.1 Description of first-aid measures

If inhaled
- Remove victim from exposure and then have him lie down in the recovery position.
- In case of shortness of breath, give oxygen.
- If victim has stopped breathing: administer CPR (cardio-pulmonary resuscitation)
- Immediate medical attention is required.

Skin contact
- In case of contact, immediately flush skin with plenty of water for at least 30 minutes.
- Remove all contaminated apparel under the shower.
- Wash off with plenty of water.
- Do not attempt to neutralize with chemical agents.
- Immediate medical attention is required.

Eye contact
- In case of contact, immediately flush eyes with plenty of water for at least 30 minutes.
- Immediate medical attention is required.

Ingestion
- Do NOT induce vomiting.
- If victim is conscious:
  - Rinse mouth with water.
  - Do not leave the victim unattended.
  - Risk of product entering the lungs on vomiting after ingestion.
  - Lay victim on side.
  - Never give anything by mouth to an unconscious person.
- Immediate medical attention is required.

4.2 Most important symptoms and effects, both acute and delayed

Risks
- Inhalation of product may aggravate existing chronic respiratory problems such as asthma, emphysema or bronchitis
- Skin contact may aggravate existing skin disease

4.3 Indication of any immediate medical attention and special treatment needed

Notes to physician
- All treatments should be based on observed signs and symptoms of distress in the patient. Consideration should be given to the possibility that overexposure to materials other than this product may have occurred.

SECTION 5: Firefighting measures
Flash point : not applicable
Autoignition temperature : no data available
Flammability / Explosive limit : no data available

5.1 Extinguishing media
Suitable extinguishing media : Dry chemical

5.2 Special hazards arising from the substance or mixture
Specific hazards during fire fighting : Not combustible.
Strong oxidizer. Contact with other material may cause fire.
Reacts violently with water.
Corrosive or suffocating vapors are released.
On combustion or on thermal decomposition (pyrolysis), releases:
Sulfur oxides

5.3 Advice for firefighters
Special protective equipment for fire-fighters : Firefighters should wear NIOSH/MSHA approved self-contained breathing apparatus and full protective clothing.
Acid-resistant protective clothing
Specific fire fighting methods : Fight fire with normal precautions from a reasonable distance.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures
Personal precautions, protective equipment and emergency procedures : The product must only be handled by specifically trained employees.

6.2 Environmental precautions
Environmental precautions : Do not flush into surface water or sanitary sewer system.
Collect contaminated fire extinguishing water separately. This must not be discharged into drains.
Spills may be reportable to the National Response Center (800-424-8802) and to state and/or local agencies.
Site should have a spill plan to ensure that adequate safeguards are in place to minimize the impact of episodic releases.
6.3 Methods and materials for containment and cleaning up

Recovery : Stop leak if safe to do so.
          Dam up with sand or inert earth (do not use combustible materials).

Decontamination / cleaning : Pump or collect any free spillage into an appropriate closed container. (see Section 7: Handling and Storage)
                           Exercise caution during neutralization as considerable heat may be generated
                           Carefully neutralize the remainder using:
                           soda ash
                           Soak up with inert absorbent material.
                           Scrape up.
                           Keep in suitable, closed containers for disposal.

6.4 Reference to other sections

Reference to other sections : 7. HANDLING AND STORAGE

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Technical measures : Do not breathe mist or vapors.
                     Avoid contact with the skin and the eyes.
                     When diluting, always add the product to water. Never add water to the product.
                     Reacts violently with:
                     bases.

Hygiene measures : Personal hygiene is an important work practice exposure control measure and the following general measures should be taken when working with or handling this materials:
                   1) Do not store, use, and/or consume foods, beverages, tobacco products, or cosmetics in areas where this material is stored.
                   2) Wash hands and face carefully before eating, drinking, using tobacco, applying cosmetics, or using the toilet.
                   3) Wash exposed skin promptly to remove accidental splashes or contact with material.
7.2 Conditions for safe storage, including any incompatibilities

Storage conditions
Recommended: Keep tightly closed. Store in an area: dry well-ventilated diked

Storage stability
Storage temperature: < 104°F (< 40°C)
Other data: Corrosion rates increase at elevated temperatures.

7.3 Specific end use(s)
no data available

SECTION 8: Exposure controls/personal protection

Introductory Remarks:
These recommendations provide general guidance for handling this product. Because specific work environments and material handling practices vary, safety procedures should be developed for each intended application. While developing safe handling procedures, do not overlook the need to clean equipment and piping systems for maintenance and repairs. Waste resulting from these procedures should be handled in accordance with Section 13: Disposal Considerations.

Assistance with selection, use and maintenance of worker protection equipment is generally available from equipment manufacturers.

8.1 Control parameters

Ingredients with workplace control parameters

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Value type</th>
<th>Value</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfuric acid</td>
<td>TWA</td>
<td>1 mg/m³</td>
<td>NIOSH</td>
</tr>
<tr>
<td>Sulfuric acid</td>
<td>TWA</td>
<td>0.2 mg/m³</td>
<td>ACGIH</td>
</tr>
<tr>
<td>Sulfuric acid</td>
<td>TWA</td>
<td>1 mg/m³</td>
<td>OSHA Z-1</td>
</tr>
<tr>
<td>Sulfuric acid</td>
<td>TWA</td>
<td>1 mg/m³</td>
<td>OSHA Z-1-A</td>
</tr>
<tr>
<td>Sulfuric acid</td>
<td>TWA</td>
<td>0.2 mg/m³</td>
<td>SOLVAY</td>
</tr>
</tbody>
</table>

NIOSH IDLH (Immediately Dangerous to Life or Health Concentrations)

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>CAS-No.</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfuric acid</td>
<td>7664-93-9</td>
<td>15 milligram per cubic meter</td>
</tr>
</tbody>
</table>
8.2 Exposure controls

Control measures

Engineering measures: Where engineering controls are indicated by use conditions or a potential for excessive exposure exists, the following traditional exposure control techniques may be used to effectively minimize employee exposures:

- Effective exhaust ventilation system

Personal protective equipment

Respiratory protection: When respirators are required, select NIOSH/MSHA approved equipment based on actual or potential airborne concentrations and in accordance with the appropriate regulatory standards and/or industrial recommendations.

- Recommended Filter type: Gas and vapor respirator for acidic gas and vapors

Eye protection: Eye and face protection requirements will vary dependent upon work environment conditions and material handling practices. Appropriate ANSI Z87 approved equipment should be selected for the particular use intended for this material.

- Eye contact should be prevented through the use of:

  - Wear protective eye glasses for protection against liquid splashes (goggles)

Skin and body protection: Wear as appropriate:

- Face-shield
- Acid-resistant protective clothing
- Acid resistant boots.

Hygiene measures: Personal hygiene is an important work practice exposure control measure and the following general measures should be taken when working with or handling this materials:

1) Do not store, use, and/or consume foods, beverages, tobacco products, or cosmetics in areas where this material is stored.
2) Wash hands and face carefully before eating, drinking, using tobacco, applying cosmetics, or using the toilet.
3) Wash exposed skin promptly to remove accidental splashes or contact with material.

Protective measures: Ensure that eyewash stations and safety showers are close to the workstation location.
SECTION 9: Physical and chemical properties

Physical and Chemical properties here represent typical properties of this product. Contact the business area using the Product information phone number in Section 1 for its exact specifications.

9.1 Information on basic physical and chemical properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>Form: oily</td>
</tr>
<tr>
<td></td>
<td>Physical state: liquid</td>
</tr>
<tr>
<td></td>
<td>Color: colorless</td>
</tr>
<tr>
<td>Odor</td>
<td>odorless</td>
</tr>
<tr>
<td>Odor Threshold</td>
<td>no data available</td>
</tr>
<tr>
<td>pH</td>
<td>1.0 (1 % (m/v))</td>
</tr>
<tr>
<td>Melting point/range</td>
<td>-26 °F (-32 °C)</td>
</tr>
<tr>
<td>Boiling point/boiling range</td>
<td>529 °F (276 °C) (760 mmHg (1,013.25 hPa))</td>
</tr>
<tr>
<td>Flash point</td>
<td>not applicable</td>
</tr>
<tr>
<td>Evaporation rate (Butylacetate = 1)</td>
<td>no data available</td>
</tr>
<tr>
<td>Flammability (solid, gas)</td>
<td>no data available</td>
</tr>
<tr>
<td>Flammability (liquids)</td>
<td>no data available</td>
</tr>
<tr>
<td>Flammability / Explosive limit</td>
<td>no data available</td>
</tr>
<tr>
<td>Autoignition temperature</td>
<td>no data available</td>
</tr>
<tr>
<td>Vapor pressure</td>
<td>&lt; 1 mmHg (1.33 hPa) (104 °F (40 °C))</td>
</tr>
<tr>
<td>Vapor density</td>
<td>no data available</td>
</tr>
<tr>
<td>Density</td>
<td>Relative density: 1.836 (61 °F (16 °C))</td>
</tr>
<tr>
<td>Solubility</td>
<td>Water solubility: miscible</td>
</tr>
<tr>
<td>Partition coefficient: n-octanol/water</td>
<td>no data available</td>
</tr>
<tr>
<td>Thermal decomposition</td>
<td>no data available</td>
</tr>
<tr>
<td>Viscosity</td>
<td>no data available</td>
</tr>
<tr>
<td>Explosive properties</td>
<td>no data available</td>
</tr>
<tr>
<td>Oxidizing properties</td>
<td>no data available</td>
</tr>
</tbody>
</table>

9.2 Other information

Molecular weight : 98.08 g/mol
Reactions with water / air : Reacts violently with water.

SECTION 10: Stability and reactivity

10.1 Reactivity
no data available

10.2 Chemical stability
Chemical stability : Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
Hazardous polymerization does not occur.

10.4 Conditions to avoid
no data available

10.5 Incompatible materials
Materials to avoid : Water
Strong reducing agents
Halogenated compounds
Bases
metals
Nitrogen oxides (NOx)

10.6 Hazardous decomposition products
Decomposition products : On combustion or on thermal decomposition (pyrolysis), releases:
Sulfur oxides

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity
Acute oral toxicity
Sulfuric acid : LD50 Oral : 2,140 mg/kg - rat
Gavage
Published data

Acute inhalation toxicity
Sulfuric acid : LC50 - 4 h (aerosol) : 0.375 mg/l - rat, male and female
Toxicity secondary to corrosive effects at site of contact.
Published data
LC50 - 4 h (aerosol) : 0.85 mg/l - mouse, male and female
Toxicity secondary to corrosive effects at site of contact.
Published data
(Mist) Humans
Symptoms: Potential health effects, Respiratory disorders, Symptoms may be delayed., Cough, Risk of delayed pulmonary edema.
Effects of breathing high concentration of respirable particles may include:
May cause irritation of respiratory tract.
Lung irritation
Published data

Acute dermal toxicity
Sulfuric acid : Not classified as hazardous for acute toxicity according to GHS
               not applicable
               Corrosive
               internal evaluation

Acute toxicity (other routes of administration) : no data available

Skin corrosion/irritation
Skin irritation
Sulfuric acid : Causes severe burns.
Published data

Serious eye damage/eye irritation
Eye irritation
Sulfuric acid : Risk of serious damage to eyes.
Published data

Respiratory or skin sensitization
Sensitization
Sulfuric acid : Local lymph node assay
not applicable
Corrosive
The product is not considered to be sensitizing by skin contact.
internal evaluation

Mutagenicity
Genotoxicity in vitro
Sulfuric acid : Mutagenicity (Salmonella typhimurium - reverse mutation assay)
               with and without metabolic activation
               negative
               Method: OECD Test Guideline 471
               Published data
               Chromosome aberration test in vitro
               Strain: Chinese hamster ovary cells
               with and without metabolic activation
               positive
               Effects observed are due to the reduced pH in the test medium.
Published data
               Product is not considered to be genotoxic
Genotoxicity in vivo: no data available

Carcinogenicity
Carcinogenicity
Sulfuric acid: inhalation (mist)
Animal studies
Unpublished reports
Published data
No carcinogenic effects have been observed

Note: IARC Classification: Group 1
mists from strong inorganic acids

IARC and NTP classified "occupational exposure to strong inorganic acid mists containing sulfuric acid" as a known human carcinogen. ACGIH has also classified "sulfuric acid as contained in strong inorganic acid mists" as a suspected human carcinogen. There is still a debate on the studies reviewed by these agencies. We disagree with IARC's conclusion, in that more recent studies have failed to find association between "occupational exposure to strong inorganic acid mist containing sulfuric acid" and laryngeal or lung cancer. In fact, in 2012 IARC revised their classification dropping the "containing sulfuric acid" wording. Lifetime animal studies in hamsters, rats, and guinea pigs were conducted by the EPA and NIEHS and were all negative. However, they were not formally published by the agencies and not considered by IARC or NTP.

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>CAS-No.</th>
<th>Rating</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong inorganic acid mists containing sulfuric acid</td>
<td></td>
<td>Group 1: Carcinogenic to humans</td>
<td>IARC</td>
</tr>
<tr>
<td>Strong inorganic acid mists containing sulfuric acid</td>
<td></td>
<td>Suspected human carcinogen</td>
<td>ACGIH</td>
</tr>
<tr>
<td>Strong inorganic acid mists containing sulfuric acid</td>
<td></td>
<td>Known to be human carcinogen</td>
<td>NTP</td>
</tr>
<tr>
<td>Sulfuric acid</td>
<td>7664-93-9</td>
<td>Suspected human carcinogen</td>
<td>ACGIH</td>
</tr>
</tbody>
</table>

This product does not contain any ingredient designated as probable or suspected human carcinogens by:

OSHA
NTP
IARC
Toxicity for reproduction and development
Toxicity to reproduction / fertility : no data available

Developmental Toxicity/Teratogenicity
Sulfuric acid : rabbit
Application Route: inhalation (mist)
NOAEC teratogenicity: 19.3 mg/m³
Method: OECD Test Guideline 414
no teratogenic effects have been observed

mouse
Application Route: inhalation (mist)
NOAEC teratogenicity: 19.3 mg/m³
Method: OECD Test Guideline 414
no teratogenic effects have been observed
Published data

STOT
STOT-single exposure
Sulfuric acid
Routes of exposure: inhalation (mist)
Target Organs: Respiratory Tract
Toxicology Assessment: May cause respiratory irritation.

STOT-repeated exposure
Sulfuric acid : Toxicology Assessment:
The substance or mixture is not classified as specific target organ toxicant,
repeated exposure, internal evaluation

Sulfuric acid : inhalation (mist) 28 d - rat
LOAEC: 0.3 mg/m³
Target Organs: Larynx
Method: OECD Test Guideline 412
Symptoms: Local irritation
Unpublished reports

inhalation (mist) 78 Weeks - Monkey
LOAEC: 0.38 mg/m³
Target Organs: Respiratory Tract
Symptoms: Local irritation, Respiratory disorders
Published data

Repeated inhalation of aerosols may cause adverse effects on health
Experience with human exposure
Experience with human exposure: Inhalation

Sulfuric acid: Target Organs: Respiratory Tract
- Target Organs: Nose
- Symptoms: Burning sensations in the nose and throat.
- Breathing difficulties
- Dental erosion
- Mist
- At high concentrations:
  - Irritating to the respiratory system and mucous membranes.
  - Published data

Carcinogenicity
Sulfuric acid: Carcinogenicity classification not possible from current data.

Teratogenicity
Sulfuric acid: Did not show teratogenic effects in animal experiments.

Aspiration toxicity
Aspiration toxicity: Sulfuric acid
- not applicable

SECTION 12: Ecological information

12.1 Toxicity

Aquatic Compartment
Acute toxicity to fish
Sulfuric acid: LC50 - 96 h: 16 - 28 mg/l - Lepomis macrochirus (Bluegill sunfish)
- static test
  - Non neutralized product
  - pH 3.5 - 3.25
  - Harmful to fish.
  - Published data

Acute toxicity to daphnia and other aquatic invertebrates.
Sulfuric acid: EC50 - 48 h: > 100 mg/l - Daphnia magna (Water flea)
- static test Method: OECD Test Guideline 202
- Fresh water
- Neutralized product
- Not harmful to aquatic invertebrates. (EC50 > 100 mg/L)
- Unpublished reports
  - EC50 - 24 h: 29 mg/l - Daphnia magna (Water flea)
  - Method: ISO 6341
  - Non neutralized product
  - Harmful to aquatic invertebrates.
  - Published data
Toxicity to aquatic plants
Sulfuric acid

: NOEC: 0.13 mg/l - Algae
  field study
  pH 5.6
  Non neutralized product
  Published data

  ErC50 - 72 h: > 100 mg/l - Desmodesmus subspicatus (green algae)
  Growth inhibition
  Method: OECD Test Guideline 201
  Neutralized product
  Unpublished reports

Chronic toxicity to fish
Sulfuric acid

: NOEC: 0.13 mg/l - 10 Months - Salvelinus fontinalis (brown trout)
  flow-through test
  pH 5.6
  Fresh water
  Non neutralized product
  Published data

Ecotoxicity assessment
Acute aquatic toxicity
Sulfuric acid

: If the product is not neutralized, it may cause adverse effects to aquatic organisms due to its acidity.
  Neutralization will reduce ecotoxic effects.

Chronic aquatic toxicity
Sulfuric acid

: If the product is not neutralized, it may cause adverse effects to aquatic organisms due to its acidity.

12.2 Persistence and degradability

Biodegradability
Biodegradability
Sulfuric acid

: Not applicable, inorganic substance

Stability
Stability in water
Sulfuric acid

: Product dissociates rapidly to corresponding ions on contact with water.

12.3 Bioaccumulative potential
Partition coefficient: n-octanol/water
Sulfuric acid

: Not applicable, inorganic substance

Bioconcentration factor (BCF)
Sulfuric acid

: Not relevant
  internal evaluation

12.4 Mobility in soil
no data available
12.5 Results of PBT and vPvB assessment
Results of PBT and vPvB assessment
Sulfuric acid : 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).

12.6 Other adverse effects
Environment assessment
Sulfuric acid : Not classified as Dangerous for the Environment

SECTION 13: Disposal considerations
13.1 Waste treatment methods
Product Disposal
Advice on Disposal : Chemical additions, processing or otherwise altering this material may make the waste management information presented in this MSDS incomplete, inaccurate or otherwise inappropriate. Please be advised that state and local requirements for waste disposal may be more restrictive or otherwise different from federal laws and regulations. Consult state and local regulations regarding the proper disposal of this material.

Waste Code : EPA:
Hazardous Waste – YES

RCRA:
D002 - Corrosive waste – (C)
D003 - Reactive waste – (R)

SECTION 14: Transport information
Transportation status: IMPORTANT! Statements below provide additional data on listed transport classification. The listed Transportation Classification does not address regulatory variations due to changes in package size, mode of shipment or other regulatory descriptors.

DOT

14.1 UN number UN 1830

14.2 Dangerous Good Description UN 1830 SULFURIC ACID, 8, II

14.3 Transport hazard class 8

14.4 Packing group
Packing group II
Label(s) 8
ERG No 137
14.5 Environmental hazards
NO
Marine pollutant

14.6 Special precautions for user
This product contains one or more ingredients identified as a hazardous substance in Appendix A of 49 CFR 172.101. The product quantity, in one package, which triggers the RQ requirements under 49 CFR for each hazardous substance is shown.

Reportable quantities:
- RQ substance: Sulfuric acid
- RQ limit for substance: 1,000 lb

TDG

14.1 UN number
UN 1830

14.2 Dangerous Good Description
UN 1830 SULFURIC ACID, 8, II

14.3 Transport hazard class
8

14.4 Packing group
Packing group: II
Label(s): 8
ERG No: 137

14.5 Environmental hazards
NO
Marine pollutant

IMDG

14.1 UN number
UN 1830

14.2 Dangerous Good Description
UN 1830 SULPHURIC ACID, 8, II

14.3 Transport hazard class
8

14.4 Packing group
Packing group: II
Label(s): 8
EmS: F-A, S-B

14.5 Environmental hazards
NO
Marine pollutant

14.6 Special precautions for user
For personal protection see section 8.

IATA

14.1 UN number
UN 1830

14.2 Dangerous Good Description
UN 1830 SULPHURIC ACID, 8, II
14.3 Transport hazard class 8

14.4 Packing group
Packing group II
Label(s): 8
Packing instruction (cargo aircraft) 855
Max net qty / pkg 30.00 L
Packing instruction (passenger aircraft) 851
Max net qty / pkg 1.00 L

14.5 Environmental hazards
Marine pollutant

14.6 Special precautions for user
For personal protection see section 8.

Note: The above regulatory prescriptions are those valid on the date of publication of this sheet. Given the possible evolution of transportation regulations for hazardous materials, it would be advisable to check their validity with your sales office.

SECTION 15: Regulatory information

15.1 Notification status
United States TSCA Inventory : y (positive listing)
On TSCA Inventory

Canadian Domestic Substances List (DSL) : y (positive listing)
All components of this product are on the
Canadian DSL.

Australia Inventory of Chemical Substances (AICS) : y (positive listing)
On the inventory, or in compliance with the
inventory

Japan. CSCL - Inventory of Existing and New Chemical Substances : y (positive listing)
On the inventory, or in compliance with the
inventory

Korea. Korean Existing Chemicals Inventory (KECI) : y (positive listing)
On the inventory, or in compliance with the
inventory

China. Inventory of Existing Chemical Substances in China (IECSC) : y (positive listing)
On the inventory, or in compliance with the
inventory

15.2 Federal Regulations
SARA 311/312 Hazards

<table>
<thead>
<tr>
<th>Hazard</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire Hazard</td>
<td>no</td>
</tr>
<tr>
<td>Reactivity Hazard</td>
<td>yes</td>
</tr>
<tr>
<td>Sudden Release of Pressure Hazard</td>
<td>no</td>
</tr>
<tr>
<td>Acute Health Hazard</td>
<td>yes</td>
</tr>
<tr>
<td>Chronic Health Hazard</td>
<td>no</td>
</tr>
</tbody>
</table>

SARA 313: The following components are subject to reporting levels established by SARA Title III, Section 313:

- Sulfuric acid 7664-93-9 93 %

SARA 302: The following components are subject to reporting levels established by SARA Title III, Section 302:

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>CAS-No.</th>
<th>Threshold planning quantity</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfuric acid</td>
<td>7664-93-9</td>
<td>1000 lb</td>
<td></td>
</tr>
</tbody>
</table>

EPCRA - Emergency Planning and Community Right-to-Know

CERCLA Reportable Quantity

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>CAS-No.</th>
<th>Reportable quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unlisted hazardous wastes - Characteristic of Corrosivity</td>
<td></td>
<td>100 lb</td>
</tr>
<tr>
<td>Unlisted hazardous wastes - Characteristic of Reactivity</td>
<td>7664-93-9</td>
<td>100 lb</td>
</tr>
<tr>
<td>Sulfuric acid</td>
<td>7664-93-9</td>
<td>1000 lb</td>
</tr>
</tbody>
</table>

SARA 304 Reportable Quantity

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>CAS-No.</th>
<th>Reportable quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfuric acid</td>
<td>7664-93-9</td>
<td>1000 lb</td>
</tr>
</tbody>
</table>

SARA 302 Reportable Quantity

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>CAS-No.</th>
<th>Reportable quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfuric acid</td>
<td>7664-93-9</td>
<td>1000 lb</td>
</tr>
</tbody>
</table>

15.3 State Regulations

California Prop 65: WARNING! This product contains a chemical known in the State of California to cause cancer.

Strong inorganic acid mists containing sulfuric acid

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

SECTION 16: Other information
SAFE DATA SHEET

SULFURIC ACID 93% WATER WHITE

Revision:  .  US ( EN )  
Issuing date: 07/10/2014

NFPA-Classification
Health :  3 serious
Flammability :  0 minimal
Instability or Reactivity :  2 moderate

HMIS-Classification
Health :  3 serious
Flammability :  0 minimal
Reactivity :  2 moderate

Further information
Date Prepared : 07/10/2014
Further information : Product classified under the US GHS format.

Key or legend to abbreviations and acronyms used in the safety data sheet

TWA : 8-hour, time-weighted average
ACGIH : American Conference of Governmental Industrial Hygienists
OSHA : Occupational Safety and Health Administration
WHMIS : Workplace Hazardous Materials Information System
NTP : National Toxicology Program
IARC : International Agency for Research on Cancer
Solvay OEL : SAEL (Solvay Acceptable Exposure Limit)
NIOSH : National Institute for Occupational Safety and Health
NFPA : National Fire Protection Association
HMIS : Hazardous Materials Identification System (Paint & Coating)

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. Such information is only given as a guidance to help the user handle, use, process, store, transport, dispose, and release the product in satisfactory safety conditions and is not to be considered as a warranty or quality specification. It should be used in conjunction with technical sheets but do not replace them. Thus, the information only relates to the designated specific product and may not be applicable if such product is used in combination with other materials or in another manufacturing process, unless otherwise specifically indicated. It does not release the user from ensuring he is in conformity with all regulations linked to its activity.
SULFURIC ACID 93% TECHNICAL

Causes severe skin burns and eye damage - Causes serious eye damage - May cause respiratory irritation; or; May cause drowsiness or dizziness

Avoid breathing dust/fume/gas/mist/vapours/spray. - Wash skin thoroughly after handling. - Use only outdoors or in a well-ventilated area. - Wear protective gloves/protective clothing/eye protection/face protection. - IF SWALLOWED: Rinse mouth. Do NOT induce vomiting. - IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower. - IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. - Immediately call a POISON CENTER or doctor/physician. - Wash contaminated clothing before reuse. - Store in a well-ventilated place. Keep container tightly closed. - Store locked up. - Dispose of contents/container to an approved waste disposal plant.

Please refer to the original SDS for more information
1. Identification of the Substance / Preparation and of the Company / Undertaking

Product Name: Hydrochloric Acid 20' Tech
UN/ID No: UN1789
Synonyms: Muriatic acid
Formula: HCl in H₂O
Molecular Weight: 36.46

Company Name:
Hawkins, Inc. 3100 E. Hennepin Avenue Minneapolis, MN 55413 (612-331-6910)

Emergency Telephone:
CHEMTREC (US): 1-800-424-9300

2. Hazards Identification

GHS - Classification

<table>
<thead>
<tr>
<th>Hazard Category</th>
<th>Description</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute toxicity - Oral</td>
<td>Category 4</td>
<td></td>
</tr>
<tr>
<td>Acute toxicity - Inhalation (Gases)</td>
<td>Category 3</td>
<td></td>
</tr>
<tr>
<td>Acute toxicity - Inhalation (Dusts/Mists)</td>
<td>Category 1</td>
<td></td>
</tr>
<tr>
<td>Skin corrosion/irritation</td>
<td>Category 1 Category 1A</td>
<td></td>
</tr>
<tr>
<td>Serious eye damage/eye irritation</td>
<td>Category 1</td>
<td></td>
</tr>
<tr>
<td>Respiratory sensitization</td>
<td>Category 1A</td>
<td></td>
</tr>
<tr>
<td>Specific target organ toxicity (single exposure)</td>
<td>Category 1</td>
<td></td>
</tr>
<tr>
<td>Specific target organ toxicity (repeated exposure)</td>
<td>Category 1</td>
<td></td>
</tr>
</tbody>
</table>

Signal Word: Danger

Hazard Statements:
• Harmful if swallowed
• Fatal if inhaled
• Causes severe skin burns and eye damage
• May cause allergy or asthma symptoms or breathing difficulties if inhaled
• Causes damage to organs
• Causes damage to organs through prolonged or repeated exposure

Physical Hazards
Corrosive to metals Category 1
• May be corrosive to metals

Precautionary Statements:
• IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell
• Rinse mouth
• Call a POISON CENTER or doctor/physician
• Use only outdoors or in a well-ventilated area
• Wear respiratory protection
• Store in a well-ventilated place. Keep container tightly closed
• IF SWALLOWED: Rinse mouth. Do NOT induce vomiting
• IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower
• Wash contaminated clothing before reuse
• IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
• Wear protective gloves/protective clothing/eye protection/face protection
• 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
• Avoid breathing dust/fume/gas/mist/vapors/spray
• In case of inadequate ventilation wear respiratory protection
• IF INHALED: If breathing is difficult, remove victim to fresh air and keep at rest in a position comfortable for breathing
• If experiencing respiratory symptoms: Call a POISON CENTER or doctor/physician
• IF exposed: Call a POISON CENTER or doctor/physician
• Store locked up
• Do not breathe dust/fume/gas/mist/vapors/spray
• Wash face, hands and any exposed skin thoroughly after handling
• Do not eat, drink or smoke when using this product
• Get medical advice/attention if you feel unwell
• Dispose of contents/container to an approved waste disposal plant
• Immerse in cool water/soak in wet bandages
• Absorb spillage to prevent material damage
• Store in corrosive resistant aluminum container with a resistant liner

3. Composition / Information on Ingredients

<table>
<thead>
<tr>
<th>Hazardous</th>
<th>Chemical Name</th>
<th>CAS No</th>
<th>Weight-%</th>
<th>EC No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrochloric acid</td>
<td>7647-01-0</td>
<td>30-32</td>
<td>231-595-7</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Non-Hazardous</th>
<th>Chemical Name</th>
<th>CAS No</th>
<th>Weight-%</th>
<th>EC No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>7732-18-5</td>
<td>Balance</td>
<td>231-791-2</td>
<td></td>
</tr>
</tbody>
</table>

4. First Aid Measures

General Advice: Immediate medical attention is required.

Eye Contact: Keep eye wide open while rinsing. Immediate medical attention is required. Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Do not rub affected area.

Skin Contact: Immediate medical attention is required. Wash off immediately with soap and plenty of water while removing all contaminated clothes and shoes.

Inhalation: Move to fresh air. Call a physician or poison control center immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.
Ingestion: Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Drink plenty of water. Immediate medical attention is required. Remove from exposure, lie down. Clean mouth with water and drink afterwards plenty of water. Call a physician or poison control center immediately.

Note to Physicians: Product is a corrosive material. Use of gastric lavage or emesis is contraindicated. Possible perforation of stomach or esophagus should be investigated. Do not give chemical antidotes. Asphyxia from glottal edema may occur. Marked decrease in blood pressure may occur with moist rales, frothy sputum, and high pulse pressure. Treat symptomatically.

Self-protection of the First Aider: Use personal protective equipment as required. Avoid contact with skin, eyes or clothing.

5. Fire-fighting Measures

Flammable Properties: Not considered to be a fire hazard, May react with metals or heat to release flammable hydrogen gas

Explosive Properties: Not considered to be an explosion hazard

Suitable Extinguishing Media: Water, Water spray (fog), Neutralize with soda ash or slaked lime

Unsuitable Extinguishing Media: No information available

Specific Hazards Arising from the Chemical: The product causes burns of eyes, skin and mucous membranes, Thermal decomposition can lead to release of irritating and toxic gases and vapors, In the event of fire and/or explosion do not breathe fumes

Protective Equipment and Precautions for Firefighters: In the event of a fire, wear full protective clothing and MSHA/NIOSH (approved or equivalent) self-contained breathing apparatus with full facepiece operated in the pressure-demand or other positive pressure mode, Structural firefighter’s protective clothing is ineffective for fires involving this material, Stay away from ends of tanks, Cool tanks with water spray until well after fire is out

6. Accidental Release Measures

Personal Precautions: Use personal protective equipment as required. Evacuate personnel to safe areas. Avoid contact with skin, eyes or clothing. Keep people away from and upwind of spill/leak.

Environmental Precautions: Do not allow into any sewer, on the ground or into any body of water. Should not be released into the environment. Prevent further leakage or spillage if safe to do so. Prevent product from entering drains.

Methods for Containment: Prevent further leakage or spillage if safe to do so. Cover powder spill with plastic sheet or tarp to minimize spreading. Dike far ahead of liquid spill for later disposal.

Methods for Cleaning Up: Dike far ahead of liquid spill for later disposal. Soak up with inert absorbent material. Take up mechanically, placing in appropriate containers for disposal. Clean contaminated surface thoroughly. Prevent product from entering drains. Dam up. After cleaning, flush away traces with water.

Other Information: Not applicable.

7. Handling and Storage
900 Hydrochloric Acid 20' Tech

Advice on Safe Handling: Avoid contact with skin, eyes or clothing. Use personal protective equipment as required. Use only with adequate ventilation. In case of insufficient ventilation, wear suitable respiratory equipment. Use only with adequate ventilation and in closed systems.

Storage Conditions: Keep container tightly closed in a dry and well-ventilated place. Keep out of the reach of children. Keep containers tightly closed in a dry, cool and well-ventilated place. Keep in properly labeled containers.

Incompatible Materials: Strong acids and bases; Oxidizing agents

8. Exposure Controls / Personal Protection

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>ACGIH TLV</th>
<th>OSHA PEL</th>
<th>Ontario TWA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrochloric acid</td>
<td>Ceiling: 2 ppm</td>
<td>5 ppm Ceiling</td>
<td>CEV: 2 ppm</td>
</tr>
</tbody>
</table>

Chemical Name | European Union | China | Japan | Korea | Australia | Taiwan |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrochloric acid</td>
<td>TWA 5 ppm Ceiling</td>
<td>Ceiling: 7.5 mg/m³</td>
<td>Ceiling: 5 ppm Ceiling</td>
<td>STEL: 2 ppm Ceiling</td>
<td>7.5 mg/m³ Peak</td>
<td>5 ppm Peak</td>
</tr>
</tbody>
</table>

Exposure Guidelines: Vacated limits revoked by the Court of Appeals decision in AFL-CIO v. OSHA, 965 F.2d 962 (11th Cir., 1992)

Engineering Controls: Ensure adequate ventilation, especially in confined areas

Personal protective equipment (PPE): Tight sealing safety goggles. Face protection shield.

Eye/Face Protection: Gloves made of plastic or rubber. Suitable protective clothing. Rubber boots. Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact. Wear chemical resistant clothing such as gloves, apron, boots or whole bodysuits made from neoprene, as appropriate.

Body Protection: General Hygiene Considerations: When using do not eat, drink or smoke. Wash contaminated clothing before reuse. Keep away from food, drink and animal feeding stuffs. Contaminated work clothing should not be allowed out of the workplace. Regular cleaning of equipment, work area and clothing is recommended. Avoid contact with skin, eyes or clothing. Take off all contaminated clothing and wash it before reuse. Wear suitable gloves and eye/face protection.

9. Physical and Chemical Properties

9.1. Information on basic physical and chemical properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Values</th>
<th>Remarks • Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical State:</td>
<td>Liquid</td>
<td></td>
</tr>
<tr>
<td>Appearance:</td>
<td>Aqueous solution</td>
<td></td>
</tr>
<tr>
<td>Color:</td>
<td>Clear Colorless</td>
<td></td>
</tr>
<tr>
<td>Odor:</td>
<td>Pungent</td>
<td></td>
</tr>
<tr>
<td>Odor Threshold:</td>
<td>No information available</td>
<td></td>
</tr>
<tr>
<td>pH:</td>
<td></td>
<td>No information available</td>
</tr>
<tr>
<td>&quot;Salt Out&quot; Point (°F):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Melting Point/Freezing Point:</td>
<td></td>
<td>No information available</td>
</tr>
<tr>
<td>Boiling Point/Freezing Point:</td>
<td>81 °C / 178 °C</td>
<td>No information available</td>
</tr>
<tr>
<td>Flash Point:</td>
<td></td>
<td>No information available</td>
</tr>
<tr>
<td>Evaporation Rate (BuAc=1):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flammability (solid, gas):</td>
<td></td>
<td>No information available</td>
</tr>
<tr>
<td>Flammability Limits in Air:</td>
<td></td>
<td>No information available</td>
</tr>
<tr>
<td>Upper Flammability Limit:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower Flammability Limit:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vapor Pressure (mm Hg):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vapor density (Air =1)</td>
<td></td>
<td>No information available</td>
</tr>
<tr>
<td>Specific Gravity (H₂O=1):</td>
<td></td>
<td>No information available</td>
</tr>
</tbody>
</table>
900 Hydrochloric Acid 20’ Tech

Specific Gravity (2nd value): No information available
Water Solubility: 100% soluble in water
Solubility(ies): No information available
Partition Coefficient (n-octanol/water): No information available
Autoignition Temperature: No information available
Decomposition Temperature: No information available
Kinematic Viscosity: No information available
Dynamic Viscosity: No information available
Oxidizing Properties: No information available
Explosive Properties: Not considered to be an explosion hazard

9.2. Other information
Softening Point: No information available
Molecular Weight: 36.46
VOC Content(%): No information available
Density: 1.16
Bulk Density: No information available

10. Stability and Reactivity
Stability: Stable under normal conditions of use and storage
Conditions to Avoid: Exposure to air or moisture over prolonged periods; Extremes of temperature and direct sunlight; Heat
Incompatible Materials: Strong acids and bases, Oxidizing agents
Hazardous Decomposition Products: Emits toxic hydrogen chloride fumes when heated to decomposition; Will react with water to produce toxic and corrosive fumes; Emits toxic chlorine fumes when heated to decomposition
Possibility of Hazardous Reactions: None under normal processing

11. Toxicological Information

Product Information
Acute Toxicity: 0% of the mixture consists of ingredient(s) of unknown toxicity.
The following values are calculated based on chapter 3.1 of the GHS document

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Oral LD&lt;sub&gt;50&lt;/sub&gt; :</th>
<th>Dermal LD&lt;sub&gt;50&lt;/sub&gt; :</th>
<th>LC&lt;sub&gt;50&lt;/sub&gt; (Lethal Concentration):</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrochloric acid</td>
<td>700 mg/kg ( Rat )</td>
<td>5010 mg/kg ( Rabbit )</td>
<td>3124 ppm ( Rat ) 1 h</td>
</tr>
<tr>
<td>Water</td>
<td>90 mL/kg ( Rat )</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Chronic Toxicity:
Carcinogenicity: This product contains one or more substances which are classified by IARC as carcinogenic to humans (Group 1), probably carcinogenic to humans (Group 2A) or possibly carcinogenic to humans (Group 2B)

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>IARC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrochloric acid</td>
<td>3</td>
</tr>
</tbody>
</table>

IARC (International Agency for Research on Cancer)
Not classifiable as a human carcinogen
Target Organ Effects: Eyes, Respiratory system, Skin

12. Ecological Information

Ecotoxicity

0% of the mixture consists of components(s) of unknown hazards to the aquatic environment

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Toxicity to algae</th>
<th>Toxicity to fish</th>
<th>Toxicity to daphnia and other aquatic invertebrates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrochloric acid</td>
<td></td>
<td>282: 96 h Gambusia affinis mg/L LC50 static</td>
<td></td>
</tr>
</tbody>
</table>

Persistence and Degradability: No information available.
Bioaccumulation: No information available.
Mobility: No information available.

13. Disposal Considerations

Waste from Residues/Unused Products: Disposal should be in accordance with applicable regional, national and local laws and regulations
Contaminated Packaging: Do not reuse container.

14. Transport Information

DOT

Proper shipping name: HYDROCHLORIC ACID
Hazard Class: 8
UN/ID No: UN1789
Packing Group: II
Description: UN1789, HYDROCHLORIC ACID, 8, PG II

15. Regulatory Information

International Inventories
All of the components in the product are on the following Inventory lists: TSCA (United States), Canada (DSL/NDSL), Europe (EINECS/ELINCS/NLP), Australia (AICS), South Korea (KECL), China (IECSC), Philippines (PICCS), This product contains a substance not listed on international inventories - it is for research and development use only.

AICS Complies
TSCA Complies
DSL/NDSL Complies
EINECS/ELINCS Complies
900 Hydrochloric Acid 20' Tech

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>AICS</th>
<th>TSCA</th>
<th>DSL</th>
<th>NDSL</th>
<th>EINECS</th>
<th>ELINCS</th>
<th>ENCS</th>
<th>IECSC</th>
<th>KECL</th>
<th>PICCS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrochloric acid</td>
<td>Listed</td>
<td>Listed</td>
<td>Listed</td>
<td>-</td>
<td>Listed</td>
<td>-</td>
<td>(1)-215</td>
<td>Listed</td>
<td>KE-20189</td>
<td>Present</td>
</tr>
<tr>
<td>Water</td>
<td>Listed</td>
<td>Listed</td>
<td>Listed</td>
<td>-</td>
<td>Listed</td>
<td>-</td>
<td>-</td>
<td>Listed</td>
<td>KE-35400</td>
<td>Present</td>
</tr>
</tbody>
</table>

**Inventory Legend**

**AICS** - Australian Inventory of Chemical Substances

**TSCA** - United States Toxic Substances Control Act Section 8(b) Inventory

**DSL/NDSL** - Canadian Domestic Substances List/Non-Domestic Substances List

**EINECS/ELINCS** - European Inventory of Existing Chemical Substances/European List of Notified Chemical Substances

**ENCS** - Japan Existing and New Chemical Substances

**IECSC** - China Inventory of Existing Chemical Substances

**KECL** - Korean Existing and Evaluated Chemical Substances

**PICCS** - Philippines Inventory of Chemicals and Chemical Substances

**RESTRICTIONS - REACH TITLE VII**  No information available

**US Federal Regulations**

**CERCLA**

This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material

**SARA 313**

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product contains a chemical or chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>SARA 313 - Threshold Values %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrochloric acid</td>
<td>1.0</td>
</tr>
</tbody>
</table>

**SARA 311/312 Hazard Categories**

- Acute health hazard: Yes
- Chronic health hazard: Yes
- Fire hazard: No
- Sudden release of pressure hazard: No
- Reactive hazard: No

**U.S. State Right-to-Know Regulations**

California Proposition 65:
This product does not contain any Proposition 65 chemicals

**16. Other Information**

**National Fire Protection Association (NFPA) Ratings**
Maximum Use (mg/L unless otherwise indicated): 40

Prepared By: HSE Department
Issue Date: 18-Dec-2014
Revision Date: 08-May-2013
Revision Note: Updated section(s) 16

Disclaimer:
Please be advised that it is your responsibility to inform your employees of the hazards of this substance, to advise them of what these properties mean and be sure they understand exposure information. 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 presented herein, while not guaranteed, was prepared by competent technical personnel and is true and accurate to the best of our knowledge. No warranty or guaranty, express or implied, is made regarding performance, stability, or otherwise. This information is not intended to be all-inclusive as to the manner and conditions of use, handling, and storage. Other factors may require additional safety or performance considerations. While our technical personnel will be happy to respond to questions regarding safe handling and use procedures, the handling and use remains the responsibility of the consumer. No suggestions are intended as, and should not be constructed as, a recommendation to infringe on any existing patents or to violate any Federal, State, or local laws.

End of Safety Data Sheet
Hydrochloric Acid 20'

Causes severe skin burns and eye damage - Causes damage to organs (or state all organs affected, if known) (state route of exposure if it is conclusively proven that no other routes of exposure cause hazard) - Causes damage to organs (or state all organs affected, if known) through prolonged or repeated exposure (state route of exposure if it is conclusively proven that no other routes of exposure cause hazard) - Fatal if inhaled

Do not eat, drink or smoke when using this product. - Use only outdoors or in a well-ventilated area. - Wear respiratory protection. - IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell. - IF SWALLOWED: Rinse mouth. Do NOT induce vomiting. - IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower. - IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. - IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. - Absorb spillage to prevent material damage. - Store locked up. - Store in corrosive resistant aluminum container with a resistant inner liner.

Please refer to the original SDS for more information.
1. Product and Company Identification

Use: flocculation agent

Company
BASF CORPORATION
100 Campus Drive
Florham Park, NJ 07932, USA

24 Hour Emergency Response Information
CHEMTREC: 1-800-424-9300
BASF HOTLINE: 1-800-832-HELP

2. Hazards Identification

Emergency overview

May cause mild eye irritation.
Use with local exhaust ventilation.
Avoid dust formation.
Wear protective clothing.
Caution - Slippery when wet!

State of matter: solid
Colour: off-white
Odour: odourless

Potential health effects

Primary routes of exposure:
Routes of entry for solids and liquids include eye and skin contact, ingestion and inhalation. Routes of entry for gases include inhalation and eye contact. Skin contact may be a route of entry for liquified gases.

Chronic toxicity:

Carcinogenicity: None of the components in this product at concentrations greater than 0.1% are listed by IARC, NTP, OSHA or ACGIH as a carcinogen.

Reproductive toxicity: No data available concerning reproduction toxicity.

Teratogenicity: No data available concerning teratogenic effects.

Genotoxicity: No data was available concerning mutagenic activity.

Signs and symptoms of overexposure:
The most important known symptoms and effects are described in the labelling (see section 2) and/or in section 11. Further important symptoms and effects are so far not known.

3. Composition / Information on Ingredients

This product is not regarded as hazardous under current OSHA Hazard Communication standard; CFR 29 Part 1910.1200.

4. First-Aid Measures

**General advice:**
Remove contaminated clothing.

**If inhaled:**
If difficulties occur after dust has been inhaled, remove to fresh air and seek medical attention.

**If on skin:**
Wash thoroughly with soap and water.

If irritation develops, seek medical attention.

**If in eyes:**
Wash affected eyes for at least 15 minutes under running water with eyelids held open.

Seek medical attention.

**If swallowed:**
Rinse mouth and then drink plenty of water. Do not induce vomiting. Immediate medical attention required.

**Note to physician**
Treatment: Treat according to symptoms (decontamination, vital functions), no known specific antidote.

5. Fire-Fighting Measures

**Flash point:** not applicable

**Suitable extinguishing media:**
dry powder, foam

**Unsuitable extinguishing media for safety reasons:**
water jet

**Additional information:**
If water is used, restrict pedestrian and vehicular traffic in areas where slip hazard may exist.

**Hazards during fire-fighting:**
carbon oxides, nitrogen oxides
The substances/groups of substances mentioned can be released in case of fire. Very slippery when wet.

**Protective equipment for fire-fighting:**
Wear a self-contained breathing apparatus.

**Further information:**
The degree of risk is governed by the burning substance and the fire conditions. Contaminated extinguishing water must be disposed of in accordance with official regulations.
6. Accidental release measures

**Personal precautions:**
Use personal protective clothing.

**Environmental precautions:**
Do not discharge into drains/surface waters/groundwater.

**Cleanup:**
Spilled product which becomes wet or spilled aqueous solution create a hazard because of their slippery nature. Avoid raising dust.
For small amounts: Pick up with suitable appliance and dispose of.
For large amounts: Contain with dust binding material and dispose of.

7. Handling and Storage

**Handling**

**General advice:**
Breathing must be protected when large quantities are decanted without local exhaust ventilation. Handle in accordance with good industrial hygiene and safety practice. Forms slippery surfaces with water.

**Storage**

**General advice:**
Store in unopened original containers in a cool and dry place. Avoid wet, damp or humid conditions, temperature extremes and ignition sources.

8. Exposure Controls and Personal Protection

**Personal protective equipment**

**Respiratory protection:**
Wear a NIOSH-certified (or equivalent) organic vapour/particulate respirator.

**Hand protection:**
Chemical resistant protective gloves

**Eye protection:**
Safety glasses with side-shields.

**General safety and hygiene measures:**
Wear protective clothing as necessary to minimize contact. Handle in accordance with good industrial hygiene and safety practice.

9. Physical and Chemical Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Form</td>
<td>powder</td>
<td></td>
</tr>
<tr>
<td>Odour</td>
<td>odourless</td>
<td></td>
</tr>
<tr>
<td>Colour</td>
<td>off-white</td>
<td></td>
</tr>
<tr>
<td>pH value</td>
<td>6 - 8</td>
<td>(10 g/l) The product has not been tested. The statement has been derived from products of a similar structure or composition. The substance / product decomposes therefore not determined.</td>
</tr>
<tr>
<td>Melting point</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bulk density</td>
<td>approx. 750 kg/m3</td>
<td></td>
</tr>
<tr>
<td>% volatiles</td>
<td>not determined</td>
<td></td>
</tr>
</tbody>
</table>
10. Stability and Reactivity

**Conditions to avoid:**
Avoid extreme temperatures. Avoid humidity.

**Substances to avoid:**
strong acids, strong bases, strong oxidizing agents

**Hazardous reactions:**
The product is not a dust explosion risk as supplied; however the build-up of fine dust can lead to a risk of dust explosions.
Stable under normal conditions.
No hazardous reactions known.

**Decomposition products:**
No hazardous decomposition products if stored and handled as prescribed/indicated.

**Corrosion to metals:**
No corrosive effect on metal.

**Oxidizing properties:**
not fire-propagating

11. Toxicological information

**Acute toxicity**

**Oral:**
Type of value: LD50
Species: rat
Value: > 2,000 mg/kg (OECD Guideline 401)

**Irritation / corrosion**

**Skin:**
Species: rabbit
Result: non-irritant
Method: OECD Guideline 404

**Eye:**
Species: rabbit
Result: non-irritant

**Sensitization:**
Result: Non-sensitizing.

**Other Information:**
The product has not been tested. The statements on toxicology have been derived from products of a similar structure and composition.

12. Ecological Information
Fish

Acute:
static
Oncorhynchus mykiss/LC50 (96 h): > 100 mg/l
(under static conditions in the presence of 10 mg/L humic acid)

Aquatic invertebrates

Acute:
Daphnia magna/LC50 (48 h): > 100 mg/l

Environmental mobility:

Information on: Anionic polyacrylamide
Assessment transport between environmental compartments:
Adsorption to solid soil phase is expected.

Other adverse effects:
The product has not been tested. The statements on ecotoxicology have been derived from products of a similar structure and composition.

13. Disposal considerations

Waste disposal of substance:
Dispose of in accordance with national, state and local regulations.

Container disposal:
Dispose of in a licensed facility. Recommend crushing, puncturing or other means to prevent unauthorized use of used containers.

RCRA:
Not a hazardous waste under RCRA (40 CFR 261).

14. Transport Information

Land transport
USDOT
Not classified as a dangerous good under transport regulations

Sea transport
IMDG
Not classified as a dangerous good under transport regulations

Air transport
IATA/ICAO
Not classified as a dangerous good under transport regulations
15. Regulatory Information

VOC content:
not determined

Federal Regulations

Registration status:
Chemical TSCA, US released / listed
TSCA, US released / listed

OSHA hazard category: Chronic target organ effects reported;

EPCRA 311/312 (Hazard categories): Not hazardous;

State regulations

CA Prop. 65:
THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER AND BIRTH DEFECTS OR OTHER REPRODUCTIVE HARM.

16. Other Information

NFPA Hazard codes:
Health: 1 Fire: 1 Reactivity: 0 Special: -

HMIS III rating
Health: 1 Flammability: 1 Physical hazard: 0

NFPA and HMIS use a numbering scale ranging from 0 to 4 to indicate the degree of hazard. A value of zero means that the substance possesses essentially no hazard; a rating of four indicates extreme danger. Although similar, the two rating systems are intended for different purposes, and use different criteria. The NFPA system was developed to provide an on-the-spot alert to the hazards of a material, and their severity, to emergency responders. The HMIS system was designed to communicate workplace hazard information to employees who handle hazardous chemicals.

We support worldwide Responsible Care® initiatives. We value the health and safety of our employees, customers, suppliers and neighbors, and the protection of the environment. Our commitment to Responsible Care is integral to conducting our business and operating our facilities in a safe and environmentally responsible fashion, supporting our customers and suppliers in ensuring the safe and environmentally sound handling of our products, and minimizing the impact of our operations on society and the environment during production, storage, transport, use and disposal of our products.

MSDS Prepared by:
BASF NA Product Regulations
msds@basf.com
MSDS Prepared on: 2011/06/29

MAGNAFLOC® 342 is a registered trademark of BASF Corporation or BASF SE
IMPORTANT: WHILE THE DESCRIPTIONS, DESIGNS, DATA AND INFORMATION CONTAINED HEREIN ARE PRESENTED IN GOOD FAITH AND BELIEVED TO BE ACCURATE, IT IS PROVIDED FOR YOUR GUIDANCE ONLY. BECAUSE MANY FACTORS MAY AFFECT PROCESSING OR APPLICATION/USE, WE RECOMMEND THAT YOU MAKE TESTS TO DETERMINE THE SUITABILITY OF A PRODUCT FOR YOUR PARTICULAR PURPOSE PRIOR TO USE. NO WARRANTIES OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR
END OF DATA SHEET
1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: OPTIMER® 9877 PULV
APPLICATION: FLOCCULANT
COMPANY IDENTIFICATION: Nalco Company
1601 W. Diehl Road
Naperville, Illinois
60563-1198
EMERGENCY TELEPHONE NUMBER(S): (800) 424-9300 (24 Hours) CHEMTREC

NFPA 704M/HMIS RATING
HEALTH: 0 / 1 FLAMMABILITY: 1 / 1 INSTABILITY: 0 / 0 OTHER:
0 = Insignificant 1 = Slight 2 = Moderate 3 = High 4 = Extreme * = Chronic Health Hazard

2. COMPOSITION/INFORMATION ON INGREDIENTS

Based on our hazard evaluation, none of the substances in this product are hazardous.

3. HAZARDS IDENTIFICATION

**EMERGENCY OVERVIEW**

CAUTION
May cause irritation with prolonged contact.
Do not get in eyes, on skin, on clothing. Do not take internally. Avoid generating dusts. Do not breathe dust. Use with adequate ventilation. In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. After contact with skin, wash immediately with plenty of water.
Wear suitable protective clothing.
May form explosive dust-air mixtures. Handling operations may generate combustible dust in the finely divided and suspended state. To reduce the potential for dust explosions and/or fire, do not permit dust to accumulate. Empty product containers may contain product residue. Do not pressurize, cut, heat, weld, or expose containers to flame or other sources of ignition. May evolve oxides of carbon (COx) under fire conditions. May evolve oxides of nitrogen (NOx) under fire conditions.

PRIMARY ROUTES OF EXPOSURE:
Eye, Skin, Inhalation

HUMAN HEALTH HAZARDS - ACUTE:

EYE CONTACT:
May cause irritation with prolonged contact.

SKIN CONTACT:
May cause irritation with prolonged contact.
INGESTION:
Not a likely route of exposure. There may be irritation to the gastro-intestinal tract with nausea and vomiting. May be harmful if swallowed.

INHALATION:
Irritant to respiratory system. If dust is generated, can cause mucous membrane irritation. Repeated or prolonged exposure may irritate the respiratory tract. A single brief inhalation exposure (minutes) is not likely to cause serious effects.

SYMPTOMS OF EXPOSURE:
Acute:
A review of available data does not identify any symptoms from exposure not previously mentioned.

Chronic:
A review of available data does not identify any symptoms from exposure not previously mentioned.

AGGRAVATION OF EXISTING CONDITIONS:
A review of available data does not identify any worsening of existing conditions.

4. FIRST AID MEASURES

EYE CONTACT:
Immediately flush eye with water for at least 15 minutes while holding eyelids open. If only one eye is affected be sure to use care not to contaminate the other eye with the run-off. If irritation persists, repeat flushing. Get medical attention.

SKIN CONTACT:
Immediately wash with plenty of soap and water. Get medical attention.

INGESTION:
Do not induce vomiting without medical advice. If conscious, washout mouth and give water to drink. If reflexive vomiting occurs, rinse mouth and repeat administration of water. Get medical attention. If unconscious, do not give anything by mouth, place in the recovery position, check breathing and pulse. If necessary give artificial respiration.

INHALATION:
Remove to fresh air, treat symptomatically. Get medical attention.

NOTE TO PHYSICIAN:
Based on the individual reactions of the patient, the physician's judgement should be used to control symptoms and clinical condition.

5. FIRE FIGHTING MEASURES

FLASH POINT:
None

EXTINGUISHING MEDIA:
Foam, Dry powder, Carbon dioxide, Other extinguishing agent suitable for Class B fires
Use extinguishing media appropriate for surrounding fire. Not expected to burn.
SAFETY DATA SHEET

PRODUCT

OPTIMER® 9877 PULV

EMERGENCY TELEPHONE NUMBER(S)
(800) 424-9300 (24 Hours) CHEMTREC

UNSUITABLE EXTINGUISHING MEDIA:
Water spray, Do not use water jets.

FIRE AND EXPLOSION HAZARD:
May form explosive dust-air mixtures. Handling operations may generate combustible dust in the finely divided and suspended state. To reduce the potential for dust explosions and/or fire, do not permit dust to accumulate. Empty product containers may contain product residue. Do not pressurize, cut, heat, weld, or expose containers to flame or other sources of ignition. May evolve oxides of carbon (COx) under fire conditions. May evolve oxides of nitrogen (NOx) under fire conditions.

SPECIAL PROTECTIVE EQUIPMENT FOR FIRE FIGHTING:
In case of fire, wear a full face positive-pressure self contained breathing apparatus and protective suit.

6.  ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTIONS:
Restrict access to area as appropriate until clean-up operations are complete. Ensure adequate ventilation. Remove sources of ignition. Ensure clean-up is conducted by trained personnel only. Use personal protective equipment recommended in Section 8 (Exposure Controls/Personal Protection). Notify appropriate government, occupational health and safety and environmental authorities. Spill may be slippery.

METHODS FOR CLEANING UP:
For powder: Remove as much as possible with broom, scoop or vacuum, as the addition of water causes slippery floor conditions. Reclaim into recovery or salvage drums. Dispose of material in compliance with regulations indicated in Section 13 (Disposal Considerations).

ENVIRONMENTAL PRECAUTIONS:
Do not contaminate surface water.

7.  HANDLING AND STORAGE

HANDLING:
Do not get in eyes, on skin, on clothing. Do not take internally. Use with adequate ventilation. Avoid generating dusts. Keep the containers closed when not in use. Ensure all containers are labeled. Use personal protective equipment recommended in Section 8 (Exposure Controls/Personal Protection). Empty product containers may contain product residue. Do not pressurize, cut, heat, weld, or expose containers to flame or other sources of ignition. Do not use, store, spill or pour near heat, sparks or open flame. Maintain good housekeeping practices.

STORAGE CONDITIONS:
Store in a cool well ventilated area away from direct sunlight. Store separately from oxidizers. Keep in dry place. Store away from heat and sources of ignition. Connections must be grounded to avoid electrical charges.

SUITEABLE CONSTRUCTION MATERIAL:
Compatibility with Plastic Materials can vary; we therefore recommend that compatibility is tested prior to use.
8. EXPOSURE CONTROLS/PERSONAL PROTECTION

OCCUPATIONAL EXPOSURE LIMITS:
Exposure guidelines have not been established for this product. Available exposure limits for the substance(s) are shown below.

<table>
<thead>
<tr>
<th>Substance(s)</th>
<th>Category:</th>
<th>ppm</th>
<th>mg/m3</th>
<th>Non-Standard Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inhalable (Total Dust) Nuisance Particulates</td>
<td>ACGIH/TWA</td>
<td>10</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Inhalable (Total Dust) Nuisance Particulates</td>
<td>ACGIH/TWA</td>
<td>3</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Inhalable (Total Dust) Nuisance Particulates</td>
<td>OSHA Z1/PEL</td>
<td>5</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Inhalable (Total Dust) Nuisance Particulates</td>
<td>OSHA Z1/PEL</td>
<td>15</td>
<td>-</td>
<td>15 MPPCF</td>
</tr>
<tr>
<td>Inhalable (Total Dust) Nuisance Particulates</td>
<td>Z3/TWA</td>
<td>15</td>
<td>-</td>
<td>50 MPPCF</td>
</tr>
<tr>
<td>Inhalable (Total Dust) Nuisance Particulates</td>
<td>Z3/TWA</td>
<td>5</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Inhalable (Total Dust) Nuisance Particulates</td>
<td>Z3/TWA</td>
<td>15</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

ENGINEERING MEASURES:
Use general ventilation with local exhaust ventilation. Local exhaust ventilation may be necessary when dusts or mists are generated.

RESPIRATORY PROTECTION:
Due to its low toxicity, the hazard potential associated with this material is relatively low. If dusts are generated, use an approved air-purifying respirator. A particulate cartridge may be used.

HAND PROTECTION:
When handling this product, the use of chemical gloves is recommended. The choice of work glove depends on work conditions and what chemicals are handled. Please contact the PPE manufacturer for advice on what type of glove material may be suitable. Gloves should be replaced immediately if signs of degradation are observed.

SKIN PROTECTION:
Wear chemical resistant apron, chemical splash goggles, impervious gloves and boots.

EYE PROTECTION:
Wear chemical splash goggles.

HYGIENE RECOMMENDATIONS:
Use good work and personal hygiene practices to avoid exposure. Keep a safety shower available. Keep an eye wash fountain available. Always wash thoroughly after handling chemicals. When handling this product never eat, drink or smoke. If clothing is contaminated, remove clothing and thoroughly wash the affected area. Launder contaminated clothing before reuse.

HUMAN EXPOSURE CHARACTERIZATION:
Based on our recommended product application and personal protective equipment, the potential human exposure is: High
9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE Powder
APPEARANCE White
ODOR Slight

SOLUBILITY IN WATER Insoluble
pH (1 %) 5.5 - 7.5
VOC CONTENT 0 % Calculated

Note: These physical properties are typical values for this product and are subject to change.

10. STABILITY AND REACTIVITY

STABILITY:
Stable under normal conditions.

HAZARDOUS POLYMERIZATION:
Hazardous polymerization will not occur.

CONDITIONS TO AVOID:

MATERIALS TO AVOID:
Contact with strong oxidizers (e.g. chlorine, peroxides, chromates, nitric acid, perchlorate, concentrated oxygen, permanganate) may generate heat, fires, explosions and/or toxic vapors.

HAZARDOUS DECOMPOSITION PRODUCTS:
Under fire conditions: Oxides of carbon, Oxides of nitrogen

11. TOXICOLOGICAL INFORMATION

No toxicity studies have been conducted on this product.

SENSITIZATION:
This product is not expected to be a sensitizer.

CARCINOGENICITY:
None of the substances in this product are listed as carcinogens by the International Agency for Research on Cancer (IARC), the National Toxicology Program (NTP) or the American Conference of Governmental Industrial Hygienists (ACGIH).
12. ECOLOGICAL INFORMATION

ECOTOXICOLOGICAL EFFECTS:
No toxicity studies have been conducted on this product.

MOBILITY:
The environmental fate was estimated using a level III fugacity model embedded in the EPI (estimation program interface) Suite TM, provided by the US EPA. The model assumes a steady state condition between the total input and output. The level III model does not require equilibrium between the defined media. The information provided is intended to give the user a general estimate of the environmental fate of this product under the defined conditions of the models.
If released into the environment this material is expected to distribute to the air, water and soil/sediment in the approximate respective percentages:

<table>
<thead>
<tr>
<th>Air</th>
<th>Water</th>
<th>Soil/Sediment</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;5%</td>
<td>&lt; 5%</td>
<td>&gt; 90%</td>
</tr>
</tbody>
</table>

The portion in water is expected to be soluble or dispersible.

BIOACCUMULATION POTENTIAL
This preparation or material is not expected to bioaccumulate.

ENVIRONMENTAL HAZARD AND EXPOSURE CHARACTERIZATION
Based on our hazard characterization, the potential environmental hazard is: Low
Based on our recommended product application and the product’s characteristics, the potential environmental exposure is: Moderate

If released into the environment, see CERCLA/SUPERFUND in Section 15.

13. DISPOSAL CONSIDERATIONS

If this product becomes a waste, it is not a hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA) 40 CFR 261, since it does not have the characteristics of Subpart C, nor is it listed under Subpart D.

As a non-hazardous waste, it is not subject to federal regulation. Consult state or local regulation for any additional handling, treatment or disposal requirements. For disposal, contact a properly licensed waste treatment, storage, disposal or recycling facility. Dispose of wastes in an approved incinerator or waste treatment/disposal site, in accordance with all applicable regulations. Do not dispose of wastes in local sewer or with normal garbage.
14. TRANSPORT INFORMATION

The information in this section is for reference only and should not take the place of a shipping paper (bill of lading) specific to an order. Please note that the proper Shipping Name / Hazard Class may vary by packaging, properties, and mode of transportation. Typical Proper Shipping Names for this product are as follows.

LAND TRANSPORT :

Proper Shipping Name : PRODUCT IS NOT REGULATED DURING TRANSPORTATION

AIR TRANSPORT (ICAO/IATA) :

Proper Shipping Name : PRODUCT IS NOT REGULATED DURING TRANSPORTATION

MARINE TRANSPORT (IMDG/IMO) :

Proper Shipping Name : PRODUCT IS NOT REGULATED DURING TRANSPORTATION

15. REGULATORY INFORMATION

This section contains additional information that may have relevance to regulatory compliance. The information in this section is for reference only. It is not exhaustive, and should not be relied upon to take the place of an individualized compliance or hazard assessment. Nalco accepts no liability for the use of this information.

NATIONAL REGULATIONS, USA :

OSHA HAZARD COMMUNICATION RULE, 29 CFR 1910.1200 :
Based on our hazard evaluation, none of the substances in this product are hazardous.

CERCLA/SUPERFUND, 40 CFR 117, 302 :
Notification of spills of this product is not required.

SARA/SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 (TITLE III) - SECTIONS 302, 311, 312, AND 313 :

SECTION 302 - EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355) :
This product does not contain substances listed in Appendix A and B as an Extremely Hazardous Substance.

SECTIONS 311 AND 312 - MATERIAL SAFETY DATA SHEET REQUIREMENTS (40 CFR 370) :
Our hazard evaluation has found that this product is not hazardous under 29 CFR 1910.1200.

Under SARA 311 and 312, the EPA has established threshold quantities for the reporting of hazardous chemicals. The current thresholds are: 500 pounds or the threshold planning quantity (TPQ), whichever is lower, for extremely hazardous substances and 10,000 pounds for all other hazardous chemicals.
SAFETY DATA SHEET

PRODUCT

OPTIMER® 9877 PULV

EMERGENCY TELEPHONE NUMBER(S)
(800) 424-9300 (24 Hours) CHEMTREC

SECTION 313 - LIST OF TOXIC CHEMICALS (40 CFR 372) :
This product does not contain substances on the List of Toxic Chemicals.

TOXIC SUBSTANCES CONTROL ACT (TSCA) :
The substances in this preparation are included on or exempted from the TSCA 8(b) Inventory (40 CFR 710)

FOOD AND DRUG ADMINISTRATION (FDA) Federal Food, Drug and Cosmetic Act :
When use situations necessitate compliance with FDA regulations, this product is acceptable under ; 21 CFR 176.170 Components of paper and paperboard in contact with aqueous and fatty foods and 21 CFR 176.180 Components of paper and paperboard in contact with dry foods.

FEDERAL WATER POLLUTION CONTROL ACT, CLEAN WATER ACT, 40 CFR 401.15 / formerly Sec. 307, 40 CFR 116.4 / formerly Sec. 311 :
Substances listed under this regulation are not intentionally added or expected to be present in this product. Listed components may be present at trace levels.

CLEAN AIR ACT, Sec. 112 (40 CFR 61, Hazardous Air Pollutants), Sec. 602 (40 CFR 82, Class I and II Ozone Depleting Substances) :
Substances listed under this regulation are not intentionally added or expected to be present in this product. Listed components may be present at trace levels.

CALIFORNIA PROPOSITION 65 :
Substances listed under California Proposition 65 are not intentionally added or expected to be present in this product.

MICHIGAN CRITICAL MATERIALS :
Substances listed under this regulation are not intentionally added or expected to be present in this product. Listed components may be present at trace levels.

STATE RIGHT TO KNOW LAWS :
Substances listed under this regulation are not intentionally added or expected to be present in this product. Listed components may be present at trace levels.

NATIONAL REGULATIONS, CANADA :

WORKPLACE HAZARDOUS MATERIALS INFORMATION SYSTEM (WHMIS) :
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

WHMIS CLASSIFICATION :
Not considered a WHMIS controlled product.

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) :
The substance(s) in this preparation are included in or exempted from the Domestic Substance List (DSL).
AUSTRALIA
All substances in this product comply with the National Industrial Chemicals Notification & Assessment Scheme (NICNAS).

CHINA
All substances in this product comply with the Provisions on the Environmental Administration of New Chemical Substances and are listed on the Inventory of Existing Chemical Substances China (IECSC).

EUROPE
The substances in this preparation have been reviewed for compliance with the EINECS or ELINCS inventories.

JAPAN
All substances in this product comply with the Law Regulating the Manufacture and Importation Of Chemical Substances and are listed on the Existing and New Chemical Substances list (ENCS).

KOREA
All substances in this product comply with the Toxic Chemical Control Law (TCCL) and are listed on the Existing Chemicals List (ECL)

PHILIPPINES
All substances in this product comply with the Republic Act 6969 (RA 6969) and are listed on the Philippines Inventory of Chemicals & Chemical Substances (PICCS).

16. OTHER INFORMATION

Due to our commitment to Product Stewardship, we have evaluated the human and environmental hazards and exposures of this product. Based on our recommended use of this product, we have characterized the product's general risk. This information should provide assistance for your own risk management practices. We have evaluated our product's risk as follows:

* The human risk is: Low
* The environmental risk is: Low

Any use inconsistent with our recommendations may affect the risk characterization. Our sales representative will assist you to determine if your product application is consistent with our recommendations. Together we can implement an appropriate risk management process.

This product material safety data sheet provides health and safety information. The product is to be used in applications consistent with our product literature. Individuals handling this product should be informed of the recommended safety precautions and should have access to this information. For any other uses, exposures should be evaluated so that appropriate handling practices and training programs can be established to insure safe workplace operations. Please consult your local sales representative for any further information.

REFERENCES

Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices, American Conference of Governmental Industrial Hygienists, OH., (Ariel Insight” CD-ROM Version), Ariel Research Corp., Bethesda, MD.
Hazardous Substances Data Bank, National Library of Medicine, Bethesda, Maryland (TOMES CPS™ CD-ROM Version), Micromedex, Inc., Englewood, CO.


Registry of Toxic Effects of Chemical Substances, National Institute for Occupational Safety and Health, Cincinnati, OH, (TOMES CPS™ CD-ROM Version), Micromedex, Inc., Englewood, CO.

Ariel Insight™ (An integrated guide to industrial chemicals covered under major regulatory and advisory programs), North American Module, Western European Module, Chemical Inventories Module and the Generics Module (Ariel Insight™ CD-ROM Version), Ariel Research Corp., Bethesda, MD.

The Teratogen Information System, University of Washington, Seattle, WA (TOMES CPS™ CD-ROM Version), Micromedex, Inc., Englewood, CO.

Prepared By: Product Safety Department
Date issued: 08/28/2009
Version Number: 1.10
**FLOCCULANT**

**CAUTION!** May cause irritation with prolonged contact. Do not get in eyes, on skin, on clothing. Do not take internally. Avoid generating dusts. Do not breathe dust. Use with adequate ventilation. In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. After contact with skin, wash immediately with plenty of water. Wear suitable protective clothing.

**ATTENTION:** For more information refer to the material safety data sheet. Empty containers may contain residual product. DO NOT reuse containers unless properly reconditioned.

**U.S. DOT Shipping Name:** PRODUCT IS NOT REGULATED DURING TRANSPORTATION

**MARINE TRANSPORT (IMDG/IMO):** PRODUCT IS NOT REGULATED DURING TRANSPORTATION
Safety Data Sheet
Magnafloc® 155

1. Product and Company Identification

Use: flocculation agent

<table>
<thead>
<tr>
<th>Company</th>
<th>24 Hour Emergency Response Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>BASF CORPORATION</td>
<td>CHEMTREC: 1-800-424-9300</td>
</tr>
<tr>
<td>100 Park Avenue</td>
<td>BASF HOTLINE: 1-800-832-HELP (4357)</td>
</tr>
<tr>
<td>Florham Park, NJ 07932, USA</td>
<td></td>
</tr>
</tbody>
</table>

2. Hazards Identification

Emergency overview

May cause mild eye and skin irritation based on a component of this product.
Organic powders may be capable of generating static discharges and creating explosive mixtures in air. Handle with caution.
Avoid dust formation.
Use with local exhaust ventilation.
Wear protective clothing.
Caution - Slippery when wet!

State of matter: solid
Colour: off-white
Odour: odourless

Potential health effects

Primary routes of exposure:
Routes of entry for solids and liquids include eye and skin contact, ingestion and inhalation. Routes of entry for gases include inhalation and eye contact. Skin contact may be a route of entry for liquified gases.

Chronic toxicity:

Carcinogenicity: None of the components in this product at concentrations greater than 0.1% are listed by IARC; NTP, OSHA or ACGIH as a carcinogen.

Reproductive toxicity: No data available concerning reproduction toxicity.

Teratogenicity: No data available concerning teratogenic effects.

Genotoxicity: No data was available concerning mutagenic activity.
Signs and symptoms of overexposure:
The most important known symptoms and effects are described in the labelling (see section 2) and/or in section 11., Further important symptoms and effects are so far not known.

3. Composition / Information on Ingredients

This product is not regarded as hazardous under current OSHA Hazard Communication standard; CFR 29 Part 1910.1200.

4. First-Aid Measures

General advice:
Remove contaminated clothing.

If inhaled:
If difficulties occur after dust has been inhaled, remove to fresh air and seek medical attention.

If on skin:
Wash thoroughly with soap and water.
If irritation develops, seek medical attention.

If in eyes:
Wash affected eyes for at least 15 minutes under running water with eyelids held open.
Seek medical attention.

If swallowed:
Rinse mouth and then drink plenty of water. Do not induce vomiting. Immediate medical attention required.

Note to physician
Treatment: Treat according to symptoms (decontamination, vital functions), no known specific antidote.

5. Fire-Fighting Measures

Flash point: not applicable
Autoignition: 350 °C

Suitable extinguishing media:
dry powder, foam

Unsuitable extinguishing media for safety reasons:
water jet

Additional information:
If water is used, restrict pedestrian and vehicular traffic in areas where slip hazard may exist.

Hazards during fire-fighting:
carbon oxides, nitrogen oxides
The substances/groups of substances mentioned can be released in case of fire. Very slippery when wet.

Protective equipment for fire-fighting:
Wear a self-contained breathing apparatus.
Further information:
The degree of risk is governed by the burning substance and the fire conditions. Contaminated extinguishing water must be disposed of in accordance with official regulations.

6. Accidental release measures

Personal precautions:
Use personal protective clothing.

Environmental precautions:
Do not discharge into drains/surface waters/groundwater.

Cleanup:
Spilled product which becomes wet or spilled aqueous solution create a hazard because of their slippery nature.
Avoid raising dust.
For small amounts: Pick up with suitable appliance and dispose of.
For large amounts: Contain with dust binding material and dispose of.

7. Handling and Storage

Handling
General advice:
Breathing must be protected when large quantities are decanted without local exhaust ventilation. Handle in accordance with good industrial hygiene and safety practice. Forms slippery surfaces with water.

Storage
General advice:
Store in unopened original containers in a cool and dry place. Avoid wet, damp or humid conditions, temperature extremes and ignition sources.

8. Exposure Controls and Personal Protection

Personal protective equipment

Respiratory protection:
Wear a NIOSH-certified (or equivalent) organic vapour/particulate respirator.

Hand protection:
Chemical resistant protective gloves

Eye protection:
Safety glasses with side-shields.

General safety and hygiene measures:
Wear protective clothing as necessary to minimize contact. Handle in accordance with good industrial hygiene and safety practice.

9. Physical and Chemical Properties

Form: powder
Odour: odourless
Colour: off-white
pH value: 6 - 8

(10 g/l) The product has not been tested.
The statement has been derived from products of a similar structure or composition.
10. Stability and Reactivity

Conditions to avoid:
Avoid extreme temperatures. Avoid humidity.

Substances to avoid:
strong acids, strong bases, strong oxidizing agents

Hazardous reactions:
The product is not a dust explosion risk as supplied; however the build-up of fine dust can lead to a risk of dust explosions.
Stable under normal conditions.
No hazardous reactions known.

Decomposition products:
No hazardous decomposition products if stored and handled as prescribed/indicated.

Corrosion to metals:
No corrosive effect on metal.

Oxidizing properties:
not fire-propagating

11. Toxicological information

Acute toxicity

Oral:
Type of value: LD50
Species: rat
Value: > 2,000 mg/kg (OECD Guideline 401)

Irritation / corrosion

Skin:
Species: rabbit
Result: non-irritant
Method: OECD Guideline 404

Eye:
Species: rabbit
Result: non-irritant

Sensitization:
Result: Non-sensitizing.

Other Information:
The product has not been tested. The statements on toxicology have been derived from products of a similar structure and composition.
12. Ecological Information

Fish

Acute:
static
Oncorhynchus mykiss/LC50 (96 h): > 100 mg/l
(under static conditions in the presence of 10 mg/L humic acid)

Aquatic invertebrates

Acute:
Daphnia magna/LC50 (48 h): > 100 mg/l

Environmental mobility:

Information on: Anionic polyacrylamide
Assessment transport between environmental compartments:
Adsorption to solid soil phase is expected.

Other adverse effects:
The product has not been tested. The statements on ecotoxicology have been derived from products of a similar structure and composition.

13. Disposal considerations

Waste disposal of substance:
Dispose of in accordance with national, state and local regulations.

Container disposal:
Dispose of in a licensed facility. Recommend crushing, puncturing or other means to prevent unauthorized use of used containers.

RCRA:
Not a hazardous waste under RCRA (40 CFR 261).

14. Transport Information

Land transport
USDOT

Not classified as a dangerous good under transport regulations

Sea transport
IMDG

Not classified as a dangerous good under transport regulations

Air transport
IATA/ICAO
15. Regulatory Information

VOC content:

not determined

Federal Regulations

Registration status:

Chemical TSCA, US released / listed

OSHA hazard category: This material is classified as not hazardous under OSHA regulations;

EPCRA 311/312 (Hazard categories): Not hazardous;

CERCLA RQ CAS Number Chemical name
5000 lbs 79-06-1 acrylamide
1000 lbs 1310-73-2 Sodium Hydroxide

State regulations

CA Prop. 65: THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER AND BIRTH DEFECTS OR OTHER REPRODUCTIVE HARM.

16. Other Information

NFPA Hazard codes:

Health: 0 Fire: 1 Reactivity: 0 Special: -

HMIS III rating

Health: 0 Flammability: 1 Physical hazard: 0

NFPA and HMIS use a numbering scale ranging from 0 to 4 to indicate the degree of hazard. A value of zero means that the substance possesses essentially no hazard; a rating of four indicates extreme danger. Although similar, the two rating systems are intended for different purposes, and use different criteria. The NFPA system was developed to provide an on-the-spot alert to the hazards of a material, and their severity, to emergency responders. The HMIS system was designed to communicate workplace hazard information to employees who handle hazardous chemicals.

We support worldwide Responsible Care® initiatives. We value the health and safety of our employees, customers, suppliers and neighbors, and the protection of the environment. Our commitment to Responsible Care is integral to conducting our business and operating our facilities in a safe and environmentally responsible fashion, supporting our customers and suppliers in ensuring the safe and environmentally sound handling of our products, and minimizing the impact of our operations on society and the environment during production, storage, transport, use and disposal of our products.

MSDS Prepared by:
BASF NA Product Regulations
msds@basf.com
MSDS Prepared on: 2011/06/20

Magnafloc® 155 is a registered trademark of BASF Corporation or BASF SE IMPORTANT: WHILE THE DESCRIPTIONS, DESIGNS, DATA AND INFORMATION CONTAINED HEREIN ARE PRESENTED IN GOOD FAITH AND BELIEVED TO BE ACCURATE, IT IS PROVIDED FOR YOUR GUIDANCE ONLY. BECAUSE MANY FACTORS MAY AFFECT PROCESSING OR APPLICATION/USE, WE
RECOMMEND THAT YOU MAKE TESTS TO DETERMINE THE SUITABILITY OF A PRODUCT FOR YOUR PARTICULAR PURPOSE PRIOR TO USE. NO WARRANTIES OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ARE MADE REGARDING PRODUCTS DESCRIBED OR DESIGNS, DATA OR INFORMATION SET FORTH, OR THAT THE PRODUCTS, DESIGNS, DATA OR INFORMATION MAY BE USED WITHOUT INFRINGING THE INTELLECTUAL PROPERTY RIGHTS OF OTHERS. IN NO CASE SHALL THE DESCRIPTIONS, INFORMATION, DATA OR DESIGNS PROVIDED BE CONSIDERED A PART OF OUR TERMS AND CONDITIONS OF SALE. FURTHER, YOU EXPRESSLY UNDERSTAND AND AGREE THAT THE DESCRIPTIONS, DESIGNS, DATA, AND INFORMATION FurnISHED BY BASF HEREUNDER ARE GIVEN GRATIS AND BASF ASSUMES NO OBLIGATION OR LIABILITY FOR THE DESCRIPTION, DESIGNS, DATA AND INFORMATION GIVEN OR RESULTS OBTAINED, ALL SUCH BEING GIVEN AND ACCEPTED AT YOUR RISK.

END OF DATA SHEET
May cause mild eye and skin irritation based on a component of this product. Organic powders may be capable of generating static discharges and creating explosive mixtures in air. Handle with caution. Avoid dust formation. Use with local exhaust ventilation. Wear protective clothing. Caution - Slippery when wet!

FIRST AID: GENERAL: Remove contaminated clothing. SKIN: Wash thoroughly with soap and water. If irritation develops, seek medical attention. EYES: Wash affected eyes for at least 15 minutes under running water with eyelids held open. Seek medical attention. INGESTION: Rinse mouth and then drink plenty of water. Do not induce vomiting. Immediate medical attention required. INHALATION: If difficulties occur after dust has been inhaled, remove to fresh air and seek medical attention.

IN CASE OF FIRE: EXTINGUISHING MEDIA: dry powder, foam MAY BE Emitted: carbon oxides nitrogen oxides The substances/groups of substances mentioned can be released in case of fire. Very slippery when wet. Wear a self-contained breathing apparatus. The degree of risk is governed by the burning substance and the fire conditions. Contaminated extinguishing water must be disposed of in accordance with official regulations.

IN CASE OF SPILLS OR LEAKS: Use personal protective clothing. Do not discharge into drains/surface waters/groundwater. Spilled product which becomes wet or spilled aqueous solution create a hazard because of their slippery nature. Avoid raising dust.

EMPTY CONTAINERS: Dispose of in a licensed facility. Recommend crushing, puncturing or other means to prevent unauthorized use of used containers.

DISPOSAL: Dispose of in accordance with national, state and local regulations.

HANDLING AND STORAGE: Breathing must be protected when large quantities are decanted without local exhaust ventilation. Handle in accordance with good industrial hygiene and safety practice. Forms slippery surfaces with water. Store in unopened original containers in a cool and dry place. Avoid wet, damp or humid conditions, temperature extremes and ignition sources.

IN CASE OF CHEMICAL EMERGENCY: Call CHEMTREC day or night for assistance and information concerning spilled material, fire, explosive, and other chemical accidents. 800-424-9300 or 703-527-3887 outside the US.

ATTENTION: Refer to our technical bulletin and material safety data sheet regarding safety, usage, application, hazards, procedures and disposal of this product. Consult your supervisor for additional information.

RTK: urea 57-13-6; Water 7732-18-5; 2-Propenoic acid, sodium salt, polymer with 2-propenamide 25085-02-3

PROPER SHIPPING NAME: NOT REQUIRED

BASF CORPORATION
2301 WILROY RD.
SUFFOLK, VA, 23434 USA

PKG NO: 1
NET     GROSS
KG 25.0   25.2
LB 55.1   55.6
Magnafloc® 155

Anionic flocculant

Description
Magnafloc 155 is a high molecular weight anionic polyacrylamide flocculant supplied as a free flowing granular powder.

Principal uses
Magnafloc 155 has found application in a wide variety of mineral processing operations including the following:

1. Base metal sulphide and oxide concentrates thickening and filtration
2. Clarification of "neutral" stage electrolytic zinc pulp
3. Sedimentation of coal tailings
4. Sedimentation of coal fines
5. Filtration of coal fines
6. Sedimentation and filtration of cobalt hydroxide
7. Sedimentation of iron oxides in copper/cobalt leach systems and clarification of pregnant liquors
8. Sedimentation of fine sands and clays

Dosage depends upon the application but normally lies in the range 2–500 g/tonne of dry substrate flocculated.

Typical properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical form</td>
<td>Off-white granular powder</td>
</tr>
<tr>
<td>Particle size</td>
<td>98% &lt; 1000 μm</td>
</tr>
<tr>
<td>Bulk density</td>
<td>0.75 g/cm³</td>
</tr>
<tr>
<td>pH of 1% solution at 25 °C</td>
<td>7.0</td>
</tr>
<tr>
<td>Viscosity at 25 °C</td>
<td>See graph and table</td>
</tr>
</tbody>
</table>

Apparent Viscosity-Concentration Graph
(Fann Viscometer-Shear Rate 5.11 sec⁻¹)
Application & Storage

Recommended solution concentrations:

Stock solution: 0.25 – 0.5 % max.
Feed solution: 0.025 – 0.1 % max.

Shelf life

2 years from receipt of goods

Stock solution: 1 – 2 days

Storage of polymer should be in a cool, dry place.

Details on preparation and application can be obtained from a BASF representative.

Solution viscosity data
(Fann viscometer – 25 °C – solvent – deionised water)

<table>
<thead>
<tr>
<th>Magnafloc 155 concentration (%)</th>
<th>Shear rate (sec⁻¹)</th>
<th>5.11</th>
<th>10.22</th>
<th>170</th>
<th>340</th>
<th>511</th>
<th>1022</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>Viscosity (cP)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1700</td>
<td></td>
<td>1050</td>
<td>180</td>
<td>120</td>
<td>60</td>
<td>48</td>
<td></td>
</tr>
<tr>
<td>0.5</td>
<td></td>
<td>900</td>
<td>550</td>
<td>78</td>
<td>62</td>
<td>49</td>
<td>41</td>
</tr>
<tr>
<td>0.25</td>
<td></td>
<td>400</td>
<td>255</td>
<td>44</td>
<td>33</td>
<td>26</td>
<td>22</td>
</tr>
<tr>
<td>0.10</td>
<td></td>
<td>180</td>
<td>125</td>
<td>22</td>
<td>17</td>
<td>14</td>
<td>11</td>
</tr>
</tbody>
</table>

Shipping & Handling

Magnafloc 155 is supplied in 25 kg nett plastic bags shrinkwrapped onto a pallet suitable for export shipment. The product can also be supplied via intermediate big bags or bulk tanker. Specific details of bag and tanker sizes can be obtained on request.

Corrosivity towards most standard materials of construction is low, but aluminium and galvanised equipment should be avoided.

Technical service

Advice and assistance in the running of laboratory and plant tests to select the correct product and determine the best application can be provided by representatives of BASF, who are experienced in mineral processing applications.

Health & Safety

Magnafloc 155 exhibits a very low order of oral toxicity and does not present any abnormal problems in its handling or general use.

Detailed information on handling and any precautions to be observed in the use of the product(s) described in this leaflet can be found in our relevant health and safety information sheet.

Note

The data contained in this publication are based on our current knowledge and experience. In view of the many factors that may affect processing and application of our product, these data do not relieve processors from carrying out their own investigations and tests; neither do these data imply any guarantee of certain properties, nor the suitability of the product for a specific purpose. Any descriptions, drawings, photographs, data, proportions, weights etc. given herein may change without prior information and do not constitute the agreed contractual quality of the product. It is the responsibility of the recipient of our products to ensure that any proprietary rights and existing laws and legislation are observed.

March 2013

BASF SE
Global Mining Solutions
67056 Ludwigshafen, Germany
www.basf.com/miningsolutions
1. IDENTIFICATION OF THE PRODUCT AND THE COMPANY

Product Name: NS 6670
Company: Neo Solutions, Inc.
P.O. Box 26
Beaver, PA 15009
Emergency Telephone Number: (724) 728-1847 Fax: (724) 728-3440
Product Use: Process aid for industrial applications.

2. HAZARDS IDENTIFICATION

Appearance and Odor: Form: Granular solid Color: White Odor: None

Emergency Overview

Aqueous solutions or powders that become wet render surfaces extremely slippery.

3. COMPOSITION / INFORMATION ON INGREDIENTS

Regulated Components: None

4. FIRST AID MEASURES

Inhalation: No hazards which require special first aid measures.
Skin contact: Wash with water and soap as a precaution. In case of persistent skin irritation, consult a physician.
Eye contact: Rinse thoroughly with plenty of water, also under the eyelids. In case of persistent eye irritation, consult a physician.
Ingestion: No hazards which require special first aid measures. The product is not considered toxic based on studies on laboratory animals.
5. FIRE-FIGHTING MEASURES

Unsuitable extinguishing media: None
Special fire-fighting precautions: Aqueous solutions or powders that become wet render surfaces extremely slippery.
Special protective equipment for firefighters: No special protective equipment required.
Flash point: Not applicable
Autoignition temperature: Not applicable

6. ACCIDENTAL RELEASE MEASURES

Personal precautions: No special precautions required.
Environmental precautions: As with all chemical products, DO NOT flush into surface water.
Methods for cleaning up: DO NOT flush with water. Clean up promptly by sweeping or vacuum. Keep in suitable and closed containers for disposal. After cleaning, flush away traces with water.

7. HANDLING AND STORAGE

Handling
Safe handling advice: Avoid contact with skin and eyes. Avoid dust formation. DO NOT breathe dust. Wash hands before breaks and at the end of workday.
Storage: Keep in a dry, cool place (5 - 35° C).

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Occupational Exposure Limits: No exposure limits noted for ingredient(s).
Engineering measures: Use local exhaust if dusting occurs. Natural ventilation is adequate in absence of dusts.
Personal protection equipment
Respiratory protection: Dust safety masks are recommended where concentration of total dust is more than 10 mg / m³.
Hand protection: Rubber gloves.
Eye protection: Safety glasses with side-shields. Do not wear contact lenses where this product is used.
Skin and body protection: Chemical resistant apron or protective suit if splashing or repeated contact with solution is likely.

Hygiene measures: Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

9. PHYSICAL AND CHEMICAL PROPERTIES

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Form</td>
<td>granular solid</td>
</tr>
<tr>
<td>Color</td>
<td>white</td>
</tr>
<tr>
<td>Odor</td>
<td>none</td>
</tr>
<tr>
<td>pH</td>
<td>4 - 9 @ 5 g / L</td>
</tr>
<tr>
<td>Melting point (° C):</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Flash point:</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Autoignition temperature:</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Vapor pressure (mm Hg):</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Approx. Bulk density:</td>
<td>0.80</td>
</tr>
<tr>
<td>Water solubility</td>
<td>Completely miscible</td>
</tr>
<tr>
<td>$L_{ow}$</td>
<td>$P_{ow}$</td>
</tr>
<tr>
<td></td>
<td>~0</td>
</tr>
</tbody>
</table>

10. STABILITY AND REACTIVITY

Stability: Product is stable, no hazardous polymerization will occur.

Materials to avoid: Oxidizing agents may cause exothermic reactions.

Hazardous decomposition products: Thermal decomposition may produce: nitrogen oxides (NOx), carbon oxides.

11. TOXICOLOGICAL INFORMATION

Acute toxicity

Skin: The results of testing on rabbits showed this material to be non-toxic even at high dose levels.

Oral: LD50 / oral / rat > 5000 mg / kg

Inhalation: The product is not expected to be toxic by inhalation.

Irritation

Skin: The results of testing on rabbits showed this material to be non-irritating to the skin.

Eyes: Testing conducted according to the Draize technique showed the material produces no corneal or iridial effects and only slight transitory conjunctival effects similar to those which all granular materials have on conjunctivae.

Sensitization: The results of testing on guinea pigs showed this material to be non-sensitizing.

Chronic toxicity: A two-year feeding study on rats did not reveal adverse health effects. A one-year feeding study on dogs did not reveal adverse health effects.
12. **ECOLOGICAL INFORMATION**

**Acute aquatic toxicity**

Toxicity to fish: LC50 / 96 hours > 100 mg / L (OECD 203)

Toxicity to daphnia: LC50 / Daphnia m. / 48 hours > 100 mg / L (OECD 202)

Toxicity to algae: IC50 / Scenedesmus subspicatus / 72 hours > 100 mg / L (OECD 201)

**Environmental fate**

Persistence and degradation: Not readily biodegradable.

Hydrolysis: Does not hydrolyze.

\( \text{LogPow} \): ~0

Bioaccumulation: Does not bioaccumulate.

13. **DISPOSAL CONSIDERATIONS**

Disposal: Dispose of in accordance with local, state/provincial and federal regulations.

Container: Rinse empty containers with water and use the rinse water to prepare the working solution. Can be landfilled or incinerated, when in compliance with local, state/provincial and federal regulations.

14. **TRANSPORT INFORMATION**

**DOT:** Remarks: Not classified as dangerous in the meaning of DOT regulations.

**IMDG / IMO:** Remarks: Not classified as dangerous in the meaning of IMDG / IMO regulations.

**ICAO / IATA:** Remarks: Not classified as dangerous in the meaning of ICAO / IATA regulations.

15. **REGULATORY INFORMATION**

**US SARA Reporting Requirements**

**SATA Title III Sections**

**State Regulations**

**California Proposition 65 Information:** The following statement is made in order to comply with the California Safe Drinking Water and Toxic Enforcement Act of 1986. This product contains the following substance(s) known to the State of California to cause cancer: Acrylamide.
International Inventories

USA (TSCA): All components of this product are either listed on the inventory or are exempt from listing.

Australia (AICS): All components of this product are either listed on the inventory or are exempt from listing.

Canada (DSL): All components of this product are either listed on the inventory or are exempt from listing.

China (IECSC): All components of this product are either listed on the inventory or are exempt from listing.

Europe Union (EINECS / ELINCS): All components of this product are either listed on the inventory or are exempt from listing.

Japan (ENCS): All components of this product are either listed on the inventory or are exempt from listing.

Korea (ECL): All components of this product are either listed on the inventory or are exempt from listing.

Philippines (PICCS): All components of this product are either listed on the inventory or are exempt from listing.

16. OTHER INFORMATION

Person to contact: Product Manager

NFPA and HMIS Ratings:

<table>
<thead>
<tr>
<th></th>
<th>NFPA</th>
<th>HMIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>HEALTH</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>FLAMMABILITY</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>INSTABILITY</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>PHYSICAL HAZARD</td>
<td></td>
<td>0</td>
</tr>
</tbody>
</table>

This MSDS was prepared in accordance with the following:

ISO 11014-1: Material Safety Data Sheet for Chemical Products.

ANSI Z400.1-2004; Material Safety Data Sheets - Preparation

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 guide 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.
**Hazard symbol(s):** none  
**Signal Word:** none  
**Hazard statement(s):** Aqueous solutions or powders that become wet render surfaces extremely slippery  
**Precautionary Statement(s):** none  

**Prevention**  
P280 – Wear protective gloves / protective clothing / eye protection / face protection.  
P273 – Avoid release to the environment.  

**Response**  
P304+P341 – If breathing is difficult, remove victim to fresh air.  
P302+352 – Wash with plenty of soap and water.  
P313+P337 – If eye irritation persists: Get medical advice/attention.  
P301+P331 – Rinse mouth. Do NOT induce vomiting.  

**Disposal**  
P501 – Dispose of contents/container in an approved waste disposal plant.

**DOT:** Not classified as dangerous in the meaning of transport regulations.

**First Aid Measures**

- **Inhalation:** Move to fresh air. No hazards which require special first aid measures.  
- **Skin contact:** Wash with water and soap as a precaution. Get medical attention if irritation develops and persists.  
- **Eye contact:** Rinse thoroughly with plenty of water, also under the eyelids. Get medical attention.  
- **Ingestion:** Rinse mouth with water. **DO NOT** induce vomiting. No hazards which require first aid measures.

**Fire-Fighting Measures**

- **Suitable extinguishing media:** Water, Water spray, Foam, Dry powder, Carbon dioxide (CO₂).  
- **Special fire-fighting precautions:** Aqueous solutions or powders that become wet render surfaces extremely slippery.  
- **Special protective equipment for firefighters:** No special protective equipment required. This product **MUST NOT** be discharged into drains.

**Accidental Release**

- **Personal precautions:** No special precautions required.  
- **Environmental precautions:** As with all chemical products, **DO NOT** flush into surface water.  
- **Methods for cleaning up:** **DO NOT** flush with water. Clean up promptly by scoop or vacuum. Keep in suitable and closed containers for disposal. After cleaning, flush away traces with water.

**Disposal**

- **Disposal:** Dispose of in accordance with local, state, provincial and federal regulations.  
- **Container:** Can be landfilled or incinerated, when in compliance with local, state, provincial and federal regulations.
1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: NALCLEAR® 8173 P
APPLICATION: WATER CLARIFICATION AID
COMPANY IDENTIFICATION: Nalco Company
1601 W. Diehl Road
Naperville, Illinois
60563-1198
EMERGENCY TELEPHONE NUMBER(S): (800) 424-9300 (24 Hours) CHEMTREC

NFPA 704M/HMIS RATING
HEALTH: 0 / 1 FLAMMABILITY: 1 / 1 INSTABILITY: 0 / 0 OTHER:
0 = Insignificant 1 = Slight 2 = Moderate 3 = High 4 = Extreme * = Chronic Health Hazard

2. COMPOSITION/INFORMATION ON INGREDIENTS

Based on our hazard evaluation, none of the substances in this product are hazardous.

3. HAZARDS IDENTIFICATION

**EMERGENCY OVERVIEW**

CAUTION
May cause irritation with prolonged contact.
Do not get in eyes, on skin, on clothing. Do not take internally. Do not breathe dust. In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. After contact with skin, wash immediately with plenty of soap and water. Avoid generating dusts.
Wear suitable protective clothing.
May form explosive dust-air mixtures. Handling operations may generate combustible dust in the finely divided and suspended state. To reduce the potential for dust explosions and/or fire, do not permit dust to accumulate. Empty product containers may contain product residue. Do not pressurize, cut, heat, weld, or expose containers to flame or other sources of ignition. May evolve oxides of carbon (COx) under fire conditions. May evolve oxides of nitrogen (NOx) under fire conditions.

PRIMARY ROUTES OF EXPOSURE:
Eye, Skin, Inhalation

HUMAN HEALTH HAZARDS - ACUTE:

EYE CONTACT:
May cause irritation with prolonged contact.

SKIN CONTACT:
May cause irritation with prolonged contact.
INGESTION:
Not a likely route of exposure. May be harmful if swallowed.

INHALATION:
If dust is generated, can cause mucous membrane irritation. A single brief inhalation exposure (minutes) is not likely to cause serious effects.

SYMPTOMS OF EXPOSURE:
Acute:
A review of available data does not identify any symptoms from exposure not previously mentioned.
Chronic:
A review of available data does not identify any symptoms from exposure not previously mentioned.

AGGRAVATION OF EXISTING CONDITIONS:
A review of available data does not identify any worsening of existing conditions.

HUMAN HEALTH HAZARDS - CHRONIC:
No adverse effects expected other than those mentioned above.

4. FIRST AID MEASURES

EYE CONTACT:
Immediately flush eye with water for at least 15 minutes while holding eyelids open. Get immediate medical attention.

SKIN CONTACT:
Immediately wash with plenty of soap and water. Remove contaminated clothing. Wash off affected area immediately with soap and plenty of water. If skin irritation persists, obtain medical attention.

INGESTION:
Do not induce vomiting without medical advice. If conscious, washout mouth and give water to drink. Get medical attention.

INHALATION:
Remove to fresh air, treat symptomatically. Get medical attention.

NOTE TO PHYSICIAN:
Based on the individual reactions of the patient, the physician's judgement should be used to control symptoms and clinical condition.

5. FIRE FIGHTING MEASURES

FLASH POINT: None
LOWER EXPLOSION LIMIT: Not flammable
UPPER EXPLOSION LIMIT: Not flammable
SAFETY DATA SHEET

PRODUCT

NALCLEAR® 8173 P

EMERGENCY TELEPHONE NUMBER(S)

(800) 424-9300 (24 Hours) CHEMTREC

---

**EXTINGUISHING MEDIA:**
Use extinguishing media appropriate for surrounding fire.

**UNSUITABLE EXTINGUISHING MEDIA:**
Do not use water unless flooding amounts are available.

**FIRE AND EXPLOSION HAZARD:**
May form explosive dust-air mixtures. Handling operations may generate combustible dust in the finely divided and suspended state. To reduce the potential for dust explosions and/or fire, do not permit dust to accumulate. Empty product containers may contain product residue. Do not pressurize, cut, heat, weld, or expose containers to flame or other sources of ignition. May evolve oxides of carbon (COx) under fire conditions. May evolve oxides of nitrogen (NOx) under fire conditions.

**SPECIAL PROTECTIVE EQUIPMENT FOR FIRE FIGHTING:**
In case of fire, wear a full face positive-pressure self contained breathing apparatus and protective suit.

---

### 6. ACCIDENTAL RELEASE MEASURES

**PERSONAL PRECAUTIONS:**
Ensure adequate ventilation. Eliminate ignition sources. Remove sources of ignition.

**METHODS FOR CLEANING UP:**
Dispose of material in compliance with regulations indicated in Section 13 (Disposal Considerations). Clean up promptly by scoop or vacuum.

**ENVIRONMENTAL PRECAUTIONS:**
Do not contaminate surface water. If drains, streams, soil or sewers become contaminated, notify local authority.

---

### 7. HANDLING AND STORAGE

**HANDLING:**
Wash thoroughly with soap and water or shower after handling. Do not take internally. Empty product containers may contain product residue. Do not pressurize, cut, heat, weld, or expose containers to flame or other sources of ignition. Do not use, store, spill or pour near heat, sparks or open flame. Avoid generating dusts. Maintain good housekeeping practices.

**STORAGE CONDITIONS:**
Store separately from oxidizers. Store in suitable labeled containers. Keep in dry place. Store the containers tightly closed. Store away from heat and sources of ignition. Connections must be grounded to avoid electrical charges.

**SUITABLE CONSTRUCTION MATERIAL:**
Compatibility with Plastic Materials can vary; we therefore recommend that compatibility is tested prior to use.

---

### 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

**OCCUPATIONAL EXPOSURE LIMITS:**
Exposure guidelines have not been established for this product. Available exposure limits for the substance(s) are shown below.
SAFETY DATA SHEET
PRODUCT
NALCLEAR® 8173 P

EMERGENCY TELEPHONE NUMBER(S)
(800) 424-9300 (24 Hours) CHEMTREC

ACGIH/TLV :
Substance(s)
  Respirable Nuisance TWA: 3 mg/m3
Particulates
  Inhalable (Total) Nuisance TWA: 10 mg/m3
Particulates
OSHA/PEL :
Substance(s)
  Respirable Nuisance TWA: 5 mg/m3
Particulates
  Inhalable (Total) TWA: 15 mg/m3 (total dust)
Nuisance Particulates

ENGINEERING MEASURES :
General ventilation is recommended. Local exhaust ventilation may be necessary when dusts or mists are generated.

RESPIRATORY PROTECTION :
Respiratory protection is not normally needed. If dusts are generated, use an approved air-purifying respirator. A dust respirator may be used.

HAND PROTECTION :
When handling this product, the use of chemical gloves is recommended. The choice of work glove depends on work conditions and what chemicals are handled. Please contact the PPE manufacturer for advice on what type of glove material may be suitable. Gloves should be replaced immediately if signs of degradation are observed.

SKIN PROTECTION :
Wear impervious apron and boots.

EYE PROTECTION :
Wear chemical splash goggles.

HYGIENE RECOMMENDATIONS :
Use good work and personal hygiene practices to avoid exposure. Keep an eye wash fountain available. Keep a safety shower available. If clothing is contaminated, remove clothing and thoroughly wash the affected area. Launder contaminated clothing before reuse. Always wash thoroughly after handling chemicals. When handling this product never eat, drink or smoke.

9. PHYSICAL AND CHEMICAL PROPERTIES

<table>
<thead>
<tr>
<th>PHYSICAL STATE</th>
<th>Powder</th>
</tr>
</thead>
<tbody>
<tr>
<td>APPEARANCE</td>
<td>White</td>
</tr>
<tr>
<td>ODOR</td>
<td>Slight</td>
</tr>
<tr>
<td>BULK DENSITY</td>
<td>44 lb/ft3</td>
</tr>
<tr>
<td>SOLUBILITY IN WATER</td>
<td>Complete</td>
</tr>
<tr>
<td>pH (0.5 %)</td>
<td>7 - 9</td>
</tr>
</tbody>
</table>
Note: These physical properties are typical values for this product and are subject to change.

10. STABILITY AND REACTIVITY

STABILITY:
Stable under normal conditions.

HAZARDOUS POLYMERIZATION:
Hazardous polymerization will not occur.

CONDITIONS TO AVOID:
Moisture, Heat, and sources of ignition including static discharges. Avoid generating dusts.

MATERIALS TO AVOID:
Contact with strong oxidizers (e.g., chlorine, peroxides, chromates, nitric acid, perchlorate, concentrated oxygen, permanganate) may generate heat, fires, explosions and/or toxic vapors.

HAZARDOUS DECOMPOSITION PRODUCTS:
Under fire conditions: Oxides of carbon, Oxides of nitrogen, Oxides of sulfur

11. TOXICOLOGICAL INFORMATION

The following results are for the product.

ACUTE ORAL TOXICITY:
Species: Rat
LD50: > 5,000 mg/kg
Test Descriptor: Product

SENSITIZATION:
This product is not expected to be a sensitizer.

CARCINOGENICITY:
None of the substances in this product are listed as carcinogens by the International Agency for Research on Cancer (IARC), the National Toxicology Program (NTP) or the American Conference of Governmental Industrial Hygienists (ACGIH).

HUMAN HAZARD CHARACTERIZATION:
Based on our hazard characterization, the potential human hazard is: Low

12. ECOLOGICAL INFORMATION

ECOTOXICOLOGICAL EFFECTS:
The tests for (products or similar products) were performed in clean water as set forth by USEPA (EPA/600/4-90/027). In order to evaluate the potential toxicity mitigation, the tests for (representative polymers) were performed in
environmentally relevant water with dissolved organic carbon (DOC: 4.5 mg/l). The toxicity of this product is due to an external mode of action, e.g., suffocation or immobilization. In the presence of suspended material, e.g., DOC, the polymers are bound to suspended material and the bioavailability is substantially reduced. As a result, the toxicity is expected to be lower. Under normal use and discharge conditions, the LC50 values of the representative polymers tested in the presence of DOC are expected to apply to this product. However, for large spills, the clean water data is more applicable.

ACUTE FISH RESULTS:

<table>
<thead>
<tr>
<th>Species</th>
<th>Exposure</th>
<th>LC50</th>
<th>Test Descriptor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fathead Minnow</td>
<td>96 hrs</td>
<td>&gt; 1,000 mg/l</td>
<td>Product</td>
</tr>
<tr>
<td>Bluegill Sunfish</td>
<td>96 hrs</td>
<td>&gt; 100 mg/l</td>
<td>Product</td>
</tr>
<tr>
<td>Rainbow Trout</td>
<td>96 hrs</td>
<td>&gt; 100 mg/l</td>
<td>Product</td>
</tr>
<tr>
<td>Zebra Danio</td>
<td>96 hrs</td>
<td>&gt; 100 mg/l</td>
<td>Representative polymer tested in water with DOC</td>
</tr>
</tbody>
</table>

ACUTE INVERTEBRATE RESULTS:

<table>
<thead>
<tr>
<th>Species</th>
<th>Exposure</th>
<th>LC50</th>
<th>EC50</th>
<th>Test Descriptor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daphnia magna</td>
<td>48 hrs</td>
<td>&gt; 100 mg/l</td>
<td></td>
<td>Representative polymer tested in water with DOC</td>
</tr>
</tbody>
</table>

AQUATIC PLANT RESULTS:

<table>
<thead>
<tr>
<th>Species</th>
<th>Exposure</th>
<th>EC50/LC50</th>
<th>Test Descriptor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green Algae (Pseudokirchneriella subcapitata, previously Selenastrum capricornutum)</td>
<td>96 hrs</td>
<td>&gt; 1,000 mg/l</td>
<td>Product</td>
</tr>
</tbody>
</table>

ADDITIONAL ECOLOGICAL DATA

NOEC on earthworm: > 1000 mg/l (representative polymer)

PERSISTENCY AND DEGRADATION:

Chemical Oxygen Demand (COD): 523,000 mg/l

The organic portion of this preparation is expected to be poorly biodegradable.

MOBILITY:

The environmental fate was estimated using a level III fugacity model embedded in the EPI (estimation program interface) Suite TM, provided by the US EPA. The model assumes a steady state condition between the total input and output. The level III model does not require equilibrium between the defined media. The information provided is intended to give the user a general estimate of the environmental fate of this product under the defined conditions of the models. If released into the environment this material is expected to distribute to the air, water and soil/sediment in the approximate respective percentages;

<table>
<thead>
<tr>
<th>Air</th>
<th>Water</th>
<th>Soil/Sediment</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;5%</td>
<td>&lt; 5%</td>
<td>&gt; 90%</td>
</tr>
</tbody>
</table>
The portion in water is expected to float on the surface.

BIOACCUMULATION POTENTIAL
The product will not bioaccumulate.

ENVIRONMENTAL HAZARD AND EXPOSURE CHARACTERIZATION
Based on our hazard characterization, the potential environmental hazard is: Low

If released into the environment, see CERCLA/SUPERFUND in Section 15.

13. DISPOSAL CONSIDERATIONS

If this product becomes a waste, it is not a hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA) 40 CFR 261, since it does not have the characteristics of Subpart C, nor is it listed under Subpart D.

Dispose of wastes in an approved incinerator or waste treatment/disposal site, in accordance with all applicable regulations. Do not dispose of wastes in local sewer or with normal garbage.

Empty drums should be taken for recycling, recovery, or disposal through a suitably qualified or licensed contractor.

14. TRANSPORT INFORMATION

The information in this section is for reference only and should not take the place of a shipping paper (bill of lading) specific to an order. Please note that the proper Shipping Name / Hazard Class may vary by packaging, properties, and mode of transportation. Typical Proper Shipping Names for this product are as follows.

LAND TRANSPORT:

Proper Shipping Name: PRODUCT IS NOT REGULATED DURING TRANSPORTATION

AIR TRANSPORT (ICAO/IATA):

Proper Shipping Name: PRODUCT IS NOT REGULATED DURING TRANSPORTATION

MARINE TRANSPORT (IMDG/IMO):

Proper Shipping Name: PRODUCT IS NOT REGULATED DURING TRANSPORTATION
15. REGULATORY INFORMATION

This section contains additional information that may have relevance to regulatory compliance. The information in this section is for reference only. It is not exhaustive, and should not be relied upon to take the place of an individualized compliance or hazard assessment. Nalco accepts no liability for the use of this information.

NATIONAL REGULATIONS, USA:

OSHA HAZARD COMMUNICATION RULE, 29 CFR 1910.1200:
Based on our hazard evaluation, none of the substances in this product are hazardous.

CERCLA/SUPERFUND, 40 CFR 117, 302:
Notification of spills of this product is not required.

SARA/SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 (TITLE III) - SECTIONS 302, 311, 312, AND 313:

SECTION 302 - EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355):
This product does not contain substances listed in Appendix A and B as an Extremely Hazardous Substance.

SECTIONS 311 AND 312 - MATERIAL SAFETY DATA SHEET REQUIREMENTS (40 CFR 370):
Our hazard evaluation has found that this product is not hazardous under 29 CFR 1910.1200.

Under SARA 311 and 312, the EPA has established threshold quantities for the reporting of hazardous chemicals. The current thresholds are: 500 pounds or the threshold planning quantity (TPQ), whichever is lower, for extremely hazardous substances and 10,000 pounds for all other hazardous chemicals.

SECTION 313 - LIST OF TOXIC CHEMICALS (40 CFR 372):
This product does not contain substances on the List of Toxic Chemicals.

TOXIC SUBSTANCES CONTROL ACT (TSCA):
The substances in this preparation are included on or exempted from the TSCA 8(b) Inventory (40 CFR 710)

FOOD AND DRUG ADMINISTRATION (FDA) Federal Food, Drug and Cosmetic Act:
When use situations necessitate compliance with FDA regulations, this product is acceptable under: 21 CFR 176.170 Components of paper and paperboard in contact with aqueous and fatty foods and 21 CFR 176.180 Components of paper and paperboard in contact with dry foods.

Limitation: For use as an adjuvant in the manufacture of paper and paperboard in an amount not to exceed that necessary to accomplish the technical effect and not to exceed 2 percent (as polymer) by weight of the paper or paperboard.

FEDERAL WATER POLLUTION CONTROL ACT, CLEAN WATER ACT, 40 CFR 401.15 / formerly Sec. 307, 40 CFR 116.4 / formerly Sec. 311:
This product may contain trace levels (<0.1% for carcinogens, <1% all other substances) of the following substance(s) listed under the regulation:

<table>
<thead>
<tr>
<th>Substance(s)</th>
<th>Citations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ferrous Ammonium Sulphate</td>
<td>Sec. 311</td>
</tr>
</tbody>
</table>
CJNN AIR ACT, Sec. 112 (40 CFR 61, Hazardous Air Pollutants), Sec. 602 (40 CFR 82, Class I and II Ozone Depleting Substances): This product may contain trace levels (<0.1% for carcinogens, <1% all other substances) of the following substance(s) listed under the regulation:

<table>
<thead>
<tr>
<th>Substance(s)</th>
<th>Citations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acrylamide</td>
<td>Sec. 112</td>
</tr>
</tbody>
</table>

CALIFORNIA PROPOSITION 65: Substances known to the State of California to cause cancer are present as an impurity or residue.

MICHIGAN CRITICAL MATERIALS: None of the substances are specifically listed in the regulation.

STATE RIGHT TO KNOW LAWS: None of the substances are specifically listed in the regulation.

NATIONAL REGULATIONS, CANADA:

WORKPLACE HAZARDOUS MATERIALS INFORMATION SYSTEM (WHMIS): This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

WHMIS CLASSIFICATION: Not considered a WHMIS controlled product.

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA): The substance(s) in this preparation are included in or exempted from the Domestic Substance List (DSL).

AUSTRALIA All substances in this product comply with the National Industrial Chemicals Notification & Assessment Scheme (NICNAS).

CHINA All substances in this product comply with the Provisions on the Environmental Administration of New Chemical Substances and are listed on the Inventory of Existing Chemical Substances China (IECSC).

EUROPE The substances in this preparation have been reviewed for compliance with the EINECS or ELINCS inventories.

JAPAN All substances in this product comply with the Law Regulating the Manufacture and Importation Of Chemical Substances and are listed on the Existing and New Chemical Substances list (ENCS).
KOREA
All substances in this product comply with the Toxic Chemical Control Law (TCCL) and are listed on the Existing Chemicals List (ECL)

PHILIPPINES
All substances in this product comply with the Republic Act 6969 (RA 6969) and are listed on the Philippines Inventory of Chemicals & Chemical Substances (PICCS).

16. OTHER INFORMATION

Due to our commitment to Product Stewardship, we have evaluated the human and environmental hazards and exposures of this product. Based on our recommended use of this product, we have characterized the product's general risk. This information should provide assistance for your own risk management practices. We have evaluated our product's risk as follows:

* The human risk is: Low

* The environmental risk is: Low

Any use inconsistent with our recommendations may affect the risk characterization. Our sales representative will assist you to determine if your product application is consistent with our recommendations. Together we can implement an appropriate risk management process.

This product material safety data sheet provides health and safety information. The product is to be used in applications consistent with our product literature. Individuals handling this product should be informed of the recommended safety precautions and should have access to this information. For any other uses, exposures should be evaluated so that appropriate handling practices and training programs can be established to insure safe workplace operations. Please consult your local sales representative for any further information.

REFERENCES

Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices, American Conference of Governmental Industrial Hygienists, OH., (Ariel Insight™ CD-ROM Version), Ariel Research Corp., Bethesda, MD.

Hazardous Substances Data Bank, National Library of Medicine, Bethesda, Maryland (TOMES CPS™ CD-ROM Version), Micromedex, Inc., Englewood, CO.


SAFETY DATA SHEET

PRODUCT

NALCLEAR® 8173 P

EMERGENCY TELEPHONE NUMBER(S)

(800) 424-9300 (24 Hours) CHEMTREC


Registry of Toxic Effects of Chemical Substances, National Institute for Occupational Safety and Health, Cincinnati, OH, (TOMES CPS™ CD-ROM Version), Micromedex, Inc., Englewood, CO.

Ariel Insight™ (An integrated guide to industrial chemicals covered under major regulatory and advisory programs), North American Module, Western European Module, Chemical Inventories Module and the Generics Module (Ariel Insight™ CD-ROM Version), Ariel Research Corp., Bethesda, MD.

The Teratogen Information System, University of Washington, Seattle, WA (TOMES CPS™ CD-ROM Version), Micromedex, Inc., Englewood, CO.

Prepared By : Product Safety Department
Date issued : 07/04/2009
Version Number : 1.5
NALCO
An Ecolab Company

LOT NO.  DENSITY  NET WEIGHT

FDA: 21 CFR 178.170 Components of paper and paperboard in contact with aqueous and fatty foods and 21 CFR 178.180 Components of paper and paperboard in contact with dry foods. 21 CFR 173.5 Acrylate-Acrylamide Resins. Limitation: For use as an adjuvant in the manufacture of paper and paperboard in an amount not to exceed that necessary to accomplish the technical effect and not to exceed 2 percent (as polymer) by weight of the paper or paperboard. This product may be used as a flocculant in the clarification of beet sugar juice and liquor or cane sugar juice and liquor or corn starch hydrolyzed in an amount not to exceed 5 ppm by weight of the juice or 10 ppm by weight of the liquor or corn starch hydrolyze.

NSF: The official name is “Polyacrylamide.” This product has received NSF/International certification under NSF/ANSI Standard 60 in the coagulation and flocculation category. Maximum dosage 1 mg/l. Only product manufactured at Plant 101 USA and whose container label bears the NSF/ANSI Mark may be used in potable water treatment applications. Only product manufactured at Plant 150 (Burlington, Canada) and whose container label bears the NSF/ANSI Mark may be used in potable water treatment applications. Only product manufactured at Plant 109 USA and whose container label bears the NSF/ANSI Mark may be used in potable water treatment applications.

KOSHER: This product has been certified as KOSHER/PAREVE for year-round use INCLUDING THE PASSOVER SEASON by the CHICAGO RABINICAL COUNCIL.

NFPA  HMIS

0      0 0

Degree of Hazard
4 = Extreme
3 = High
2 = Moderate
1 = Low
0 = Insignificant
★ = Chronic Health Hazard
▲ = See MSDS UNLESS OTHERWISE INDICATED

EMERGENCY TELEPHONE NUMBER(S): (800) 424-9300 (24 Hours) CHEMTREC

Nalco Global Eqt Soln, Door 29
6233 West 65th Street, CHICAGO, IL, USA 60638
630-305-CHEM
Material: 8173 PULV.02 Generated: 1/22/2015

U.S. DOT Shipping Name: PRODUCT IS NOT REGULATED DURING TRANSPORTATION
MARINE TRANSPORT (IMDG/IMO): PRODUCT IS NOT REGULATED DURING TRANSPORTATION

CAUTION! May cause irritation with prolonged contact. Do not get in eyes, on skin, on clothing. Do not take internally. Use with adequate ventilation. In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. After contact with skin, wash immediately with plenty of water. Use a mild soap if available. Avoid generating dusts. Wear suitable protective clothing.

ATTENTION: For more information refer to the material safety data sheet. Empty containers may contain residual product. DO NOT reuse containers unless properly reconditioned.
1. Product and Company Identification

Company
BASF CORPORATION
100 Park Avenue
Florham Park, NJ 07932, USA

24 Hour Emergency Response Information
CHEMTREC: 1-800-424-9300
BASF HOTLINE: 1-800-832-HELP (4357)

2. Hazards Identification

Emergency overview

Caution - Slippery when wet!
May cause mild eye and skin irritation based on a component of this product.
Use with local exhaust ventilation.
Avoid dust formation.
Wear protective clothing.

State of matter: solid
Colour: off-white
Odour: odourless

Potential health effects

Primary routes of exposure:
Routes of entry for solids and liquids include eye and skin contact, ingestion and inhalation. Routes of entry for gases include inhalation and eye contact. Skin contact may be a route of entry for liquified gases.

Chronic toxicity:

Carcinogenicity: None of the components in this product at concentrations greater than 0.1% are listed by IARC, NTP, OSHA or ACGIH as a carcinogen.

Reproductive toxicity: No data available concerning reproduction toxicity.

Teratogenicity: No data available concerning teratogenic effects.

Genotoxicity: No data was available concerning mutagenic activity.

Signs and symptoms of overexposure:
No significant symptoms are expected due to the non-classification of the product.
3. Composition / Information on Ingredients

This product is not regarded as hazardous under current OSHA Hazard Communication standard; CFR 29 Part 1910.1200.

4. First-Aid Measures

General advice:
Remove contaminated clothing.

If inhaled:
If difficulties occur after dust has been inhaled, remove to fresh air and seek medical attention.

If on skin:
Wash thoroughly with soap and water.

If irritation develops, seek medical attention.

If in eyes:
Wash affected eyes for at least 15 minutes under running water with eyelids held open.

Seek medical attention.

If swallowed:
Rinse mouth and then drink plenty of water. Do not induce vomiting. Immediate medical attention required.

Note to physician
Treatment: Treat according to symptoms (decontamination, vital functions), no known specific antidote.

5. Fire-Fighting Measures

Flash point: not applicable
Autoignition: 350 °C
Self-ignition temperature: not self-igniting

Suitable extinguishing media:
dry powder, foam

Unsuitable extinguishing media for safety reasons:
water jet

Additional information:
If water is used, restrict pedestrian and vehicular traffic in areas where slip hazard may exist.

Hazards during fire-fighting:
carbon oxides, nitrogen oxides
The substances/groups of substances mentioned can be released in case of fire. Very slippery when wet.

Protective equipment for fire-fighting:
Wear a self-contained breathing apparatus.

Further information:
The degree of risk is governed by the burning substance and the fire conditions. Contaminated extinguishing water must be disposed of in accordance with official regulations.
6. Accidental release measures

**Personal precautions:**
Use personal protective clothing.

**Environmental precautions:**
Do not discharge into drains/surface waters/groundwater.

**Cleanup:**
Spilled product which becomes wet or spilled aqueous solution create a hazard because of their slippery nature. Avoid raising dust.
For small amounts: Pick up with suitable appliance and dispose of.
For large amounts: Contain with dust binding material and dispose of.

7. Handling and Storage

**Handling**

**General advice:**
Breathing must be protected when large quantities are decanted without local exhaust ventilation. Handle in accordance with good industrial hygiene and safety practice. Forms slippery surfaces with water.

**Storage**

**General advice:**
Store in unopened original containers in a cool and dry place. Avoid wet, damp or humid conditions, temperature extremes and ignition sources.

8. Exposure Controls and Personal Protection

**Personal protective equipment**

**Respiratory protection:**
Wear a NIOSH-certified (or equivalent) organic vapour/particulate respirator.

**Hand protection:**
Chemical resistant protective gloves

**Eye protection:**
Safety glasses with side-shields.

**General safety and hygiene measures:**
Wear protective clothing as necessary to minimize contact. Handle in accordance with good industrial hygiene and safety practice.

9. Physical and Chemical Properties

**Form:** powder
**Odour:** odourless
**Colour:** off-white
**Melting point:** The substance / product decomposes therefore not determined.
**Bulk density:** approx. 800 kg/m3
**% volatiles:** not determined
**Solubility in water:** Forms a viscous solution.
**Other Information:** If necessary, information on other physical and chemical parameters is indicated in this section.
10. Stability and Reactivity

**Conditions to avoid:**
Avoid extreme temperatures. Avoid humidity.

**Substances to avoid:**
strong acids, strong bases, strong oxidizing agents

**Hazardous reactions:**
The product is not a dust explosion risk as supplied; however the build-up of fine dust can lead to a risk of dust explosions.
Stable under normal conditions.
No hazardous reactions known.

**Decomposition products:**
No hazardous decomposition products if stored and handled as prescribed/indicated.

**Corrosion to metals:**
No corrosive effect on metal.

**Oxidizing properties:**
ot fire-propagating

11. Toxicological information

**Acute toxicity**

**Oral:**
Type of value: LD50
Species: rat
Value: > 2,000 mg/kg (OECD Guideline 401)

**Irritation / corrosion**

**Skin:**
Species: rabbit
Result: non-irritant
Method: OECD Guideline 404

**Eye:**
Species: rabbit
Result: non-irritant

**Sensitization:**
Result: Non-sensitizing.

**Other Information:**
The product has not been tested. The statements on toxicology have been derived from products of a similar structure and composition.

12. Ecological Information

**Fish**

Acute:
Aquatic invertebrates

Acute:
shrimp/LC50 (48 h): > 100 mg/l

Degradability / Persistence
Biological / Abiological Degradation

*Information on: Polyacrylamide*

*Evaluation:* Not readily biodegradable (by OECD criteria).

*Environmental mobility:*

*Information on: Polyacrylamide*

*Assessment transport between environmental compartments:*
Adsorption to solid soil phase is expected.

*Other adverse effects:*
The product has not been tested. The statements on ecotoxicology have been derived from products of a similar structure and composition.

### 13. Disposal considerations

**Waste disposal of substance:**
Must be disposed of or incinerated in accordance with local regulations.

**Container disposal:**
Dispose of in a licensed facility. Recommend crushing, puncturing or other means to prevent unauthorized use of used containers.

**RCRA:**
Not a hazardous waste under RCRA (40 CFR 261).

### 14. Transport Information

**Land transport**
USDOT
Not classified as a dangerous good under transport regulations

**Sea transport**
IMDG
Not classified as a dangerous good under transport regulations

**Air transport**
IATA/ICAO
15. Regulatory Information

VOC content:
not determined

Federal Regulations

Registration status:
Chemical TSCA, US released / listed

OSHA hazard category: This material is classified as not hazardous under OSHA regulations.

EPCRA 311/312 (Hazard categories): Not hazardous;

State regulations

CA Prop. 65:
THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER AND BIRTH DEFECTS OR OTHER REPRODUCTIVE HARM.

16. Other Information

NFPA Hazard codes:
Health: 0 Fire: 1 Reactivity: 0 Special: 

HMIS III rating
Health: 0 Flammability: 1 Physical hazard: 0

NFPA and HMIS use a numbering scale ranging from 0 to 4 to indicate the degree of hazard. A value of zero means that the substance possesses essentially no hazard; a rating of four indicates extreme danger. Although similar, the two rating systems are intended for different purposes, and use different criteria. The NFPA system was developed to provide an on-the-spot alert to the hazards of a material, and their severity, to emergency responders. The HMIS system was designed to communicate workplace hazard information to employees who handle hazardous chemicals.

We support worldwide Responsible Care® initiatives. We value the health and safety of our employees, customers, suppliers and neighbors, and the protection of the environment. Our commitment to Responsible Care is integral to conducting our business and operating our facilities in a safe and environmentally responsible fashion, supporting our customers and suppliers in ensuring the safe and environmentally sound handling of our products, and minimizing the impact of our operations on society and the environment during production, storage, transport, use and disposal of our products.

MSDS Prepared by:
BASF NA Product Regulations
msds@basf.com
MSDS Prepared on: 2012/10/17

Magnaflux® 351 is a registered trademark of BASF Corporation or BASF SE IMPORTANT: WHILE THE DESCRIPTIONS, DESIGNS, DATA AND INFORMATION CONTAINED HEREIN ARE PRESENTED IN GOOD FAITH AND BELIEVED TO BE ACCURATE, IT IS PROVIDED FOR YOUR GUIDANCE ONLY, BECAUSE MANY FACTORS MAY AFFECT PROCESSING OR APPLICATION/USE, WE RECOMMEND THAT YOU MAKE TESTS TO DETERMINE THE SUITABILITY OF A PRODUCT FOR YOUR PARTICULAR PURPOSE PRIOR TO USE. NO WARRANTIES OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ARE MADE REGARDING PRODUCTS DESCRIBED OR DESIGNS, DATA OR INFORMATION
SET FORTH, OR THAT THE PRODUCTS, DESIGNS, DATA OR INFORMATION MAY BE USED WITHOUT INFRINGING THE INTELLECTUAL PROPERTY RIGHTS OF OTHERS. IN NO CASE SHALL THE DESCRIPTIONS, INFORMATION, DATA OR DESIGNS PROVIDED BE CONSIDERED A PART OF OUR TERMS AND CONDITIONS OF SALE. FURTHER, YOU EXPRESSLY UNDERSTAND AND AGREE THAT THE DESCRIPTIONS, DESIGNS, DATA, AND INFORMATION FURNISHED BY OUR COMPANY HEREUNDER ARE GIVEN GRATIS AND WE ASSUME NO OBLIGATION OR LIABILITY FOR THE DESCRIPTION, DESIGNS, DATA AND INFORMATION GIVEN OR RESULTS OBTAINED, ALL SUCH BEING GIVEN AND ACCEPTED AT YOUR RISK.

Due to the merger of CIBA and BASF Group all Material Safety Data Sheets have been reassessed on the basis of consolidated information. This may have resulted in changes of the Material Safety Data Sheets. In case you have questions concerning such changes please contact us at the address mentioned in Section I.

END OF DATA SHEET
Magnafloc® 351

Caution - Slippery when wet!
May cause mild eye and skin irritation based on a component of this product. Use with local exhaust ventilation. Avoid dust formation. Wear protective clothing.

FIRST AID:  GENERAL: Remove contaminated clothing. SKIN: Wash thoroughly with soap and water. If irritation develops, seek medical attention. EYES: Wash affected eyes for at least 15 minutes under running water with eyelids held open. Seek medical attention. INGESTION: Rinse mouth and then drink plenty of water. Do not induce vomiting. Immediate medical attention required. INHALATION: If difficulties occur after dust has been inhaled, remove to fresh air and seek medical attention.

IN CASE OF FIRE:  EXTINGUISHING MEDIA: dry powder, foam MAY BE EMITTED: carbon oxides nitrogen oxides The substances/groups of substances mentioned can be released in case of fire. Very slippery when wet. Wear a self-contained breathing apparatus. The degree of risk is governed by the burning substance and the fire conditions. Contaminated extinguishing water must be disposed of in accordance with official regulations.

IN CASE OF SPILLS OR LEAKS: Use personal protective clothing. Do not discharge into drains/surface waters/groundwater. Spilled product which becomes wet or spilled aqueous solution create a hazard because of their slippery nature. Avoid raising dust.

EMPTY CONTAINERS: Dispose of in a licensed facility. Recommend crushing, puncturing or other means to prevent unauthorized use of used containers.

DISPOSAL: Dispose of in accordance with national, state and local regulations.

HANDLING AND STORAGE: Breathing must be protected when large quantities are decanted without local exhaust ventilation. Handle in accordance with good industrial hygiene and safety practice. Forms slippery surfaces with water. Store in unopened original containers in a cool and dry place. Avoid wet, damp or humid conditions, temperature extremes and ignition sources.

IN CASE OF CHEMICAL EMERGENCY: Call CHEMTREC day or night for assistance and information concerning spilled material, fire, explosive, and other chemical accidents. 800-424-9300 or 703-527-3887 outside the US.
ATTENTION: Refer to our technical bulletin and material safety data sheet regarding safety, usage, application, hazards, procedures and disposal of this product. Consult your supervisor for additional information.

RTK: polyacrylamide 9003-05-8; Water 7732-18-5; urea 57-13-6; acrylamide 79-06-1

PROPER SHIPPING NAME: NOT REQUIRED

BASF CORPORATION
2301 WILROY RD.
SUFFOLK, VA, 23434 USA

PKG NO:1

NET   GROSS
KG  25.0   25.2
LB  55.1   55.6
Magnafloc® 351

Nonionic flocculant

Description

Magnafloc 351 is a high molecular weight nonionic polyacrylamide flocculant supplied as a free flowing granular powder.

Principal uses

Magnafloc 351 has found application in a variety of mineral processing operations including the following:

1. Acid leach CCD (uranium)
2. Acid leach (copper)
3. Sedimentation of jarosite precipitate in electrolytic zinc processes
4. Clarification of zinc electrolyte
5. Flocculation of copper tailings
6. China clay flocculation
7. Base metal sulphide and oxide concentrates thickening and filtration
8. Carbonate leach CCD (uranium)
9. Potash slimes clarification and dewatering
10. Phosphoric acid clarification
11. Iron ore tailings clarification
12. Pregnant liquor clarification (gold)

Dosage depends upon the application but normally lies in the range 2 – 100 g/tonne of dry substrate flocculated.

Typical properties

Physical form: Off-white granular powder
Particle size: 98% < 1000 μm
Bulk density: 0.7 g/cm³
pH of 1% solution at 25 °C: 7.0
Viscosity at 25 °C: See graph and table
Application & Storage

Recommended solution concentrations:

Stock solution: 0.25 – 0.5 % max.
Feed solution: 0.025 – 0.1 % max.

Shelf life

2 years from receipt of goods

Stock solution: 1 – 2 days

Storage of polymer should be in a cool, dry place.

Details on preparation and application can be obtained from a BASF representative.

Solution viscosity data
(Fann viscometer – 25 °C – solvent – deionised water)

<table>
<thead>
<tr>
<th>Magnafloc 351 concentration (%)</th>
<th>Shear rate (sec⁻¹)</th>
<th>5.11</th>
<th>10.22</th>
<th>170</th>
<th>340</th>
<th>511</th>
<th>1022</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>Viscosity (cP)</td>
<td>600</td>
<td>400</td>
<td>90</td>
<td>71</td>
<td>60</td>
<td>44</td>
</tr>
<tr>
<td>0.5</td>
<td></td>
<td>100</td>
<td>75</td>
<td>21</td>
<td>17</td>
<td>15</td>
<td>13</td>
</tr>
<tr>
<td>0.25</td>
<td></td>
<td>50</td>
<td>25</td>
<td>9</td>
<td>8</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>0.10</td>
<td></td>
<td>25</td>
<td>13</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

Shipping & Handling

Magnafloc 351 is supplied in 25 kg nett plastic bags shrinkwrapped onto a pallet suitable for export shipment. The product can also be supplied via intermediate big bags or bulk tanker. Specific details of bag and tanker sizes can be obtained on request.

Corrosivity towards most standard materials of construction is low, but aluminium and galvanised equipment should be avoided.

Technical service

Advice and assistance in the running of laboratory and plant tests to select the correct product and determine the best application can be provided by representatives of BASF, who are experienced in mineral processing applications.

Health & Safety

Magnafloc 351 exhibits a very low order of oral toxicity and does not present any abnormal problems in its handling or general use.

Detailed information on handling and any precautions to be observed in the use of the product(s) described in this leaflet can be found in our relevant health and safety information sheet.
Note

The data contained in this publication are based on our current knowledge and experience. In view of the many factors that may affect processing and application of our product, these data do not relieve processors from carrying out their own investigations and tests; neither do these data imply any guarantee of certain properties, nor the suitability of the product for a specific purpose. Any descriptions, drawings, photographs, data, proportions, weights etc. given herein may change without prior information and do not constitute the agreed contractual quality of the product. It is the responsibility of the recipient of our products to ensure that any proprietary rights and existing laws and legislation are observed.

March 2013
1. IDENTIFICATION OF THE PRODUCT AND THE COMPANY

Product Name: NS 6500

Company: Neo-Solutions, Inc.
P.O. Box 26
Beaver, PA 15009

Emergency Telephone Number: (724) 728-1847 Fax: (724) 728-3440

2. COMPOSITION / INFORMATION ON INGREDIENTS

Identification of the preparation: non-ionic water-soluble polymer

This product is not considered hazardous in accordance with OSHA Federal Regulation 29 CFR 1910.1200.

3. HAZARDS IDENTIFICATION

Aqueous solutions or powders that become wet render surfaces extremely slippery.

4. FIRST AID MEASURES

Inhalation: Move to fresh air.

Skin contact: Wash with water and soap as a precaution. In case of persistent skin irritation, consult a physician.

Eye contact: Rinse thoroughly with plenty of water, also under the eyelids. In case of persistent eye irritation, consult a physician.

Ingestion: The product is not considered toxic based on studies on laboratory animals.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media: Water, water spray, foam, carbon dioxide (CO₂), dry powder.

Special fire-fighting precautions: Aqueous solutions or powders that become wet render surfaces extremely slippery.

Special protective equipment for firefighters: No special protective equipment required.
6. ACCIDENTAL RELEASE MEASURES

Personal precautions: No special precautions required.

Environmental precautions: **DO NOT** flush into surface water.

Methods for cleaning up: **DO NOT** flush with water. Clean up promptly by scoop or vacuum. Keep in suitable and closed containers for disposal. **After cleaning,** flush away traces with water.

7. HANDLING AND STORAGE

Handling: Avoid contact with skin and eyes. Avoid dust formation. **DO NOT** breathe dust. Wash hands before breaks and at the end of workday.

Storage: Keep in a dry, cool place (5 - 30 °C).

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering measures to reduce exposure: Use local exhaust if dusting occurs. Natural ventilation is adequate in absence of dusts.

Personal protection equipment:
- Respiratory protection: Dust safety masks are recommended where concentration of total dust is more than 10 mg / m³.
- Hand protection: Rubber gloves.
- Eye protection: Safety glasses with side-shields. **DO NOT** wear contact lenses where this product is used.
- Skin and body protection: Chemical resistant apron or protective suit if splashing or repeated contact with solution is likely.

Hygiene measures: Wash hands before breaks and at the end of workday. Handle in accordance with good industrial hygiene and safety practice.

9. PHYSICAL AND CHEMICAL PROPERTIES

Form: granular solid
Color: white
Odor: none
pH: 4 - 6 @ 5 g/L (for product series. See Technical Bulletin for specific value)
Melting point (°C): Not applicable.
Flash point (°C): Not applicable.
Autoignition temperature (°C): Not applicable.
Vapor pressure (mm Hg): Not applicable.
Bulk density: See Technical Bulletin.
10. STABILITY AND REACTIVITY

Stability: Product is stable, no hazardous polymerization will occur. Oxidizing agents may cause exothermic reactions.

Hazardous decomposition products: Thermal decomposition may produce: nitrogen oxides (NOx), carbon oxides (COx).

11. TOXICOLOGICAL INFORMATION

Acute toxicity
- Oral: LD50 / dermal / rat > 5000 mg / kg
- Dermal: The results of testing on rabbits showed this material to be non-toxic even at high dose levels.
- Inhalation: The product is not expected to be toxic by inhalation.

Irritation:
- Skin: The results of testing on rabbits showed this material to be non-irritating to the skin.
- Eyes: Testing conducted according to the Draize technique showed the material produces no corneal or iridial effects and only slight transitory conjunctival effects similar to those which all granular materials have on conjunctivae.

Sensitization: The results of testing on guinea pigs showed this material to be non-sensitizing.

Chronic toxicity: A two-year feeding study on rats did not reveal adverse health effects. A one-year feeding study on dogs did not reveal adverse health effects.

12. ECOLOGICAL INFORMATION

Acute aquatic toxicity
- Fish: LC50 / Danio rerio / 96 hours > 100 mg / L (OECD 203)
- Algae: EC50 / Chlorella vulgaris / 72 hours > 100 mg / L (OECD 201)
- Daphnia: EC50 / Daphnia magna / 48 hours > 100 mg / L (OECD 202)

Environmental fate
LogP ow: 0

Bioaccumulation: Does not bioaccumulate.

Persistence / Degradability: Not readily biodegradable.
13. DISPOSAL CONSIDERATIONS

Waste from residues / unused products: In accordance with federal, state, provincial and local regulations.

Contaminated packaging: Rinse empty containers with water and use the rinse water to prepare the working solution. Can be landfilled or incinerated, when in compliance with local regulations.

14. TRANSPORT INFORMATION

Not regulated by DOT.

15. REGULATORY INFORMATION

All components of this product are on the TSCA and DSL inventories.

RCRA status: Not a hazardous waste.

Hazardous waste number: Not applicable.

Reportable quantity (40 CFR 302): Not applicable.

Threshold planning quantity (40 CFR 355): Not applicable.

California Proposition 65 information The following statement is made in order to comply with the California Safe Drinking Water and Toxic Enforcement Act of 1986: This product contains a chemical(s) known to the State of California to cause cancer: residual acrylamide.

HMIS & NFPA Ratings

<table>
<thead>
<tr>
<th>HMIS</th>
<th>NFPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health:</td>
<td>1</td>
</tr>
<tr>
<td>Flammability:</td>
<td>1</td>
</tr>
<tr>
<td>Reactivity:</td>
<td>0</td>
</tr>
</tbody>
</table>

16. OTHER INFORMATION

Person to contact: Product Manager

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 guide 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.
First Aid Measures
Inhalation: Move to fresh air. No hazards which require special first aid measures.
Skin contact: Wash with water and soap as a precaution. Get medical attention if irritation develops and persists.
Eye contact: Rinse thoroughly with plenty of water, also under the eyelids. Get medical attention.
Ingestion: Rinse mouth with water. **DO NOT** induce vomiting. No hazards which require first aid measures.

Fire-Fighting Measures
Special fire-fighting precautions: Aqueous solutions or powders that become wet render surfaces extremely slippery.
Special protective equipment for firefighters: No special protective equipment required.
This product **MUST NOT** be discharged into drains.

Accidental Release
Personal precautions: No special precautions required.
Environmental precautions: As with all chemical products, **DO NOT** flush into surface water.
Methods for cleaning up: **DO NOT** flush with water. Clean up promptly by scoop or vacuum. Keep in suitable and closed containers for disposal. **After cleaning**, flush away traces with water.

Disposal
Disposal: Dispose of in accordance with local, state, provincial and federal regulations.
Container: Can be landfillied or incinerated, when in compliance with local, state, provincial and federal regulations.

**Label Elements**

- **Hazard symbol(s):** none
- **Signal Word:** none
- **Hazard statement(s):** Aqueous solutions or powders that become wet render surfaces extremely slippery
- **Precautional Statement(s):** none

**Prevention**
P280 – Wear protective gloves / protective clothing / eye protection / face protection.
P273 – Avoid release to the environment.

**Response**
**IF INHALED:** P304+P341 – If breathing is difficult, remove victim to fresh air.
**IF ON SKIN:** P302+352 – Wash with plenty of soap and water.
**IF IN EYES:** P313+P337 – If eye irritation persists: Get medical advice/attention.
**IF SWALLOWED:** P301+P331 – Rinse mouth. **DO NOT** induce vomiting.

**Disposal**
P501 – Dispose of contents/container in an approved waste disposal plant.

**Fill Weight:** ______ lbs.

**Gross Weight:** ______ lbs.

**Lot Number:**

**Fill Date:**

Refer to current SDS for further information.
1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME : OPTIMER® 9876 PULV
APPLICATION : FLOCCULANT
COMPANY IDENTIFICATION : Nalco Company
1601 W. Diehl Road
Naperville, Illinois
60563-1198

EMERGENCY TELEPHONE NUMBER(S) : (800) 424-9300 (24 Hours) CHEMTREC

NFPA 704M/HMIS RATING
HEALTH : 0 / 1 FLAMMABILITY : 1 / 1 INSTABILITY : 0 / 0 OTHER :
0 = Insignificant 1 = Slight 2 = Moderate 3 = High 4 = Extreme * = Chronic Health Hazard

2. COMPOSITION/INFORMATION ON INGREDIENTS

Our hazard evaluation has found that this product is not hazardous under 29 CFR 1910.1200.

3. HAZARDS IDENTIFICATION

**EMERGENCY OVERVIEW**

CAUTION
May cause irritation with prolonged contact.
Do not get in eyes, on skin, on clothing. Do not take internally. Avoid generating dusts. Do not breathe dust. Use with adequate ventilation. In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. After contact with skin, wash immediately with plenty of soap and water.
Wear suitable protective clothing.
May form explosive dust-air mixtures. Handling operations may generate combustible dust in the finely divided and suspended state. To reduce the potential for dust explosions and/or fire, do not permit dust to accumulate. Empty product containers may contain product residue. Do not pressurize, cut, heat, weld, or expose containers to flame or other sources of ignition. May evolve oxides of carbon (COx) under fire conditions. May evolve oxides of nitrogen (NOx) under fire conditions.

PRIMARY ROUTES OF EXPOSURE :
Eye, Skin

HUMAN HEALTH HAZARDS - ACUTE :

EYE CONTACT:
Can cause mild irritation.

SKIN CONTACT:
May cause irritation with prolonged contact.
INGESTION:
Not a likely route of exposure. Can cause mild irritation.

INHALATION:
Repeated or prolonged exposure may irritate the respiratory tract.

SYMPTOMS OF EXPOSURE:
Acute:
A review of available data does not identify any symptoms from exposure not previously mentioned.
Chronic:
A review of available data does not identify any symptoms from exposure not previously mentioned.

AGGRAVATION OF EXISTING CONDITIONS:
A review of available data does not identify any worsening of existing conditions.

HUMAN HEALTH HAZARDS - CHRONIC:
No adverse effects expected other than those mentioned above.

4. FIRST AID MEASURES

EYE CONTACT:
Brush off excess powder. Flush affected area with water. If symptoms develop, seek medical advice.

SKIN CONTACT:
Brush off excess powder. Remove contaminated clothing. Wash off affected area immediately with plenty of water. If symptoms develop, seek medical advice.

INGESTION:
Get medical attention. Do not induce vomiting without medical advice. If conscious, washout mouth and give water to drink.

INHALATION:
Remove to fresh air, treat symptomatically. If symptoms develop, seek medical advice.

NOTE TO PHYSICIAN:
Based on the individual reactions of the patient, the physician's judgement should be used to control symptoms and clinical condition. If swallowed a jelly mass may form which in digestion may cause blockage.

5. FIRE FIGHTING MEASURES

FLASH POINT:
None

EXTINGUISHING MEDIA:
Use carbon dioxide or dry chemical media for small fires. For large fires, use water spray or fog, thoroughly drenching the burning material.
FIRE AND EXPLOSION HAZARD:
May form explosive dust-air mixtures. Handling operations may generate combustible dust in the finely divided and suspended state. To reduce the potential for dust explosions and/or fire, do not permit dust to accumulate. Empty product containers may contain product residue. Do not pressurize, cut, heat, weld, or expose containers to flame or other sources of ignition. May evolve oxides of carbon (COx) under fire conditions. May evolve oxides of nitrogen (NOx) under fire conditions.

SPECIAL PROTECTIVE EQUIPMENT FOR FIRE FIGHTING:
In case of fire, wear a full face positive-pressure self contained breathing apparatus and protective suit.

6. ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTIONS:
Restrict access to area as appropriate until clean-up operations are complete. Stop or reduce any leaks if it is safe to do so. Do not touch spilled material. Ventilate spill area if possible. Remove sources of ignition. Use personal protective equipment recommended in Section 8 (Exposure Controls/Personal Protection). Notify appropriate government, occupational health and safety and environmental authorities.

METHODS FOR CLEANING UP:
Sweep up and shovel. Reclaim into recovery or salvage drums. Dispose of material in compliance with regulations indicated in Section 13 (Disposal Considerations). Water in contact with the product will cause slippery floor conditions.

ENVIRONMENTAL PRECAUTIONS:
Do not contaminate surface water.

7. HANDLING AND STORAGE

HANDLING:
Do not get in eyes, on skin, on clothing. Do not take internally. Use with adequate ventilation. Avoid generating dusts. Maintain good housekeeping practices. Ensure all containers are labeled. Keep the containers closed when not in use. Empty product containers may contain product residue. Do not pressurize, cut, heat, weld, or expose containers to flame or other sources of ignition. Do not use, store, spill or pour near heat, sparks or open flame.

STORAGE CONDITIONS:
Store separately from oxidizers. Keep in dry place. Store in suitable labeled containers. Store the containers tightly closed. Store away from heat and sources of ignition. Connections must be grounded to avoid electrical charges.

SUITABLE CONSTRUCTION MATERIAL:
Compatibility with Plastic Materials can vary; we therefore recommend that compatibility is tested prior to use.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

OCCUPATIONAL EXPOSURE LIMITS:
Exposure guidelines have not been established for this product. Available exposure limits for the substance(s) are shown below.

<table>
<thead>
<tr>
<th>Substance(s)</th>
<th>Category:</th>
<th>ppm</th>
<th>mg/m³</th>
<th>Non-Standard</th>
</tr>
</thead>
</table>

Nalco Company 1601 W. Diehl Road • Naperville, Illinois 60563-1198 • (630)305-1000
For additional copies of an MSDS visit www.nalco.com and request access.
SAFETY DATA SHEET

PRODUCT

OPTIMER® 9876 PULV

EMERGENCY TELEPHONE NUMBER(S)

(800) 424-9300 (24 Hours) CHEMTREC

RESPIRATORY PROTECTION:
Respiratory protection is not normally needed. An approved respirator must be worn if the occupational exposure limit is likely to be exceeded. A dust respirator may be used.

HAND PROTECTION:
When handling this product, the use of chemical gloves is recommended. The choice of work glove depends on work conditions and what chemicals are handled. Please contact the PPE manufacturer for advice on what type of glove material may be suitable. Gloves should be replaced immediately if signs of degradation are observed.

SKIN PROTECTION:
Wear standard protective clothing.

EYE PROTECTION:
Wear safety glasses with side-shields.

HYGIENE RECOMMENDATIONS:
Use good work and personal hygiene practices to avoid exposure. Keep an eye wash fountain available. Keep a safety shower available. If clothing is contaminated, remove clothing and thoroughly wash the affected area. Launder contaminated clothing before reuse. Always wash thoroughly after handling chemicals. When handling this product never eat, drink or smoke.

HUMAN EXPOSURE CHARACTERIZATION:
Based on our recommended product application and personal protective equipment, the potential human exposure is: High

<table>
<thead>
<tr>
<th>Respirable Nuisance Particulates (Inhalable particles)</th>
<th>ACGIH/TWA</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respirable Nuisance Particulates (Respirable particles)</td>
<td>ACGIH/TWA</td>
<td>3</td>
</tr>
<tr>
<td>Respirable Nuisance Particulates (Respirable fraction)</td>
<td>OSHA Z1/PEL</td>
<td>5</td>
</tr>
<tr>
<td>Respirable Nuisance Particulates (Total dust)</td>
<td>OSHA Z1/PEL</td>
<td>15</td>
</tr>
<tr>
<td>Respirable Nuisance Particulates (Respirable fraction)</td>
<td>Z3/TWA</td>
<td>15 MPPCF</td>
</tr>
<tr>
<td>Respirable Nuisance Particulates (Total dust)</td>
<td>Z3/TWA</td>
<td>50 MPPCF</td>
</tr>
<tr>
<td>Respirable Nuisance Particulates (Respirable fraction)</td>
<td>Z3/TWA</td>
<td>5</td>
</tr>
<tr>
<td>Respirable Nuisance Particulates (Total dust)</td>
<td>Z3/TWA</td>
<td>15</td>
</tr>
</tbody>
</table>

Inhalable (Total) Nuisance Particulates (Inhalable particles) | ACGIH/TWA | 10 |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Inhalable (Total) Nuisance Particulates (Respirable particles)</td>
<td>ACGIH/TWA</td>
<td>3</td>
</tr>
<tr>
<td>Inhalable (Total) Nuisance Particulates (Respirable fraction)</td>
<td>OSHA Z1/PEL</td>
<td>5</td>
</tr>
<tr>
<td>Inhalable (Total) Nuisance Particulates (Total dust)</td>
<td>OSHA Z1/PEL</td>
<td>15</td>
</tr>
<tr>
<td>Inhalable (Total) Nuisance Particulates (Respirable fraction)</td>
<td>Z3/TWA</td>
<td>15 MPPCF</td>
</tr>
<tr>
<td>Inhalable (Total) Nuisance Particulates (Total dust)</td>
<td>Z3/TWA</td>
<td>50 MPPCF</td>
</tr>
<tr>
<td>Inhalable (Total) Nuisance Particulates (Respirable fraction)</td>
<td>Z3/TWA</td>
<td>5</td>
</tr>
<tr>
<td>Inhalable (Total) Nuisance Particulates (Total dust)</td>
<td>Z3/TWA</td>
<td>15</td>
</tr>
</tbody>
</table>
9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE    Powder
APPEARANCE        White
ODOR              None

SPECIFIC GRAVITY     0.75 - 0.80 @ 73 °F / 23 °C
DENSITY           6.44 lb/gal
SOLUBILITY IN WATER Complete
MELTING POINT      No data available.
VOC CONTENT       0.0 % Calculated

Note: These physical properties are typical values for this product and are subject to change.

10. STABILITY AND REACTIVITY

STABILITY:
Stable under normal conditions.

HAZARDOUS POLYMERIZATION:
Hazardous polymerization will not occur.

CONDITIONS TO AVOID:
Moisture  Heat  and sources of ignition including static discharges.  Avoid generating dusts.

MATERIALS TO AVOID:
Contact with strong oxidizers (e.g. chlorine, peroxides, chromates, nitric acid, perchlorate, concentrated oxygen, permanganate) may generate heat, fires, explosions and/or toxic vapors.

HAZARDOUS DECOMPOSITION PRODUCTS:
Under fire conditions: Oxides of carbon, Oxides of nitrogen

11. TOXICOLOGICAL INFORMATION

No toxicity studies have been conducted on this product.

SENSITIZATION:
This product is not expected to be a sensitizer.

CARCINOGENICITY:
None of the substances in this product are listed as carcinogens by the International Agency for Research on Cancer (IARC), the National Toxicology Program (NTP) or the American Conference of Governmental Industrial Hygienists (ACGIH).
HUMAN HAZARD CHARACTERIZATION:
Based on our hazard characterization, the potential human hazard is: Low

12. ECOLOGICAL INFORMATION

ECOTOXICOLOGICAL EFFECTS:
No toxicity studies have been conducted on this product.

MOBILITY:
The environmental fate was estimated using a level III fugacity model embedded in the EPI (estimation program interface) Suite TM, provided by the US EPA. The model assumes a steady state condition between the total input and output. The level III model does not require equilibrium between the defined media. The information provided is intended to give the user a general estimate of the environmental fate of this product under the defined conditions of the models.
If released into the environment this material is expected to distribute to the air, water and soil/sediment in the approximate respective percentages:

<table>
<thead>
<tr>
<th></th>
<th>Air</th>
<th>Water</th>
<th>Soil/Sediment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt;5%</td>
<td>5 - 10%</td>
<td>&gt; 90%</td>
</tr>
</tbody>
</table>

The portion in water is expected to be soluble or dispersible.

BIOACCUMULATION POTENTIAL
This preparation or material is not expected to bioaccumulate.

ENVIRONMENTAL HAZARD AND EXPOSURE CHARACTERIZATION
Based on our hazard characterization, the potential environmental hazard is: Moderate
Based on our recommended product application and the product's characteristics, the potential environmental exposure is: Moderate
If released into the environment, see CERCLA/SUPERFUND in Section 15.

13. DISPOSAL CONSIDERATIONS

If this product becomes a waste, it is not a hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA) 40 CFR 261, since it does not have the characteristics of Subpart C, nor is it listed under Subpart D.

As a non-hazardous waste, it is not subject to federal regulation. Consult state or local regulation for any additional handling, treatment or disposal requirements. For disposal, contact a properly licensed waste treatment, storage, disposal or recycling facility.

Empty drums should be taken for recycling, recovery, or disposal through a suitably qualified or licensed contractor.
14. TRANSPORT INFORMATION

The information in this section is for reference only and should not take the place of a shipping paper (bill of lading) specific to an order. Please note that the proper Shipping Name / Hazard Class may vary by packaging, properties, and mode of transportation. Typical Proper Shipping Names for this product are as follows.

LAND TRANSPORT:

Proper Shipping Name: PRODUCT IS NOT REGULATED DURING TRANSPORTATION

AIR TRANSPORT (ICAO/IATA):

Proper Shipping Name: PRODUCT IS NOT REGULATED DURING TRANSPORTATION

MARINE TRANSPORT (IMDG/IMO):

Proper Shipping Name: PRODUCT IS NOT REGULATED DURING TRANSPORTATION

15. REGULATORY INFORMATION

This section contains additional information that may have relevance to regulatory compliance. The information in this section is for reference only. It is not exhaustive, and should not be relied upon to take the place of an individualized compliance or hazard assessment. Nalco accepts no liability for the use of this information.

NATIONAL REGULATIONS, USA:

OSHA HAZARD COMMUNICATION RULE, 29 CFR 1910.1200:
Based on our hazard evaluation, none of the substances in this product are hazardous.

CERCLA/SUPERFUND, 40 CFR 302:
Notification of spills of this product is not required.

SARA/SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 (TITLE III) - SECTIONS 302, 311, 312, AND 313:

SECTION 302 - EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355):
This product does not contain substances listed in Appendix A and B as an Extremely Hazardous Substance.

SECTIONS 311 AND 312 - MATERIAL SAFETY DATA SHEET REQUIREMENTS (40 CFR 370):
Our hazard evaluation has found that this product is not hazardous under 29 CFR 1910.1200.

Under SARA 311 and 312, the EPA has established threshold quantities for the reporting of hazardous chemicals. The current thresholds are: 500 pounds or the threshold planning quantity (TPQ), whichever is lower, for extremely hazardous substances and 10,000 pounds for all other hazardous chemicals.
SAFETY DATA SHEET

PRODUCT

OPTIMER® 9876 PULV

EMERGENCY TELEPHONE NUMBER(S)

(800) 424-9300 (24 Hours) CHEMTREC

SECTION 313 - LIST OF TOXIC CHEMICALS (40 CFR 372) :
This product does not contain substances on the List of Toxic Chemicals.

TOXIC SUBSTANCES CONTROL ACT (TSCA) :
The substances in this preparation are included on or exempted from the TSCA 8(b) Inventory (40 CFR 710)

FEDERAL WATER POLLUTION CONTROL ACT, CLEAN WATER ACT, 40 CFR 401.15 / formerly Sec. 307, 40 CFR 116.4 / formerly Sec. 311 :
Substances listed under this regulation are not intentionally added or expected to be present in this product. Listed components may be present at trace levels.

CLEAN AIR ACT, Sec. 112 (Hazardous Air Pollutants, as amended by 40 CFR 63), Sec. 602 (40 CFR 82, Class I and II Ozone Depleting Substances) :
Substances listed under this regulation are not intentionally added or expected to be present in this product. Listed components may be present at trace levels.

CALIFORNIA PROPOSITION 65 :
Substances listed under California Proposition 65 are not intentionally added or expected to be present in this product.

MICHIGAN CRITICAL MATERIALS :
Substances listed under this regulation are not intentionally added or expected to be present in this product. Listed components may be present at trace levels.

STATE RIGHT TO KNOW LAWS :
Substances listed under this regulation are not intentionally added or expected to be present in this product. Listed components may be present at trace levels.

INTERNATIONAL CHEMICAL CONTROL LAWS :

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) :
The substance(s) in this preparation are included in or exempted from the Domestic Substance List (DSL).

AUSTRALIA
All substances in this product comply with the National Industrial Chemicals Notification & Assessment Scheme (NICNAS).

CHINA
All substances in this product comply with the Provisions on the Environmental Administration of New Chemical Substances and are listed on or exempt from the Inventory of Existing Chemical Substances China (IECSC).

EUROPE
The substance(s) in this preparation are included in or exempted from the EINECS or ELINCS inventories.
SAFETY DATA SHEET

PRODUCT

OPTIMER® 9876 PULV

EMERGENCY TELEPHONE NUMBER(S)

(800) 424-9300 (24 Hours) CHEMTREC

JAPAN
All substances in this product comply with the Law Regulating the Manufacture and Importation Of Chemical Substances and are listed on the Existing and New Chemical Substances list (ENCS).

KOREA
All substances in this product comply with the Toxic Chemical Control Law (TCCL) and are listed on the Existing Chemicals List (ECL)

PHILIPPINES
All substances in this product comply with the Republic Act 6969 (RA 6969) and are listed on the Philippines Inventory of Chemicals & Chemical Substances (PICCS).

16. OTHER INFORMATION

Due to our commitment to Product Stewardship, we have evaluated the human and environmental hazards and exposures of this product. Based on our recommended use of this product, we have characterized the product's general risk. This information should provide assistance for your own risk management practices. We have evaluated our product's risk as follows:

* The human risk is: Low

* The environmental risk is: Moderate

Any use inconsistent with our recommendations may affect the risk characterization. Our sales representative will assist you to determine if your product application is consistent with our recommendations. Together we can implement an appropriate risk management process.

This product material safety data sheet provides health and safety information. The product is to be used in applications consistent with our product literature. Individuals handling this product should be informed of the recommended safety precautions and should have access to this information. For any other uses, exposures should be evaluated so that appropriate handling practices and training programs can be established to insure safe workplace operations. Please consult your local sales representative for any further information.

REFERENCES

Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices, American Conference of Governmental Industrial Hygienists, OH., (Ariel Insight™ CD-ROM Version), Ariel Research Corp., Bethesda, MD.

Hazardous Substances Data Bank, National Library of Medicine, Bethesda, Maryland (TOMES CPS™ CD-ROM Version), Micromedex, Inc., Englewood, CO.


SAFETY DATA SHEET

PRODUCT

OPTIMER® 9876 PULV

EMERGENCY TELEPHONE NUMBER(S)
(800) 424-9300 (24 Hours) CHEMTREC


Registry of Toxic Effects of Chemical Substances, National Institute for Occupational Safety and Health, Cincinnati, OH, (TOMES CPS™ CD-ROM Version), Micromedex, Inc., Englewood, CO.

Ariel Insight™ (An integrated guide to industrial chemicals covered under major regulatory and advisory programs), North American Module, Western European Module, Chemical Inventories Module and the Generics Module (Ariel Insight™ CD-ROM Version), Ariel Research Corp., Bethesda, MD.

The Teratogen Information System, University of Washington, Seattle, WA (TOMES CPS™ CD-ROM Version), Micromedex, Inc., Englewood, CO.

Prepared By: Product Safety Department
Date issued: 02/03/2012
Version Number: 1.11
CAUTION! May cause irritation with prolonged contact. Do not get in eyes, on skin, on clothing. Do not take internally. Avoid generating dusts. Do not breathe dust. Use with adequate ventilation. In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. After contact with skin, wash immediately with plenty of soap and water. Wear suitable protective clothing.

ATTENTION: For more information refer to the material safety data sheet. Empty containers may contain residual product. DO NOT reuse containers unless properly reconditioned.

EMERGENCY TELEPHONE NUMBER(S): (800) 424-9300 (24 Hours) CHEMTREC

U.S. DOT Shipping Name: PRODUCT IS NOT REGULATED DURING TRANSPORTATION
MARINE TRANSPORT (IMDG/IMO): PRODUCT IS NOT REGULATED DURING TRANSPORTATION
1. PRODUCT AND COMPANY IDENTIFICATION

Product Name: Sulfur Dioxide
UN/ID No.: UN1079
Synonyms: Sulfurous anhydride, Sulfur(IV) oxide
Recommended Use: Chemical intermediate, Reducing agent, Preservative
Uses advised against: Consumer uses: Private households (= general public = consumers).

Company Name:
PVS Chemical Solutions Inc.
10900 Harper Ave.
Detroit, MI 48213
313-921-1200

24 Hour Emergency Phone Number: CHEMTREC 1-800-424-9300

2. HAZARDS IDENTIFICATION

<table>
<thead>
<tr>
<th>Classification</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute toxicity - Inhalation (Gases)</td>
<td>Category 3</td>
</tr>
<tr>
<td>Acute toxicity - Inhalation (Dusts/Mists)</td>
<td>Category 3</td>
</tr>
<tr>
<td>Skin corrosion/irritation</td>
<td>Category 1</td>
</tr>
<tr>
<td>Serious eye damage/eye irritation</td>
<td>Category 1</td>
</tr>
</tbody>
</table>

Emergency Overview

DANGER

Hazard statements
- Toxic if inhaled
- Causes severe skin burns and eye damage
- Harmful to aquatic life
- Contains refrigerated gas; may cause cryogenic burns or injury
- Do not handle until all hazard precautions have been read and understood

Physical hazards

Precautionary statements

Prevention
- Use only outdoors or in a well-ventilated area
- Do not breathe dust/fume/gas/mist/vapors/spray
- Wash face, hands and any exposed skin thoroughly after handling
- Wear protective gloves/protective clothing/eye protection/face protection
- Specific treatment (see section 4 on this Safety Data Sheet)
- Immediately call a POISON CENTER or doctor/physician
- Specific treatment (see section 4 on this Safety Data Sheet)
- Store in a well-ventilated place. Keep container tightly closed
- Store locked up

Response

Storage

Disposal

Hazard not otherwise classified (HNOC)

None known.
3. COMPOSITION/INFORMATION ON INGREDIENTS

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>CAS No.</th>
<th>EC No.</th>
<th>Weight-% *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfur dioxide</td>
<td>7446-09-5</td>
<td>231-195-2</td>
<td>100</td>
</tr>
</tbody>
</table>

*The exact percentage (concentration) of composition has been withheld as a trade secret.

4. FIRST AID MEASURES

General advice
- Immediate medical attention is required

Eye contact
- Keep eye wide open while rinsing
- Immediate medical attention is required
- Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes
- Do not rub affected area

Skin Contact
- Immediate medical attention is required
- Wash off immediately with soap and plenty of water while removing all contaminated clothes and shoes

Inhalation
- Remove to fresh air
- Call a physician or poison control center immediately
- If not breathing, give artificial respiration
- If breathing is difficult, give oxygen

Ingestion
- Do NOT induce vomiting
- Never give anything by mouth to an unconscious person
- Drink plenty of water
- Immediate medical attention is required
- Remove from exposure, lie down
- Clean mouth with water and drink afterwards plenty of water
- Call a physician or poison control center immediately

Note to physician
Product is a corrosive material. Use of gastric lavage or emesis is contraindicated. Possible perforation of stomach or esophagus should be investigated. Do not give chemical antidotes. Asphyxia from glottal edema may occur. Marked decrease in blood pressure may occur with moist rales, frothy sputum, and high pulse pressure. Treat symptomatically.

Self-protection of the first aider
Use personal protective equipment as required. Avoid contact with skin, eyes or clothing.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media
- Use extinguishing measures that are appropriate to local circumstances and the surrounding environment

Unsuitable extinguishing media
- Caution: Use of water spray when fighting fire may be inefficient

Specific hazards arising from the chemical
- The product causes burns of eyes, skin and mucous membranes
- Thermal decomposition can lead to release of irritating and toxic gases and vapors
- In the event of fire and/or explosion do not breathe fumes

Protective equipment and precautions for firefighters
- Wear a self-contained breathing apparatus and chemical protective clothing

Flammable properties
- No information available

Explosive properties
- No information available
6. ACCIDENTAL RELEASE MEASURES

Personal precautions
Use personal protective equipment as required. Evacuate personnel to safe areas. Avoid contact with skin, eyes or clothing. Keep people away from and upwind of spill/leak.

Environmental precautions
For small spills absorb material with clay absorbent or other material. Dispose of the waste material according to local, state and governmental requirements. For large spills contain the material using barriers of absorbent pigs or similar.

Methods for cleaning up
Dike far ahead of liquid spill for later disposal. Soak up with inert absorbent material. Take up mechanically, placing in appropriate containers for disposal. Clean contaminated surface thoroughly. Prevent product from entering drains. Dam up. After cleaning, flush away traces with water.

Other Information
No information available.

7. HANDLING AND STORAGE

Advice on safe handling
- Avoid contact with skin, eyes or clothing
- Use personal protective equipment as required
- Ensure adequate ventilation, especially in confined areas
- In case of insufficient ventilation, wear suitable respiratory equipment
- Use only with adequate ventilation and in closed systems

Storage Conditions
- Keep container tightly closed in a dry and well-ventilated place
- Keep out of the reach of children
- Keep containers tightly closed in a dry, cool and well-ventilated place
- Keep in properly labeled containers

Incompatible materials
- Incompatible with strong acids and bases
- Incompatible with oxidizing agents

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>ACGIH TLV</th>
<th>OSHA PEL</th>
<th>NIOSH IDLH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfur dioxide</td>
<td>STEL: 0.25 ppm</td>
<td>TWA: 5 ppm</td>
<td></td>
</tr>
<tr>
<td>7446-09-5</td>
<td></td>
<td>TWA: 13 mg/m³</td>
<td>IDLH: 100 ppm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(vacated) TWA: 2 ppm</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(vacated) STEL: 15 mg/m³</td>
<td></td>
</tr>
</tbody>
</table>

Exposure Guidelines

Engineering Controls
Ensure adequate ventilation, especially in confined areas.

Individual protection measures, such as personal protective equipment

Respiratory protection
- A respiratory protection program that meets OSHA 1910.134 and ANSI Z88.2 requirements must be followed whenever workplace conditions warrant the use of a respirator.

Eye/face protection
- Tight sealing safety goggles
- Face protection shield

Skin and body protection
- Wear suitable protective clothing
- Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact
General Hygiene Considerations

- When using do not eat, drink or smoke
- Wash contaminated clothing before reuse
- Keep away from food, drink and animal feeding stuffs
- Contaminated work clothing should not be allowed out of the workplace
- Regular cleaning of equipment, work area and clothing is recommended
- Avoid contact with skin, eyes or clothing
- Take off all contaminated clothing and wash it before reuse
- Wear suitable gloves and eye/face protection

### 9. PHYSICAL AND CHEMICAL PROPERTIES

<table>
<thead>
<tr>
<th>Property</th>
<th>Values</th>
<th>Remarks • Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical state</td>
<td>compressed liquefied gas</td>
<td></td>
</tr>
<tr>
<td>Appearance</td>
<td>clear</td>
<td></td>
</tr>
<tr>
<td>Color</td>
<td>colorless</td>
<td></td>
</tr>
<tr>
<td>Odor</td>
<td>Pungent, Irritating</td>
<td></td>
</tr>
<tr>
<td>Odor threshold</td>
<td>No information available</td>
<td></td>
</tr>
<tr>
<td>pH</td>
<td>-76 °C / -105 °F</td>
<td></td>
</tr>
<tr>
<td>Melting point/Freezing Point</td>
<td>-10 °C / 14 °F</td>
<td></td>
</tr>
<tr>
<td>Boiling point / boiling range</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flash point</td>
<td>No information available</td>
<td></td>
</tr>
<tr>
<td>Evaporation rate</td>
<td>No information available</td>
<td></td>
</tr>
<tr>
<td>Flammability (solid, gas)</td>
<td>No information available</td>
<td></td>
</tr>
<tr>
<td>Flammability Limit in Air</td>
<td>No information available</td>
<td></td>
</tr>
<tr>
<td>Upper flammability limit (%)</td>
<td>No information available</td>
<td></td>
</tr>
<tr>
<td>Lower flammability limit (%)</td>
<td>No information available</td>
<td></td>
</tr>
<tr>
<td>Vapor pressure</td>
<td>47.8 psig</td>
<td>@ 20 °C</td>
</tr>
<tr>
<td>Vapor density</td>
<td>2.26</td>
<td>@ 0 °C</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>1.438</td>
<td></td>
</tr>
<tr>
<td>Water solubility</td>
<td>No information available</td>
<td></td>
</tr>
<tr>
<td>Solubility in other solvents</td>
<td>11.9% by weight</td>
<td>@ 15 °C</td>
</tr>
<tr>
<td>Partition coefficient</td>
<td>No information available</td>
<td></td>
</tr>
<tr>
<td>Autoignition temperature</td>
<td>No information available</td>
<td></td>
</tr>
<tr>
<td>Decomposition temperature</td>
<td>No information available</td>
<td></td>
</tr>
<tr>
<td>Kinematic viscosity</td>
<td>No information available</td>
<td></td>
</tr>
<tr>
<td>Dynamic viscosity</td>
<td>No information available</td>
<td></td>
</tr>
<tr>
<td>Explosive properties</td>
<td>No information available</td>
<td></td>
</tr>
<tr>
<td>Oxidizing properties</td>
<td>No information available</td>
<td></td>
</tr>
<tr>
<td>Other Information</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Softening point °C</td>
<td>No information available</td>
<td></td>
</tr>
<tr>
<td>Molecular weight</td>
<td>64.1</td>
<td></td>
</tr>
<tr>
<td>VOC Content (%)</td>
<td>No information available</td>
<td></td>
</tr>
<tr>
<td>Density</td>
<td>No information available</td>
<td></td>
</tr>
<tr>
<td>Bulk density</td>
<td>11.99292 Pounds per gallon (lb/gal)</td>
<td></td>
</tr>
</tbody>
</table>

### 10. STABILITY AND REACTIVITY

Stability

- Stable under recommended storage conditions

Conditions to avoid

- Exposure to air or moisture over prolonged periods

Incompatible materials

- Incompatible with strong acids and bases
- Incompatible with oxidizing agents

Hazardous Decomposition Products

- Thermal decomposition can lead to release of irritating and toxic gases and vapors

Possibility of Hazardous Reactions

- None under normal processing and storage
11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

<table>
<thead>
<tr>
<th>Route</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inhalation</td>
<td>May cause irritation of respiratory tract. Avoid breathing vapors or mists.</td>
</tr>
<tr>
<td>Ingestion</td>
<td>No data available.</td>
</tr>
<tr>
<td>Skin Contact</td>
<td>No data available.</td>
</tr>
<tr>
<td>Eye contact</td>
<td>Contact with eyes may cause irritation.</td>
</tr>
</tbody>
</table>

Information on toxicological effects

Symptoms
No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

<table>
<thead>
<tr>
<th>Sensitization</th>
<th>No information available.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germ cell mutagenicity</td>
<td>No information available.</td>
</tr>
<tr>
<td>Carcinogenicity</td>
<td>The table below indicates whether each agency has listed any ingredient as a carcinogen.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>ACGIH</th>
<th>IARC</th>
<th>NTP</th>
<th>OSHA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfur dioxide</td>
<td></td>
<td>Group 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7446-09-5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

IARC (International Agency for Research on Cancer)
Not classifiable as a human carcinogen

Reproductive toxicity
No information available.

STOT - single exposure
No information available.

STOT - repeated exposure
Chronic exposure to corrosive fumes/gases may cause erosion of the teeth followed by jaw necrosis. Bronchial irritation with chronic cough and frequent attacks of pneumonia are common. Gastrointestinal disturbances may also be seen. Avoid repeated exposure. Possible risk of irreversible effects.

Target Organ Effects
Eyes, Respiratory system, Skin.

Aspiration hazard
No information available.

Numerical measures of toxicity - Product Information

Unknown Acute Toxicity
0% of the mixture consists of ingredient(s) of unknown toxicity

The following values are calculated based on chapter 3.1 of the GHS document  . mg/l

12. ECOLOGICAL INFORMATION

Ecotoxicity
100% of the mixture consists of components(s) of unknown hazards to the aquatic environment

Persistence and degradability
No information available.

Bioaccumulation
No information available.

Other adverse effects
No information available

13. DISPOSAL CONSIDERATIONS

Disposal of wastes
Disposal should be in accordance with applicable regional, national and local laws and regulations.

Contaminated packaging
Do not reuse container.

US EPA Waste Number
D002

14. TRANSPORT INFORMATION
DOT
Proper shipping name: Sulfur dioxide
Hazard Class: 2.3
UN/ID No.: UN1079
Description: UN1079, Sulfur dioxide, 2.3 (8)
Subsidiary class: 8
Special Provisions: 3, B14, T50, TP19
Emergency Response Guide Number: 125

IATA: Forbidden Not regulated
IMDG
UN/ID No.: UN1079
Proper shipping name: Sulphur dioxide
Hazard Class: 2.3
Subsidiary hazard class: 8
EmS-No.: F-C, S-U

15. REGULATORY INFORMATION

US Federal Regulations

SARA 311/312 Hazard Categories
- Acute health hazard: Yes
- Chronic Health Hazard: No Yes
- Fire hazard: No
- Sudden release of pressure hazard: Yes
- Reactive Hazard: No

SARA 313
Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372

CWA (Clean Water Act)
This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42)

CERCLA
This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Hazardous Substances RQs</th>
<th>CERCLA/SARA RQ</th>
<th>Reportable Quantity (RQ) (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfur dioxide</td>
<td>-</td>
<td>500 lb</td>
<td>-</td>
</tr>
<tr>
<td>7446-09-5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

US State Regulations

California Proposition 65
This product contains the following Proposition 65 chemicals

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>California Proposition 65</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfur dioxide - 7446-09-5</td>
<td>Developmental</td>
</tr>
</tbody>
</table>

U.S. State Right-to-Know Regulations

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>New Jersey</th>
<th>Massachusetts</th>
<th>Pennsylvania</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfur dioxide</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>7446-09-5</td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

International Inventories

TSCA: Complies
DSL/NDSL: Complies
EINECS/ELINCS: Complies
ENCS: Complies
IECSC: Complies
KECL: Complies
Item # 10731 Sulfur Dioxide

PICCS Complies
AICS Complies

Legend:
TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List
EINECS/ELINCS - European Inventory of Existing Chemical Substances/European List of Notified Chemical Substances
ENCS - Japan Existing and New Chemical Substances
IECSC - China Inventory of Existing Chemical Substances
KECL - Korean Existing and Evaluated Chemical Substances
PICCS - Philippines Inventory of Chemicals and Chemical Substances
AICS - Australian Inventory of Chemical Substances

16. OTHER INFORMATION

<table>
<thead>
<tr>
<th>NFPA</th>
<th>Health hazards 3</th>
<th>Flammability 0</th>
<th>Instability 0</th>
<th>Physical and Chemical Properties -</th>
</tr>
</thead>
<tbody>
<tr>
<td>HMIS</td>
<td>Health hazards 3</td>
<td>Flammability 0</td>
<td>Physical hazards 0</td>
<td>Personal protection C</td>
</tr>
</tbody>
</table>

Item # 10731
Safety Data Sheet 0733
Revision Date Feb-10-2015
Issue Date Feb-10-2015
Version 1
Revision Note *** Updated value on SDS.

Disclaimer
All information, statements, data, advice, and/or recommendations, including, without limitation, those relating to storage, loading/unloading, piping, and transportation (collectively referred to herein as "information") are believed to be accurate, reliable, and based on reliable industry and regulatory references. However, no representation or warranty, express or implied, is made as to its completeness, accuracy, fitness for a particular purpose or any other matter, including, without limitation, that the practice or application of any such information is free of patent infringement or other intellectual property misappropriation. The Company providing this SDS is not engaged in the business of providing technical, operational, engineering, or safety information for a fee, and therefore, any such information provided herein has been furnished as an accommodation and without charge. All information provided herein is intended for use by persons having requisite knowledge, skill, and experience in the chemical industry. The Company providing this SDS shall not be responsible or liable for the use, application, or implementation of the information provided herein, and all such information is to be used at the risk, and in the sole judgment and discretion of such persons, their employees, advisors, and agents. This safety data sheet (SDS) is offered for your information, consideration, and investigation as required by federal hazardous products act and related legislation.

End of Safety Data Sheet
**Sulfur Dioxide**

**UN1079, Sulfur dioxide, 2.3 (8)**

**Hazard statements**
Toxic if inhaled. Causes severe skin burns and eye damage. Harmful to aquatic life. Contains refrigerated gas; may cause cryogenic burns or injury.

**Physical hazards**
Avoid contact with eyes, skin and clothing. Do not breathe dust/fume/gas/mist/vapors/spray.

**Prevention**
Use only outdoors or in a well-ventilated area. Do not breathe dust/fume/gas/mist/vapors/spray. Wash face, hands and any exposed skin thoroughly after handling. Wear protective gloves/protective clothing/eye protection/face protection.

**First aid measures**
- **Eye contact** Keep eye wide open while rinsing. Immediate medical attention is required. Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Do not rub affected area.
- **Skin Contact** Immediate medical attention is required. Wash off immediately with soap and plenty of water while removing all contaminated clothes and shoes.
- **Inhalation** Remove to fresh air. Call a physician or poison control center immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.
- **Ingestion** Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Drink plenty of water. Immediate medical attention is required. Remove from exposure, lie down. Clean mouth with water and drink afterwards plenty of water. Call a physician or poison control center immediately.

**General advice**
Immediate medical attention is required.

**Storage Conditions**
Keep container tightly closed in a dry and well-ventilated place. Keep out of reach of children. Keep containers tightly closed in a dry, cool and well-ventilated place. Keep in properly labeled containers.

**Appearance:** clear, colorless, compressed liquefied gas.

**Odor:** Pungent, Irritating

**Net Weight (lbs)**
No Data

**Recommended Use:** Chemical intermediate, Reducing agent, Preservative.

**24 Hour Emergency Phone Number:** CHEMTREC (800) 424-9300

**UN1079**
# Limestone

## 1. Identification

**Product Name:** Limestone

**Synonyms:**

| #1 Grit, | Agg OGB Select Material Stone, | GFP270C, | Minn. Class 5s, |
| #3 Grit Coated, | Aggregate Limestone, | GFP7, | OGB, |
| #3 Grit, | Agricultural Stone-Large, | GPS 20, | OH-57, |
| #57 Washed Stone, | Agricultural Stone-Small, | GPS 325, | OH-67, |
| #57, | | Grade B, | OH-8, |
| #8's Limestone, | | Grade F, | OHIO #4, |
| 100 mesh, | Blast Furnace Stone, | Granular A, | OHIO 57's, |
| 100x0, | BOF Stone, | Granular M, | OHIO 8's, |
| 12mx50m, | Calcite #1, | Ground Limestone, | PCC Limestone, |
| 12x50, | Calcite 467, | Guideline Field Marker, | Pellet Flux, |
| 16 m x 100 m, | Calcite 57/2B, | H1, | Pelletized Limestone, |
| 16x100, | Calcite 8/1B, | H2, | Port Inld Screenings, |
| 16x140M, | Calcite, | H3, | Premiacal - Grade F, |
| 16x200, | Calcitic Aglime Dry, | Hi Cal Blast Furnace Stone, | Premiacal 16, |
| 20x0, | Calcitic Aglime, | Hi Cal Fluxing Stone, | Premiacal 20, |
| 20x200, | Camdil 76-325, | Hi Cal Large Sand, | Premiacal 22, |
| 21AA, | Camdil 99-325, | Hi Cal Min. Filler 62/200-BK, | Premiacal 28, |
| 23A, | CM 11, | Hi Cal Min. Filler 75/200-BK, | Premiacal 29, |
| 2A Sub Base, | Commercial Aggregates, | Hi Cal Sinter Flux Stone, | Premiacal, |
| 3" X 6", | Commercial Stone, | Hi Cal Stone, | Pro Pulverized, |
| 5x9M, | Concrete Stone, | Hi Calcium Blast Furnace Flux, | Pulverized calcium carbonate, |
| 60x0, | Feed Grade Calcium Bulk, | High Calcium Limestone | Pulverized Limestone, |
| 62/200, | Feed grade HiCal, | HL-3, | Rock Dust 101 (White), |
| 6AA, | FGD Limestone, | Intermediate Aggregate, | ROM Stone, |
| 75-200, | FGD Stone, | Large Fraction, | ROMF, |
| 78/200, | G Chemical, | Lut 95-150m, | Rotary E2, |
| 80/325, | GFP 101, | Manufactured Sand 3-32, | Sewer Stone, |
| 85-200, | GFP 101WO, | Manufactured Sand, | Sinter Stone, |
| 8mx20m, | GFP 102, | MI-22A, | Soil Doctor, |
| 8x20, | GFP 135, | MI-23A, | TMG Hi Cal 325, |
| 90/325, | GFP 200C, | MI-25A, | Tri-County 8 Mesh Fertilizer Filler, |
| 90-325, | GFP 250, | MI-31A, | Tuff Shell HiCal, |
| 95-150M, | GFP 250C, | MI-6AA, | VDOT Rockfill, |
| Ag Lime, | GFP 3, | MI-6AAA, | W-10, |
| Agg #57 Stone, | GFP 325, | Mine Safety Dust, | York CA Chips, |
| Agg 75, | GFP 60C, | | |

**Recommended Uses:** Mineral filler, Manufacture of lime and lime related products, and aggregate
Safety Data Sheet

Limestone

Manufacturer: Carmeuse Lime & Stone

US Office
11 Stanwix Street, 21st Floor
Pittsburgh, PA 15222
Phone: (412) 995-5500
Fax: (412) 995-5594

Canadian Office
PO Box 190
Ingersoll, ON N5C 3K5
Phone: (519) 423-6283
Fax: (519) 423-6545

Emergency Contact: Infotrac: (800) 535-5053 (24 hrs a day, 7 days a week)

2. Hazards Identification

GHS classification
Physical Hazards
None

Health Hazards
Skin irritation Category 3
Eye irritation Category 2B
Carcinogenicity Category 1A
Specific Target Organ Toxicity – Repeated Exposure Category 1

GHS Label Elements:
Signal Word: Danger

Hazard Statements:
Causes mild skin irritation
Causes eye irritation
May cause cancer through inhalation
Causes damage to lungs through prolonged or repeated exposure by inhalation

Precautionary Statements:
Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.
Do not breathe dust.
Wash thoroughly after handling.
Use personal protective equipment as required
Do not eat, smoke or drink when using this product

Pictograms:

3. Composition

<table>
<thead>
<tr>
<th>Chemical name</th>
<th>% by weight</th>
<th>CAS#</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium carbonate</td>
<td>90+</td>
<td>1317-65-3</td>
</tr>
<tr>
<td>Magnesium carbonate</td>
<td>&lt; 5</td>
<td>546-93-0</td>
</tr>
<tr>
<td>Silica-crystalline quartz</td>
<td>0.1 - 2</td>
<td>14808-60-7</td>
</tr>
</tbody>
</table>
4. First Aid Measures

**Eyes:** Flush victim’s eyes thoroughly with large quantities of water, including under eye lids. Get medical attention if irritation persists.

**Skin:** Remove dusty clothing. Wash skin thoroughly with soap and water. Launder clothing before re-use. Get medical attention if irritation persists.

**Ingestion:** Get medical attention if a large amount is swallowed.

**Inhalation:** Remove victim to fresh air. If symptoms persist or breathing is difficult, get medical attention.

**Most Important Symptoms:** Eye and respiratory irritation due to exposure to dust.

**Immediate medical attention / special treatment?** No immediate medical attention anticipated.

5. Fire Fighting Measures

**Suitable (and unsuitable) fire extinguishing media:** Use extinguishing media appropriate for surrounding conditions.

**Specific hazards arising from the product** Decomposes at 950 °C to produce calcium oxide and magnesium oxide.

**Special protective equipment and precautions for fire fighters** Dust that becomes wet may cause surfaces to be extremely slippery and cause a slip hazard.

6. Accidental Release Measures

**Personal precautions, protective equipment, emergency procedures:**

Avoid eye and skin contact. Avoid generating airborne dust. Wear appropriate clothing to prevent skin contact. Wearing of standard SCBA should be adequate to protect against inhalation of dust.

**Methods and materials for containment and clean up:**

Utilize cleanup methods that minimize generating dust: vacuum. Avoid dry sweeping. Water may be used to control dust, but wet dust can be very slippery and result in a slip hazard. Residue on surfaces may be removed with water or vinegar.

7. Handling & Storage

**Safe Handling:** Avoid skin and eye contact. Avoid generating airborne dust. An eye wash station should be readily available when this product is handled.

**Safe Storage:** Store in dry, well ventilated areas, away from incompatible materials.
8. Exposure Controls/Personal Protection

<table>
<thead>
<tr>
<th>Occupational Exposure Limits</th>
<th>OSHA PEL (mg/m³)</th>
<th>ACGIH TLV (mg/m³)</th>
<th>Ont. Reg. 833 TWAEV (mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium carbonate</td>
<td>15</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Magnesium carbonate</td>
<td>15 (respirable)</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>silica - crystalline quartz</td>
<td>30 / (% silica +2) (total)</td>
<td>0.025</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td>10 / (% silica +2) (respirable)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Engineering Controls: Use with adequate general or local exhaust ventilation and to maintain exposure below occupational exposure limits.

Individual Protection Measures (Personal Protective Equipment):

Specific Eye / Face Protection: In windy conditions, or if work activity generates elevated airborne dust levels, dust proof or chemical goggles are recommended.

Specific Skin Protection: When prolonged skin contact is likely to occur, wear appropriate clothing and gloves.

Specific Respiratory Protection: If exposure limits are exceeded, an approved particulate respirator, or supplied air respirator, appropriate for the airborne concentrations, should be used. Selection and use of the respiratory protective equipment must be in accordance with applicable regulations and good industrial hygiene practices.

9. Physical & Chemical Properties

Appearance: Solid, white or grey powder or stone

Odor: Odorless

Odor threshold: Not Applicable

pH: 9.4 in saturated water solution at 25 °C (77 °F)

Melting Point/Freezing Point: 950 °C (1742 °F)

Boiling Point and range: 2850 °C (5162 °F)

Flash Point: Not Applicable

Evaporation Rate: Not Applicable

Flammability: Not Available

Upper/lower flammability or explosive limits: Not Applicable

Vapor pressure/density: Non Volatile
Safety Data Sheet

Limestone

Relative density: 2.7
Solubility: Slightly soluble in water: 0.013 g/L at 18 °C
Partition coefficient: n-octanol/water Not Applicable
Auto-ignition temperature: Not Available
Decomposition temperature: 950 °C (1742 °F)
Viscosity: Not Applicable

10. Stability & Reactivity
Reactivity: Not normally reactive.
Chemical stability: Stable under normal storage and handling conditions.
Possibility of Hazardous Reactions: Reacts with acids to form calcium salts while generating heat.
Conditions to avoid: Vicinity of incompatible materials.
Incompatibility: Incompatible with acids (reaction generates carbon dioxide gas and heat); reactive fluoridated, brominated or phosphorous compounds; aluminum (may form hydrogen gas), ammonium salts, mercury, hydrogen, magnesium, reactive powdered metals; organic acid anhydrides; nitro-organic compounds; interhalogenated compounds.
Hazardous decomposition products: Calcium oxide and carbon dioxide

11. Toxicological Information
Likely routes of exposure & symptoms:
Eyes: Exposure to pulverized dust may cause irritation
Skin: Exposure to pulverized dust may cause dryness and irritation
Ingestion: No adverse effects expected for normal, incidental ingestion. If a large amount is swallowed, may cause gastrointestinal irritation, discomfort and blockage.
Inhalation: Exposure to pulverized dust may cause irritation in nose, throat and lungs

Chronic health effects: This product contains trace amounts of crystalline silica. Prolonged or repeated inhalation of respirable crystalline silica can cause silicosis, as serious lung disease.
Respiratory or skin sensitization: This material is not known to cause sensitization
Germ cell mutagenicity: No data available.
Carmeuse

Limestone

Carcinogenicity: This product is not listed as carcinogenic by OSHA, IARC, NTP, ACGIH, or the EU Directives. This product may contain trace amounts of crystalline silica quartz which is listed by IARC as “Carcinogenic to Humans” (Group 1) and “Known to be a Human Carcinogen” by NTP.

Reproductive toxicity: No Data Available.

Numerical Measures of Toxicity
Crystalline Silica: Oral Rate LD$_{50}$ > 22,500 mg/kg

12. Ecological Information
Because of the elevated pH of this product, it might be expected to produce some ecotoxicity upon exposure to certain aquatic organisms and aquatic systems in high concentrations. This material shows no bioaccumulation effect or food chain concentration toxicity.

13. Disposal Considerations
Dispose of contents in accordance with federal, state, provincial and local regulations.

14. Transport Information
This product is not classified as a hazardous material under US DOT or Canadian TDG regulations.

15. Regulatory Information

<table>
<thead>
<tr>
<th>CERCLA Hazardous Substances</th>
<th>Not listed</th>
</tr>
</thead>
<tbody>
<tr>
<td>SARA Toxic Chemical (40 CFR 372.65)</td>
<td>Not listed</td>
</tr>
<tr>
<td>SARA Section 302 Extremely Hazardous Substances (40 CFR 355)</td>
<td>Not listed</td>
</tr>
<tr>
<td>SARA 311/312</td>
<td>Not listed</td>
</tr>
<tr>
<td>SARA Section 313 Toxic Chemicals reporting requirements</td>
<td>none</td>
</tr>
<tr>
<td>Threshold planning quantity (TPQ)</td>
<td>Not listed</td>
</tr>
<tr>
<td>RCRA Hazardous Waste Classification (40 CFR 261)</td>
<td>Not Classified</td>
</tr>
<tr>
<td>EPA Toxic Substances Control Act (TSCA) Status</td>
<td>All of the components of this product are listed on the TSCA</td>
</tr>
<tr>
<td>California Proposition 65</td>
<td>Airborne crystalline silica particulates of respirable size are known to the State of California to cause cancer.</td>
</tr>
<tr>
<td>NFPA ratings</td>
<td>Health: 1 Fire: 0 Reactivity: 0</td>
</tr>
<tr>
<td>HMIS Ratings</td>
<td>Health: 1 Fire: 0 Reactivity: 0 Personal protection: A</td>
</tr>
<tr>
<td>OSHA Specifically regulated substance (29 CFR 1910)</td>
<td>Not listed</td>
</tr>
<tr>
<td>OSHA Air contaminant (29 CFR 1910.1000, Table Z-1, Z-1-A)</td>
<td>Listed</td>
</tr>
</tbody>
</table>
Safety Data Sheet
Limestone

Revision date:
June 24, 2015

MSHA
Not listed

Canada DSL
Listed

Canadian WHMIS Classification
D2A, Materials Causing other toxic effects.

Canada CPR
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulation of Canada and this SDS contains all the required information.

16. Other Information

List of GHS Hazard Statements:
H316: Causes mild skin irritation
H320: Causes eye irritation
H350: May cause cancer by inhalation
H372: Causes damage to lungs through prolonged or repeated exposure by inhalation.

List of GHS Precautionary Statements:
P201: Obtain special instructions before use.
P202: Do not handle until all safety precautions have been read and understood.
P260: Do not breathe dust.
P264: Wash hands thoroughly after handling.
P270: Do not eat, drink or smoke when using this product.
P281: Use personal protective equipment as required

Abbreviations

CERCLA Comprehensive Environmental Response, Compensation and Liability Act
RCRA Resource Conservation and Recovery Act
SARA Superfund Amendments and Reauthorization Act
IARC International Agency for Research on Cancer
NTP National Toxicology Program

The information contained herein is believed to be accurate and reliable as of the date hereof. However, Carmeuse makes no representation, warranty or guarantee as to results or as to the information’s accuracy, reliability or completeness. Carmeuse has no liability for any loss or damage that may result from use of the information. Each user is responsible to review this information, satisfy itself as to the information’s suitability and completeness, and circulate the information to its employees, customers and other appropriate third parties.
LIMESTONE

Causes mild skin irritation - Causes eye irritation - May cause cancer (state route of exposure if it is conclusively proven that no other routes of exposure cause hazard) - Causes damage to organs (or state all organs affected, if known) through prolonged or repeated exposure (state route of exposure if it is conclusively proven that no other routes of exposure cause hazard)

Obtain special instructions before use. - Do not handle until all safety precautions have been read and understood. - Wash thoroughly after handling. - Do not eat, drink or smoke when using this product. - Use personal protective equipment as required.

Carmeuse Lime & Stone

Please refer to the original SDS for more information
SAFETY DATA SHEET
HIGH CALCIUM LIMESTONE

Section 1. Identification

GHS product identifier : HIGH CALCIUM LIMESTONE
Other means of identification : Limestone, Calcium Carbonate, Calcite, Aragonite, Flux stone, Fine Ground Limestone, Rock Dust.
Product code : Not available.
Product type : Solid.

Identified uses
Neutralization, desulphurization, flux, aggregates, mineral filler, liming, lime, feed ingredient.

Supplier/Manufacturer : GRAYMONT
#200-10991 Shellbridge Way
Richmond, BC V6X 3C6
Canada
Phone: 1 604 207-4292
Toll free : 1 866 207-4292
Fax: 1 604 207-9014
Web Site: http://www.graymont.com/

Emergency telephone number (with hours of operation) : CANUTEC (613-996-6666)
CIEMTREC, US (800-424-9300)
INTERNATIONAL: (703-527-3887)

Section 2. Hazards identification

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).
Classification of the substance or mixture : CARCINOGENICITY (inhalation) - Category 1A
SPECIFIC TARGET ORGAN TOXICITY (REPEATED EXPOSURE) - Category 1

GHS label elements
Hazard pictograms :

Signal word : Danger
Hazard statements :
H350 - May cause cancer if inhaled.
H372 - Causes damage to organs through prolonged or repeated exposure.

Precautionary statements
Prevention : P201 - Obtain special instructions before use.
P202 - Do not handle until all safety precautions have been read and understood.
P281 - Use personal protective equipment as required.
P260 - Do not breathe dust.
P270 - Do not eat, drink or smoke when using this product.
P264 - Wash hands thoroughly after handling.

Response : P314 - Get medical attention if you feel unwell.
P308 + P313 - IF exposed or concerned: Get medical attention.
Section 2. Hazards identification

Storage : P401 - Store to minimize dust generation.
Disposal : P501 - Dispose of contents and container in accordance with all local, regional, national and international regulations.

Hazard not otherwise classified (HNOC)
- Physical hazards not otherwise classified (PHNOC) : None known.
- Health hazards not otherwise classified (HHNOC) : None known.

Section 3. Composition/information on ingredients

Substance/mixture : Mixture
Other means of identification : Limestone, Calcium Carbonate, Calcite, Aragonite, Flux stone, Fine Ground Limestone, Rock Dust.

CAS number/other identifiers
- CAS number : Not applicable.
- Product code : Not available.

<table>
<thead>
<tr>
<th>Ingredient name</th>
<th>%</th>
<th>CAS number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limestone</td>
<td>60 - 100</td>
<td>1317-85-3</td>
</tr>
<tr>
<td>Crystalline silica, quartz</td>
<td>0.0001 - 1</td>
<td>14808-60-7</td>
</tr>
</tbody>
</table>

Crystalline silica has been found in some products at or above detection level 0.1%. Concentration is dependent upon limestone source.

Any concentration shown as a range is to protect confidentiality or is due to batch variation.

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 20 minutes. Get medical attention.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Get medical attention. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

Skin contact : Wash contaminated skin with soap and water. Wash contaminated clothing thoroughly with water before removing it, or wear gloves. Continue to rinse for at least 20 minutes. Get medical attention. Wash clothing before reuse. Clean shoes thoroughly before reuse.
Section 4. First aid measures

Ingestion: Wash out mouth with water. Remove dentures if any. Remove victim to fresh air and keep at rest in a position comfortable for breathing. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Stop if the exposed person feels sick as vomiting may be dangerous. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Get medical attention. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact: No known significant effects or critical hazards.
Inhalation: No known significant effects or critical hazards.
Skin contact: No known significant effects or critical hazards.
Ingestion: No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact: No known significant effects or critical hazards.
Inhalation: No known significant effects or critical hazards.
Skin contact: No known significant effects or critical hazards.
Ingestion: No known significant effects or critical hazards.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician: Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments: No specific treatment.

Protection of first-aiders: No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media: Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media: None known.

Specific hazards arising from the chemical

No specific fire or explosion hazard.

Hazardous thermal decomposition products: Decomposition products may include the following materials: carbon dioxide metal oxide/oxides

Special protective actions for fire-fighters: No special measures are required.
Section 5. Fire-fighting measures

Special protective equipment for fire-fighters: Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel: No action shall be taken involving any personal risk or without suitable training. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders: If specialized clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions: Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways or air).

Methods and materials for containment and cleaning up

Spill: Move containers from spill area. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Avoid dust generation. Do not dry sweep. Vacuum dust with equipment fitted with a HEPA filter and place in a closed, labeled waste container. Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures: Put on appropriate personal protective equipment (see Section 8). Avoid exposure - obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Do not get in eyes or on skin or clothing. Do not ingest. If during normal use the material presents a respiratory hazard, use only with adequate ventilation or wear appropriate respirator. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene: Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities: Store in accordance with local regulations. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink. Store to minimize dust generation. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.
### Section 8. Exposure controls/personal protection

#### Control parameters

**United States**

**Occupational exposure limits**

<table>
<thead>
<tr>
<th>Ingredient name</th>
<th>Exposure limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystalline silica, quartz</td>
<td><strong>OSHA PEL</strong> Z3 (United States, 2/2013).</td>
</tr>
<tr>
<td></td>
<td>TWA: 10 mg/m³ 8 hours. Form: Respirable</td>
</tr>
<tr>
<td></td>
<td>TWA: 250 mppcf 8 hours. Form: Respirable</td>
</tr>
<tr>
<td></td>
<td>TWA: 5 mg/m³ Form: Respirable fraction</td>
</tr>
<tr>
<td></td>
<td>TWA: 16 mg/m³ Form: Total dust</td>
</tr>
<tr>
<td><strong>NIOSH REL</strong> (United States, 10/2013).</td>
<td>TWA: 0.05 mg/m³ 10 hours. Form: Respirable dust</td>
</tr>
<tr>
<td></td>
<td>TWA: 5 mg/m³ Form: Respirable fraction</td>
</tr>
<tr>
<td></td>
<td>TWA: 10 mg/m³ Form: Total dust</td>
</tr>
<tr>
<td><strong>ACGIH TLV</strong> (United States, 4/2014).</td>
<td>TWA: 0.025 mg/m³ 8 hours. Form: Respirable fraction</td>
</tr>
<tr>
<td><strong>MSHA PEL</strong></td>
<td>TWA 8/40 hours: 30 mg/m³(%SiO₂)+2 mg/m³ Form: Total dust</td>
</tr>
<tr>
<td></td>
<td>10 mg/m³(%SiO₂)+2 mg/m³ Form: Respirable dust</td>
</tr>
<tr>
<td><strong>NIOSH REL</strong> (United States, 4/2013).</td>
<td>TWA: 5 mg/m³ 10 hours. Form: Respirable fraction</td>
</tr>
<tr>
<td></td>
<td>TWA: 10 mg/m³ Form: Total dust</td>
</tr>
<tr>
<td><strong>OSHA PEL</strong> (United States, 2/2013).</td>
<td>TWA: 5 mg/m³ 8 hours. Form: Respirable fraction</td>
</tr>
<tr>
<td></td>
<td>TWA: 15 mg/m³ 8 hours. Form: Total dust</td>
</tr>
<tr>
<td><strong>ACGIH TLV</strong></td>
<td>TWA: 10 mg/m³</td>
</tr>
</tbody>
</table>

**Limestone**

<table>
<thead>
<tr>
<th>Ingredient name</th>
<th>TWA (8 hours)</th>
<th>STEF (15 mins)</th>
<th>Ceiling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystalline silica, quartz</td>
<td>US ACGIH 4/2014</td>
<td>0.025</td>
<td>Another</td>
</tr>
<tr>
<td>AB 4/2009</td>
<td>-</td>
<td>0.025</td>
<td>Other</td>
</tr>
<tr>
<td>BC 7/2013</td>
<td>-</td>
<td>0.025</td>
<td>Other</td>
</tr>
<tr>
<td>ON 1/2013</td>
<td>-</td>
<td>0.1</td>
<td>Other</td>
</tr>
<tr>
<td>QC 1/2014</td>
<td>-</td>
<td>0.1</td>
<td>Other</td>
</tr>
<tr>
<td>AB 4/2009</td>
<td>-</td>
<td>10</td>
<td>Other</td>
</tr>
<tr>
<td>BC 7/2013</td>
<td>-</td>
<td>3</td>
<td>Other</td>
</tr>
<tr>
<td>QC 12/2012</td>
<td>-</td>
<td>10</td>
<td>Other</td>
</tr>
<tr>
<td></td>
<td></td>
<td>20</td>
<td>Other</td>
</tr>
</tbody>
</table>

Form: [a] Respirable fraction [b] Respirable particulate. [c] Respirable [d] Respirable dust [e] Total dust

#### Appropriate engineering controls

If user operations generate dust, fumes, gas, vapor or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. Engineering controls may be required to control the primary or secondary risks associated with this product.

#### Environmental exposure controls

Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation.

#### Individual protection measures

**Hygiene measures**

Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.
Section 8. Exposure controls/personal protection

Eye/face protection: Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: safety glasses with side-shields.

Skin protection

Hand protection: Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.

Body protection: Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection: Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection: Use a properly fitted, particulate filter respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator. Wear an appropriate NIOSH approved respirator if concentration levels exceed the safe exposure limits.

Section 9. Physical and chemical properties

Appearance

Physical state: Solid. [Solid or powder.]

Color: White to gray.

Odor: Odorless.

Odor threshold: Not available.

pH: 8 to 9.2 at 25°C

Melting point: Not available.

Boiling point: Not available.

Flash point: Closed cup: Not applicable.

Evaporation rate: Not applicable.

Flammability (solid, gas): Not applicable.

Lower and upper explosive (flammable) limits: Not applicable.

Vapor pressure: Not available.

Vapor density: Not available.

Relative density: 2.68 to 2.76

Solubility: Not available.

Solubility in water: 0.00066g/100g at 20°C

Partition coefficient: n-octanol/water: Not available.

Auto-ignition temperature: Not applicable.

Decomposition temperature: 900°C (1652°F) for 760 mm pressure.

Viscosity: Not available.

Volatile: Not available.
Section 9. Physical and chemical properties

VOC (w/w) : 0 % (w/w)

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : Do not allow limestone to come into contact with incompatible materials.

Incompatible materials : Reactive or incompatible with the following materials: oxidizing materials and strong acids.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity
There is no data available.

Irritation/Corrosion
There is no data available.

Sensitization
There is no data available.

Carcinogenicity
Classification

<table>
<thead>
<tr>
<th>Product/ingredient name</th>
<th>OSHA</th>
<th>IARC</th>
<th>NTP</th>
<th>ACGIH</th>
<th>EPA</th>
<th>NIOSH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystalline silica, quartz</td>
<td>-</td>
<td>1</td>
<td>Known to be a human carcinogen.</td>
<td>A2</td>
<td>-</td>
<td>+</td>
</tr>
</tbody>
</table>

Specific target organ toxicity (single exposure)
There is no data available.

Specific target organ toxicity (repeated exposure)

<table>
<thead>
<tr>
<th>Name</th>
<th>Category</th>
<th>Route of exposure</th>
<th>Target organs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystalline silica, quartz</td>
<td>Category 1</td>
<td>Inhalation</td>
<td>kidneys, respiratory tract and testes</td>
</tr>
</tbody>
</table>

Aspiration hazard
There is no data available.

Information on the likely routes of exposure

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Inhalation : No known significant effects or critical hazards.
Section 11. Toxicological information

**Skin contact**: No known significant effects or critical hazards.

**Ingestion**: No known significant effects or critical hazards.

**Symptoms related to the physical, chemical and toxicological characteristics**

- **Eye contact**: No known significant effects or critical hazards.
- **Inhalation**: No known significant effects or critical hazards.
- **Skin contact**: No known significant effects or critical hazards.
- **Ingestion**: No known significant effects or critical hazards.

**Delayed and immediate effects and also chronic effects from short and long term exposure**

**Short term exposure**

- **Potential immediate effects**: No known significant effects or critical hazards.
- **Potential delayed effects**: No known significant effects or critical hazards.

**Long term exposure**

- **Potential immediate effects**: No known significant effects or critical hazards.
- **Potential delayed effects**: No known significant effects or critical hazards.

**Potential chronic health effects**

- **General**: Causes damage to organs through prolonged or repeated exposure.
- **Carcinogenicity**: May cause cancer if inhaled. Risk of cancer depends on duration and level of exposure.
- **Mutagenicity**: No known significant effects or critical hazards.
- **Teratogenicity**: No known significant effects or critical hazards.
- **Developmental effects**: No known significant effects or critical hazards.
- **Fertility effects**: No known significant effects or critical hazards.

**Numerical measures of toxicity**

**Acute toxicity estimates**

There is no data available.

Section 12. Ecological information

**Toxicity**

There is no data available.

**Persistence and degradability**

There is no data available.

**Bioaccumulative potential**

There is no data available.

**Mobility in soil**

- **Soil/water partition coefficient (Koc)**: Not available.

**Other adverse effects**

No known significant effects or critical hazards.
Section 13. Disposal considerations

**Disposal methods**: The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling empty containers that have not been cleaned or rinsed out. Empty containers or liners may retain some product residues. Avoid dispersal of spilled material and runoff and contact with waterways, drains and sewers.

Section 14. Transport information

<table>
<thead>
<tr>
<th></th>
<th>DOT</th>
<th>TDG</th>
<th>IMDG</th>
<th>IATA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>UN proper shipping name</strong></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Transport hazard class(es)</strong></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Packing group</strong></td>
<td>-</td>
<td>No.</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Environmental hazards</strong></td>
<td>No.</td>
<td>No.</td>
<td>No.</td>
<td>-</td>
</tr>
<tr>
<td><strong>Additional information</strong></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**AERG**: Not applicable.

**Special precautions for user**: Transport within user’s premises: always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

**Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code**: Not available.

Section 15. Regulatory information

**U.S. Federal regulations**: TSCA 8(a) CDR Exempt/Partial exemption: Not determined

United States inventory (TSCA 8b): All components are listed or exempted.

RCRA classification: Limestone is not listed or classified.

CWA-311: Limestone does not appear on the Clean Water Act (CWA) list of hazardous substances.

CERCLA: Limestone is not listed.

FDA: Limestone has been determined as “Generally Recognized As Safe” (GRAS) by FDA. See 21CFR184.1409. (CFR Title 21 Part 184 - Direct food substances affirmed as generally recognized as safe).
Section 15. Regulatory information

Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs)
Clean Air Act Section 602 Class I Substances: Not listed
Clean Air Act Section 602 Class II Substances: Not listed
DEA List I Chemicals (Precursor Chemicals): Not listed

SARA 302/304
Composition/information on ingredients
No products were found.

SARA 304 RQ: Not applicable.

SARA 311/312
Classification: Delayed (chronic) health hazard

Composition/information on ingredients

<table>
<thead>
<tr>
<th>Name</th>
<th>%</th>
<th>Fire hazard</th>
<th>Sudden release of pressure</th>
<th>Reactive</th>
<th>Immediate (acute) health hazard</th>
<th>Delayed (chronic) health hazard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystalline silica, quartz</td>
<td>0.0001 - 1</td>
<td>NO.</td>
<td>No.</td>
<td>No.</td>
<td>No.</td>
<td>Yes.</td>
</tr>
</tbody>
</table>

SARA 313

<table>
<thead>
<tr>
<th>Product name</th>
<th>CAS number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Form R - Reporting requirements</td>
<td>Not listed.</td>
<td>-</td>
</tr>
<tr>
<td>Supplier notification</td>
<td>Not listed.</td>
<td>-</td>
</tr>
</tbody>
</table>

SARA 313 notifications must not be detached from the SDS and any copying and redistribution of the SDS shall include copying and redistribution of the notice attached to copies of the SDS subsequently redistributed.

State regulations

Massachusetts: The following components are listed: Limestone; Crystalline silica, quartz
New York: None of the components are listed.
New Jersey: The following components are listed: Limestone; Crystalline silica, quartz
Pennsylvania: The following components are listed: Limestone; Crystalline silica, quartz

California Prop. 65
WARNING: This product contains a chemical known to the State of California to cause cancer.

<table>
<thead>
<tr>
<th>Ingredient name</th>
<th>Cancer</th>
<th>Reproductive</th>
<th>No significant risk level</th>
<th>Maximum acceptable dosage level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystalline silica, quartz</td>
<td>Yes.</td>
<td>No.</td>
<td>No.</td>
<td>No.</td>
</tr>
</tbody>
</table>

Canada
Canadian lists
Section 15. Regulatory information

Canadian NPRI : None of the components are listed.
CEPA Toxic substances : None of the components are listed.
Canada inventory : At least one component is not listed in DSL but all such components are listed in NDSL.

International lists
National inventory
Australia : All components are listed or exempted.
China : All components are listed or exempted.
Europe : All components are listed or exempted.
Japan : Not determined.
Malaysia : Not determined.
New Zealand : All components are listed or exempted.
Philippines : All components are listed or exempted.
Republic of Korea : All components are listed or exempted.
Taiwan : Not determined.

Section 16. Other information

Hazardous Material Information System (U.S.A.)

Health : 1
Flammability : 0
Physical hazards : 0

Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks. Although HMIS® ratings are not required on SDSs under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6668.

The customer is responsible for determining the PPE code for this material.

National Fire Protection Association (U.S.A.)

Health : 1
Flammability : 0
Instability : 0

Reprinted with permission from NFPA 704-2001. Identification of the Hazards of Materials for Emergency Response Copyright ©1997, National Fire Protection Association, Quincy, MA 02269. This reprinted material is not the complete and official position of the National Fire Protection Association, on the referenced subject which is represented only by the standard in its entirety.

Copyright ©2001, National Fire Protection Association, Quincy, MA 02269. This warning system is intended to be interpreted and applied only by properly trained individuals to identify fire, health and reactivity hazards of chemicals. The user is referred to certain limited number of chemicals with recommended classifications in NFPA 49 and NFPA 325, which would be used as a guideline only. Whether the chemicals are classified by NFPA or not, anyone using the 704 systems to classify chemicals does so at their own risk.

History

Date of issue mm/dd/yyyy : 04/15/2015
Version : 1
Prepared by : KMK Regulatory Services Inc.
Key to abbreviations : ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
UN = United Nations
Section 16. Other information

Notice to reader
To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.

Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.
HIGH CALCIUM LIMESTONE

May cause cancer (state route of exposure if it is conclusively proven that no other routes of exposure cause hazard) - Causes damage to organs (or state all organs affected, if known) through prolonged or repeated exposure (state route of exposure if it is conclusively proven that no other routes of exposure cause hazard)

Obtain special instructions before use. - Do not handle until all safety precautions have been read and understood. - Do not breathe dust/fume/gas/mist/vapours/spray. - Wash hands thoroughly after handling. - Do not eat, drink or smoke when using this product. - Use personal protective equipment as required. - IF exposed or concerned: Get medical advice/attention. - Get medical advice/attention if you feel unwell.

Please refer to the original SDS for more information
SAFETY DATA SHEET

SECTION 1: PRODUCT AND COMPANY IDENTIFICATION

Product Name(s): BruMag Magnesium Hydroxide; Liquid/Slurry

Product Identities: BruMag Slurry, Magnesium Hydroxide, in suspension / slurry.

Supplier/Manufacture:
Diversified Minerals Inc.
1135 E. Wooley Road
Oxnard CA, 93030
(888) 364-9595

Recommended Uses: BruMag Magnesium Hydroxide slurry has many uses in chemical processing, water treatment, (Acid Neutralization, Soluble Metals Reduction); Gas Stream Purification (SO2 Removal); Boiler slag control; Odor control in waste water. BruMag Slurry is a Non-hazardous replacement for Caustic Soda (NaOH) in pH control and waste water treatment systems.

Restrictions on Use: Acids (unless used in a controlled process), and Aluminum powder

SECTION 2: HAZARD IDENTIFICATION

GHS Classification: (Please see GHS Classifications on our website under Resources)
Skin Irritation - Category 2
Eye Irritation - Category 2A
Specific Target Organ Toxicity Repeat Exposure - Category 2

GHS LABEL ELEMENTS Symbol(s)
SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS RN</th>
<th>ACGIH TLV (mg/m³)</th>
<th>OSHA-PEL (mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnesium Hydroxide</td>
<td>1317-43-7</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>Water</td>
<td>7732-18-5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Magnesium Hydroxide is a natural mineral. Trace amounts of other chemicals may be detected by chemical analyses.

SECTION 4: FIRST-AID MEASURES

Eye Contact: Rinse eyes thoroughly with water for at least 15 minutes, including under lids to remove all particles. Seek medical attention for discomfort or if irritation or other symptoms do not subside.

Skin Contact: Wash with water and pH neutral soap or a mild skin detergent. Seek medical attention for rash, irritation, dermatitis and prolonged unprotected exposures to wet Magnesium Hydroxide.

Inhalation: Move person to fresh air. Seek medical attention for discomfort or if coughing or other symptoms do not subside.

Ingestion: Do not induce vomiting. If conscious, have person drink plenty of water. Seek medical attention or contact poison control immediately.

SECTION 5: FIRE-FIGHTING MEASURES

Flashpoint & Method: Non-combustible

General Hazard: Avoid breathing dust.

Extinguishing Media: Use extinguishing media appropriate for surrounding fire.

Firefighting Equipment: Magnesium Hydroxide poses no fire-related hazard.

Combustion Products: In excess of 1000°C compounds will break down into their constituent oxides.

SECTION 6: ACCIDENTAL RELEASE MEASURES

General: Place spilled material into a container. Avoid actions that cause the Magnesium Hydroxide to become airborne. Avoid inhalation of Magnesium Hydroxide and direct contact with skin. Wear appropriate Personal Protective Equipment (PPE) as described in Section 8 below.

Waste Disposal: Dispose of Magnesium Hydroxide according to Federal, State, Provincial and local regulations.
SECTION 7: HANDLING AND STORAGE

General: Handle with care and use appropriate control measures. Some agitation is needed to keep solids in suspension while slurry is in storage. It is not necessary to operate an agitator continuously. Intermittently mixing Magnesium Hydroxide slurry for 1 out of 3 hours can effectively agitate the slurry (i.e. keep the solids in suspension). Short shutdown periods due to power outages will not adversely affect the slurry; but 4-8 hours of continuous agitation should follow such incidents. One should avoid longer shutdown periods. However, if such periods are unavoidable, one should air-sparge the slurry around the agitator's propeller before restarting the mixer. This will help reduce the power surge upon the mixer restart. Agitator manufacturers can provide advice on the proper selection of suitable equipment for an agitator's intended purpose. All process pipes must be heated and/or insulated if they are located in areas where temperatures are extreme (below 32°F or above 95°F). Steam tracing is not recommended the high temperature generated by the steam can dry the Magnesium Hydroxide solids.

Engulfment hazard: To prevent burial or suffocation, do not enter a confined space, such as a silo, bin, bulk truck or other storage container or vessel that stores or contains Magnesium Hydroxide. Magnesium Hydroxide can build up or adhere to the walls of a confined space. The Magnesium Hydroxide can suddenly release, collapse, or fall unexpectedly.

Housekeeping: Avoid actions that cause Magnesium Hydroxide to become airborne during clean-up such as dry sweeping or using compressed air.

Storage Temperature: See Notes above Generally Handling & Storage
Storage Pressure: Ambient.
Storage Moisture: Slurry concentration is kept at 50% which is equal to 12lbs of Magnesium Hydroxide per Gallon U.S.
Clothing: Promptly remove and launder clothing that is dusty or wet with Magnesium Hydroxide. Thoroughly wash skin after exposure to Magnesium Hydroxide.

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls: Use local exhaust and general dilution ventilation or other suppression methods to maintain dust levels below exposure limits.

Personal Protective Equipment (PPE):

  Respiratory Protection: Under ordinary circumstances no respiratory protection is required. Wear a NIOSH approved respirator that is properly fitted and is in good condition when exposed to dust above exposure limits.
  Eye Protection: Wear ANSI approved glasses or safety goggles when handling dust or slurries to prevent contact with eyes.
  Skin Protection: Wear gloves, boot covers and protective clothing impervious to water to prevent skin contact. Do not rely on barrier creams, in place of impervious gloves. Remove clothing and PPE that become saturated with wet Magnesium Hydroxide and immediately wash exposed areas.
SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State: Liquid Slurry  
Evaporation Rate: NA  
Appearance: White to off-white.

SECTION 10: STABILITY AND REACTIVITY

Stability: Stable under ambient temperature and pressures. Avoid contact with incompatible materials.

Incompatibility: Acids – vigorous reaction, heat generated (unless used in a controlled process)  
Aluminum powder – may ignite/explode when heated;

Hazardous Polymerization: None.

Hazardous Decompositions: Oxides of magnesium - Will not spontaneously occur. Avoid exposure to acids and oxidizers.

SECTION 11 AND 12: TOXICOLOGICAL AND ECOLOGICAL INFORMATION

For questions regarding toxicological and ecological information refer to contact information in Section 1.

SECTION 13: DISPOSAL CONSIDERATIONS

Dispose of waste and containers in compliance with Federal, State, Provincial and Local regulations.

SECTION 14: TRANSPORT INFORMATION

This product is not classified as a Hazardous material under US D.O.T or Canadian TDG regulations.

SECTION 15: REGULATORY INFORMATION

OSHA/MSHA Hazard Communication:

This product is not considered by OSHA/MSHA to be a hazardous chemical and should be included in the employer’s hazard communication program.

CERCLA/Superfund: This product is not listed as a CERCLA hazardous substance.

EPCRA This product has been reviewed according to the EPA Hazard Categories

SARA Title III: Promulgated under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 and this product is considered a “Non-hazardous substance”.

EPRCA This product does not contain any of the substance subject to the reporting

SARA Section 313: This product does not contain any SARA reportable requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372

Proposition 65: WARNING: This material may contain chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.
### SECTION 16: OTHER INFORMATION

#### General Abbreviations:

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;</td>
<td>Greater than</td>
</tr>
<tr>
<td>&lt;</td>
<td>Lesser than</td>
</tr>
<tr>
<td>ACGIH</td>
<td>American Conference of Governmental Industrial Hygienists</td>
</tr>
<tr>
<td>CAS RN</td>
<td>Chemical Abstracts Reference Number</td>
</tr>
<tr>
<td>CERCLA</td>
<td>Comprehensive Environmental Response, Compensations and Liability Act</td>
</tr>
<tr>
<td>CFR</td>
<td>Code of Federal Regulations</td>
</tr>
<tr>
<td>CL</td>
<td>Ceiling Limit</td>
</tr>
<tr>
<td>DOT</td>
<td>Department of Transportation</td>
</tr>
<tr>
<td>g/cm³</td>
<td>Grams per cubic centimeter</td>
</tr>
<tr>
<td>HEPA</td>
<td>High-Efficiency Particulate Air</td>
</tr>
<tr>
<td>HMIS</td>
<td>Hazardous Materials Identification Systems</td>
</tr>
<tr>
<td>IARC</td>
<td>International Agency for Research on Cancer</td>
</tr>
<tr>
<td>mg/m³</td>
<td>Milligrams per cubic meter</td>
</tr>
<tr>
<td>MSHA</td>
<td>Mine Safety and Health Administration</td>
</tr>
<tr>
<td>NA</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>NFPA</td>
<td>National Fire Protection Association</td>
</tr>
<tr>
<td>NIOSH</td>
<td>National Institute for Occupational Safety and Health</td>
</tr>
<tr>
<td>NTP</td>
<td>National Toxicology Program</td>
</tr>
<tr>
<td>OSHA</td>
<td>Occupational Safety and Health Administration</td>
</tr>
<tr>
<td>PEL</td>
<td>Permissible Exposure Limit</td>
</tr>
<tr>
<td>pH</td>
<td>Negative log of hydrogen ion</td>
</tr>
<tr>
<td>PPE</td>
<td>Personal Protective Equipment</td>
</tr>
<tr>
<td>R</td>
<td>Respirable Particulate</td>
</tr>
<tr>
<td>RCRA</td>
<td>Resource Conservation and Reauthorization Act</td>
</tr>
<tr>
<td>SARA</td>
<td>Superfund Amendments and Reauthorization Act</td>
</tr>
<tr>
<td>SDS</td>
<td>Safety Data Sheet</td>
</tr>
<tr>
<td>T</td>
<td>Total Particulate</td>
</tr>
<tr>
<td>TDG</td>
<td>Transportation of Dangerous Goods</td>
</tr>
<tr>
<td>TLV</td>
<td>Threshold Limit Value</td>
</tr>
<tr>
<td>TWA</td>
<td>Time Weighted Average (8 hour)</td>
</tr>
<tr>
<td>WHMIS</td>
<td>Workplace Hazardous Materials Information System</td>
</tr>
<tr>
<td>---</td>
<td>-----</td>
</tr>
</tbody>
</table>

This SDS (Section 1-16) was revised on May 21, 2015.

An electronic version of this SDS is available at: [www.dmicement.com](http://www.dmicement.com)

The data in the Safety Data Sheet related only to the specific material designated herein and does not relate to use in combination with any other material on or in any process. Diversified Minerals Inc. (DMI) believes the information contained herein is accurate; however, DMI makes no guarantees with respect to such accuracy and assumes no liability in connection with the use of the information contained herein which is not intended to be and should not be construed as legal advice or as insuring compliance with any federal, state or local laws or regulations. Any party using this product should review all such laws, rules, or regulations prior to use, including but not limited to Federal, Provincial, State and Local regulations.

NO WARRANTY IS MADE, EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR OTHERWISE.
Warning

BruMag Magnesium Hydroxide; Liquid/Slurry

Causes skin irritation - Causes serious eye irritation - May cause damage to organs (or state all organs affected, if known) (state route of exposure if it is conclusively proven that no other routes of exposure cause hazard)

IF SWALLOWED: Rinse mouth. Do NOT induce vomiting. - IF ON SKIN: Wash with plenty of soap and water. - IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. - IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

Please refer to the original SDS for more information
Brucite
Safety Data Sheet
According To Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules And Regulations
Revision Date: 12/04/2014 Version: 1.0

SECTION 1: IDENTIFICATION

1.1. Product Identifier
Product Form: Mixture
Product Name: Brucite, UM6090, UM10, MagH, MgOH2 Powder, Magnesium Hydroxide Powder
Synonyms: Magnesium Hydroxide

1.2. Intended Use of the Product Not available

1.3. Name, Address, and Telephone of the Responsible Party
Company
Garrison Minerals, LLC
2054 Broadway
Denver, CO 80205
Phone: 720-389-7609

1.4. Emergency Telephone Number
Emergency Number: 720-389-7609

SECTION 2: HAZARDS IDENTIFICATION

2.1. Classification of the Substance or Mixture
Classification (GHS-US)
Not classified

2.2. Label Elements
GHS-US Labeling No labeling applicable

2.3. Other Hazards
Exposure may aggravate those with pre-existing eye, skin, or respiratory conditions.

2.4. Unknown Acute Toxicity (GHS-US) No data available

SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

3.1. Substances
Not applicable

<table>
<thead>
<tr>
<th>Name</th>
<th>Product Identifier</th>
<th>% (w/w)</th>
<th>Classification (GHS-US)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brucite</td>
<td>(CAS No) 1317-43-7</td>
<td>100</td>
<td>Not classified</td>
</tr>
</tbody>
</table>

Full text of H-phrases: see section 16

SECTION 4: FIRST AID MEASURES

4.1. Description of First Aid Measures
General: Never give anything by mouth to an unconscious person. If you feel unwell, seek medical advice (show the label where possible).

Inhalation: When symptoms occur: go into open air and ventilate suspected area. Obtain medical attention if breathing difficulty persists.

Skin Contact: Remove contaminated clothing. Drench affected area with water for at least 15 minutes. Obtain medical attention if irritation develops or persists.

Eye Contact: Rinse cautiously with water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Obtain medical attention if irritation develops or persists.

Ingestion: Rinse mouth. Do NOT induce vomiting. Obtain medical attention.

4.2. Most Important Symptoms and Effects Both Acute and Delayed
General: Not expected to present a significant hazard under anticipated conditions of normal use. Dust may cause mechanical irritation to eyes, nose, throat, and lungs.

Inhalation: Prolonged contact with large amounts of dust may cause mechanical irritation.

Skin Contact: Skin contact with large amounts of dust may cause mechanical irritation.

Eye Contact: Eye contact with dust may cause mechanical irritation.

Ingestion: Ingestion is likely to be harmful or have adverse effects.

Chronic Symptoms: Not available
Brucite
Safety Data Sheet
According To Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules And Regulations

4.3. Indication of Any Immediate Medical Attention and Special Treatment Needed
If exposed or concerned, get medical advice and attention.

SECTION 5: FIRE-FIGHTING MEASURES

5.1. Extinguishing Media
Suitable Extinguishing Media: Use extinguishing media appropriate for surrounding fire.
Unsuitable Extinguishing Media: Do not use a heavy water stream. Use of heavy stream of water may spread fire.

5.2. Special Hazards Arising From the Substance or Mixture
Fire Hazard: Not considered flammable but may burn at high temperatures.
Explosion Hazard: Product is not explosive.
Reactivity: Hazardous reactions will not occur under normal conditions.

5.3. Advice for Firefighters
Precautionary Measures Fire: Exercise caution when fighting any chemical fire.
Firefighting Instructions: Use water spray or fog for cooling exposed containers.
Protection During Firefighting: Do not enter fire area without proper protective equipment, including respiratory protection.
Hazardous Combustion Products: None known.

Reference to Other Sections
Refer to section 9 for flammability properties.

SECTION 6: ACCIDENTAL RELEASE MEASURES

6.1. Personal Precautions, Protective Equipment and Emergency Procedures
General Measures: Avoid breathing (dust, mist, fumes). Avoid prolonged contact with eyes, skin and clothing.
6.1.1. For Non-Emergency Personnel
Protective Equipment: Use appropriate personal protection equipment (PPE).
6.1.2. For Emergency Personnel
Protective Equipment: Equip cleanup crew with proper protection.
Emergency Procedures: Ventilate area.

6.2. Environmental Precautions
Prevent entry to sewers and public waters.

6.3. Methods and Material for Containment and Cleaning Up
For Containment: Avoid generation of dust during clean-up of spills.
Methods for Cleaning Up: Clear up spills immediately and dispose of waste safely. Recover the product by vacuuming, shovelling or sweeping. Avoid generation of dust during clean-up of spills.

6.4. Reference to Other Sections
See heading 8, Exposure Controls and Personal Protection.

SECTION 7: HANDLING AND STORAGE

7.1. Precautions for Safe Handling
Hygiene Measures: Handle in accordance with good industrial hygiene and safety procedures. Wash hands and other exposed areas with mild soap and water before eating, drinking, or smoking and again when leaving work.

7.2. Conditions for Safe Storage, Including Any Incompatibilities
Technical Measures: Comply with applicable regulations.
Storage Conditions: Store in a dry, cool and well-ventilated place. Keep container closed when not in use. Keep/Store away from extremely high or low temperatures, incompatible materials.
Incompatible Materials: Strong acids. Strong bases, strong oxidizers, halogenated compounds, reactive metal powders.

7.3. Specific End Use(s) Not available

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1. Control Parameters
For substances listed in section 3 that are not listed here, there are no established Exposure limits from the manufacturer, supplier, importer, or the appropriate advisory agency including: ACGIH (TLV), NIOSH (REL), OSHA (PEL), Canadian provincial governments, or the Mexican government.

<table>
<thead>
<tr>
<th>Particulates not otherwise classified (PNOC) (RR-00072-6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA ACGIH</td>
</tr>
</tbody>
</table>

12/04/2014 EN (English US)
Brucite
Safety Data Sheet
According To Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules And Regulations

<table>
<thead>
<tr>
<th></th>
<th>OSHA PEL (TWA) (mg/m³)</th>
<th>5 mg/m³ Respirable fraction</th>
<th>10 mg/m³ Total Dust</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA OSHA</td>
<td>OEL TWA (mg/m³)</td>
<td>10 mg/m³ (total)</td>
<td></td>
</tr>
<tr>
<td>Alberta</td>
<td>OEL TWA (mg/m³)</td>
<td>10 mg/m³ (total dust)</td>
<td></td>
</tr>
<tr>
<td>British Columbia</td>
<td>OEL TWA (mg/m³)</td>
<td>10 mg/m³ (total dust)</td>
<td></td>
</tr>
<tr>
<td>Manitoba</td>
<td>OEL TWA (mg/m³)</td>
<td>10 mg/m³ (inhaled particles, recommended)</td>
<td></td>
</tr>
<tr>
<td>New Brunswick</td>
<td>OEL TWA (mg/m³)</td>
<td>3 mg/m³ (particulate matter containing no Asbestos and &lt;1% Crystalline silica, respirable fraction)</td>
<td></td>
</tr>
<tr>
<td>Newfoundland &amp; Labrador</td>
<td>OEL TWA (mg/m³)</td>
<td>10 mg/m³ (inhaled particles, recommended)</td>
<td></td>
</tr>
<tr>
<td>Nova Scotia</td>
<td>OEL TWA (mg/m³)</td>
<td>10 mg/m³ (inhaled particles, recommended)</td>
<td></td>
</tr>
<tr>
<td>Nunavut</td>
<td>OEL TWA (mg/m³)</td>
<td>5 mg/m³ (respirable mass)</td>
<td></td>
</tr>
<tr>
<td>Northwest Territories</td>
<td>OEL TWA (mg/m³)</td>
<td>5 mg/m³ (respirable mass)</td>
<td></td>
</tr>
<tr>
<td>Ontario</td>
<td>OEL TWA (mg/m³)</td>
<td>10 mg/m³ (inhaled)</td>
<td></td>
</tr>
<tr>
<td>Prince Edward Island</td>
<td>OEL TWA (mg/m³)</td>
<td>10 mg/m³ (inhaled particles, recommended)</td>
<td></td>
</tr>
<tr>
<td>Québec</td>
<td>VEMP (mg/m³)</td>
<td>10 mg/m³ (including dust, inert or nuisance particulates; containing no Asbestos and &lt;1% Crystalline silica-total dust)</td>
<td></td>
</tr>
<tr>
<td>Saskatchewan</td>
<td>OEL STEL (mg/m³)</td>
<td>20 mg/m³ (insoluble or poorly insoluble-inhalable fraction)</td>
<td></td>
</tr>
<tr>
<td>Saskatchewan</td>
<td>OEL TWA (mg/m³)</td>
<td>10 mg/m³ (insoluble or poorly soluble-inhalable fraction)</td>
<td></td>
</tr>
</tbody>
</table>

8.2. Exposure Controls
Appropriate Engineering Controls: Avoid creating or spreading dust. Ensure adequate ventilation, especially in confined areas. Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure. Ensure all national/local regulations are observed.


Materials for Protective Clothing: Chemically resistant materials and fabrics.
Hand Protection: Wear chemically resistant protective gloves.
Eye Protection: Safety glasses with side shields, or goggles, are recommended.
Skin and Body Protection: Not available
Respiratory Protection: Use a NIOSH-approved respirator or self-contained breathing apparatus whenever exposure may exceed established Occupational Exposure Limits.
Other Information: When using, do not eat, drink or smoke.

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 State</td>
<td>Solid</td>
</tr>
<tr>
<td>Appearance</td>
<td>White powder</td>
</tr>
<tr>
<td>Odor</td>
<td>No odor</td>
</tr>
<tr>
<td>Odor Threshold</td>
<td>Not available</td>
</tr>
<tr>
<td>pH</td>
<td>~ 10 (saturated sol)</td>
</tr>
<tr>
<td>Evaporation Rate</td>
<td>Not available</td>
</tr>
<tr>
<td>Melting Point</td>
<td>Not available</td>
</tr>
<tr>
<td>Freezing Point</td>
<td>Not available</td>
</tr>
<tr>
<td>Boiling Point</td>
<td>Not available</td>
</tr>
<tr>
<td>Flash Point</td>
<td>Not available</td>
</tr>
<tr>
<td>Auto-ignition Temperature</td>
<td>Not available</td>
</tr>
<tr>
<td>Decomposition Temperature</td>
<td>350°C (662°F)</td>
</tr>
<tr>
<td>Flammability (solid, gas)</td>
<td>Not available</td>
</tr>
</tbody>
</table>

12/04/2014 EN (English US) 3/5
Brucite
Safety Data Sheet
According To Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules And Regulations

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower Flammable Limit</td>
<td>Not available</td>
</tr>
<tr>
<td>Upper Flammable Limit</td>
<td>Not available</td>
</tr>
<tr>
<td>Vapor Pressure</td>
<td>Not available</td>
</tr>
<tr>
<td>Relative Vapor Density at 20 °C</td>
<td>Not available</td>
</tr>
<tr>
<td>Relative Density</td>
<td>Not available</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>2.42 g/cm³</td>
</tr>
<tr>
<td>Solubility</td>
<td>Water: Slightly</td>
</tr>
<tr>
<td>Partition Coefficient: N-octanol/water</td>
<td>Not available</td>
</tr>
<tr>
<td>Viscosity</td>
<td>Not available</td>
</tr>
<tr>
<td>Explosion Data – Sensitivity to Mechanical Impact</td>
<td>Not expected to present an explosion hazard due to mechanical impact.</td>
</tr>
<tr>
<td>Explosion Data – Sensitivity to Static Discharge</td>
<td>Not expected to present an explosion hazard due to static discharge.</td>
</tr>
</tbody>
</table>

**SECTION 10: STABILITY AND REACTIVITY**

10.1. Reactivity: Hazardous reactions will not occur under normal conditions.
10.2. Chemical Stability: Stable under recommended handling and storage conditions (see section 7).
10.3. Possibility of Hazardous Reactions: Hazardous polymerization will not occur.
10.4. Conditions to Avoid: Extremely high or low temperatures. Incompatible materials.
10.5. Incompatible Materials: Strong acids, strong bases, strong oxidizers, halogenated compounds, reactive metal powders.

**SECTION 11: TOXICOLOGICAL INFORMATION**

11.1. Information on Toxicological Effects - Product
  Acute Toxicity: Not classified
  LD50 and LC50 Data: Not available
  Skin Corrosion/Irritation: Not classified
  pH: ~ 10 (saturated sol)
  Serious Eye Damage/Irritation: Not classified
  pH: ~ 10 (saturated sol)
  Respiratory or Skin Sensitization: Not classified
  Germ Cell Mutagenicity: Not classified
  Teratogenicity: Not available
  Carcinogenicity: Not classified
  Specific Target Organ Toxicity (Repeated Exposure): Not classified
  Reproductive Toxicity: Not classified
  Specific Target Organ Toxicity (Single Exposure): Not classified
  Aspiration Hazard: Not classified
  Symptoms/Injuries After Inhalation: Prolonged contact with large amounts of dust may cause mechanical irritation.
  Symptoms/Injuries After Skin Contact: Skin contact with large amounts of dust may cause mechanical irritation.
  Symptoms/Injuries After Eye Contact: Eye contact with dust may cause mechanical irritation.
  Symptoms/Injuries After Ingestion: Ingestion is likely to be harmful or have adverse effects.

11.2. Information on Toxicological Effects - Ingredient(s)
  LD50 and LC50 Data:

No additional information available.

**SECTION 12: ECOLOGICAL INFORMATION**

12.1. Toxicity No additional information available

**Persistence and Degradability**

<table>
<thead>
<tr>
<th>Substance</th>
<th>Persistence and Degradability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brucite</td>
<td>Not established.</td>
</tr>
</tbody>
</table>

12.3. Bioaccumulative Potential

<table>
<thead>
<tr>
<th>Substance</th>
<th>Bioaccumulative Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brucite</td>
<td>Not established.</td>
</tr>
</tbody>
</table>
Brucite
Safety Data Sheet
According To Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules And Regulations

12.4. Mobility in Soil  Not available
12.5. Other Adverse Effects
Other Information: Avoid release to the environment.

SECTION 13: DISPOSAL CONSIDERATIONS
13.1. Waste treatment methods
Waste Disposal Recommendations: Dispose of waste material in accordance with all local, regional, national, provincial, territorial and international regulations.

SECTION 14: TRANSPORT INFORMATION
14.1. In Accordance with DOT  Not regulated for transport
14.2. In Accordance with IMDG  Not regulated for transport
14.3. In Accordance with IATA  Not regulated for transport
14.4. In Accordance with TDG  Not regulated for transport

SECTION 15: REGULATORY INFORMATION
15.1. US Federal Regulations
No additional information available.
15.2. US State Regulations
No additional information available
15.3. Canadian Regulations

<table>
<thead>
<tr>
<th>Brucite</th>
<th>Uncontrolled product according to WHMIS classification criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brucite (1317-43-7)</td>
<td>Uncontrolled product according to WHMIS classification criteria</td>
</tr>
</tbody>
</table>

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the SDS contains all of the information required by CPR.

SECTION 16: OTHER INFORMATION, INCLUDING DATE OF PREPARATION OR LAST REVISION

<table>
<thead>
<tr>
<th>Revision Date</th>
<th>12/04/2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other Information</td>
<td>This document has been prepared in accordance with the SDS requirements of the OSHA Hazard Communication Standard 29 CFR 1910.1200.</td>
</tr>
</tbody>
</table>

Party Responsible for the Preparation of This Document
Garrison Minerals, LLC
2054 Broadway
Denver, CO 80205
Phone: 720-389-7609

This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product.
Danger

Brucite, UM6090, UM10, MagH, MgOH2 Powder, Magnesium Hydroxide Powder

Health Hazards Not Otherwise Classified

IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower. - IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. - IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. - Do NOT induce vomiting.

Garrison Minerals, LLC

Please refer to the original SDS for more information
SAFETY DATA SHEET
HIGH CALCIUM QUICKLIME

Section 1. Identification

GHS product identifier: HIGH CALCIUM QUICKLIME
Other means of identification: Lime, Quicklime, Calcium Oxide, Burnt Lime, Unslaked Lime, Fluxing Lime.
Product code: Not available.
Product type: Solid.

Identified uses
Neutralization, flocculation, flux(met.), caustic agent, absorption.

Supplier/Manufacturer: GRAYMONT
#200-10991 Shellbridge Way
Richmond, BC V6X 3C6
Canada
Phone: 1 604 207-4292
Toll free: 1 866 207-4292
Fax: 1 604 207-9014
Web Site: http://www.graymont.com/

Emergency telephone number (with hours of operation): CANUTEC (613-996-6666)
OC EMTREC, US (800-424-9300)
INTERNATIONAL: (703-527-3887)

Section 2. Hazards identification

OSHA/HCS status: This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Classification of the substance or mixture: SKIN CORROSION/IRRITATION - Category 2
SERIOUS EYE DAMAGE/ EYE IRRITATION - Category 1
CARCINOGENICITY (inhalation) - Category 1A
SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPOSURE) (Respiratory tract irritation) - Category 3
SPECIFIC TARGET ORGAN TOXICITY (REPEATED EXPOSURE) - Category 1

GHS label elements
Hazard pictograms:

Signal word: Danger

Hazard statements:
H318 - Causes serious eye damage.
H315 - Causes skin irritation.
H350 - May cause cancer if inhaled.
H335 - May cause respiratory irritation.
H372 - Causes damage to organs through prolonged or repeated exposure.

Precautionary statements
Section 2. Hazards identification

Prevention:
P201 - Obtain special instructions before use.
P202 - Do not handle until all safety precautions have been read and understood.
P281 - Use personal protective equipment as required.
P280 - Wear protective gloves. Wear eye or face protection.
P271 - Use only outdoors or in a well-ventilated area.
P260 - Do not breathe dust.
P270 - Do not eat, drink or smoke when using this product.
P264 - Wash hands thoroughly after handling.

Response:
P314 - Get medical attention if you feel unwell.
P300 + P310 - IF exposed or concerned: Get medical attention.
P304 + P340 + P312 - IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER or physician if you feel unwell.
P302 + P352 + P362 + P363 - IF ON SKIN: Wash with plenty of soap and water. Take off contaminated clothing. Wash contaminated clothing before reuse.
P332 + P313 - If skin irritation occurs: Get medical attention.
P305 + P351 + P338 + P310 - 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 physician.

Storage:
P401 - Store to minimize dust generation.

Disposal:
P501 - Dispose of contents and container in accordance with all local, regional, national and international regulations.

Supplemental label elements:
Not applicable.

Hazard not otherwise classified (HNOC)

Physical hazards not otherwise classified (PHNOC):
None known.

Health hazards not otherwise classified (HHNOC):
None known.

Section 3. Composition/information on ingredients

Substance/mixture:
Mixture

Other means of identification:
Lime, Quicklime, Calcium Oxide, Burnt Lime, Unslaked Lime, Fluxing Lime.

CAS number/other identifiers

CAS number:
1305-78-8

Product code:
Not available.

<table>
<thead>
<tr>
<th>Ingredient name</th>
<th>%</th>
<th>CAS number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium oxide</td>
<td>90 - 100</td>
<td>1305-78-8</td>
</tr>
<tr>
<td>Crystalline silica, quartz</td>
<td>0.0001 - 1</td>
<td>14808-60-7</td>
</tr>
</tbody>
</table>

Crystalline silica has been found in some products at or above detection level 0.1%. Concentration is dependent upon limestone source.

Any concentration shown as a range is to protect confidentiality or is due to batch variation.

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.
Section 4. First aid measures

Description of necessary first aid measures

Eye contact: Get medical attention immediately. Call a poison center or physician. Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 20 minutes. Chemical burns must be treated promptly by a physician.

Inhalation: Get medical attention immediately. Call a poison center or physician. Remove victim to fresh air and keep at rest in a position comfortable for breathing. When used under normal conditions quicklime doesn’t generate fumes. However dust (Particulates) may be generated. Use dust-mask if dust is present. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

Skin contact: Get medical attention immediately. Call a poison center or physician. Flush contaminated skin with plenty of water. Wash contaminated clothing thoroughly with water before removing it, or wear gloves. Continue to rinse for at least 20 minutes. Chemical burns must be treated promptly by a physician. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion: Get medical attention immediately. Call a poison center or physician. Wash out mouth with water. Remove dentures if any. Remove victim to fresh air and keep at rest in a position comfortable for breathing. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Stop if the exposed person feels sick as vomiting may be dangerous. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Chemical burns must be treated promptly by a physician. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact: Causes serious eye damage.
Inhalation: May cause respiratory irritation.
Skin contact: Causes skin irritation.
Ingestion: No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact: Adverse symptoms may include the following: pain, watering, redness.
Inhalation: Adverse symptoms may include the following: respiratory tract irritation, coughing, burning sensation.
Skin contact: Adverse symptoms may include the following: pain or irritation, redness, blistering may occur.
Ingestion: Adverse symptoms may include the following: stomach pains.
Section 4. First aid measures

**Indication of immediate medical attention and special treatment needed, if necessary**

**Notes to physician**
Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

**Specific treatments**
No specific treatment.

**Protection of first-aiders**
No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

**Extinguishing media**

**Suitable extinguishing media**
Use dry chemical fire extinguisher.

**Unsuitable extinguishing media**
Do not use water or halogenated compounds, except that large amounts of water may be used to deluge small quantities of quicklime.

**Specific hazards arising from the chemical**
Not applicable.

**Hazardous thermal decomposition products**
None.

**Special protective actions for fire-fighters**
First move people out of line-of-sight of the scene and away from windows.

**Special protective equipment for fire-fighters**
Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

**Personal precautions, protective equipment and emergency procedures**

**For non-emergency personnel**
No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

**For emergency responders**
If specialized clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

**Environmental precautions**
Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and materials for containment and cleaning up
Section 6. Accidental release measures

Spill : Move containers from spill area. Do not use water on bulk material spills. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Avoid dust generation. Do not dry sweep. Vacuum dust with equipment fitted with a HEPA filter and place in a closed, labeled waste container. Dispose of via a licensed waste disposal contractor. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Avoid exposure - obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Do not get in eyes or on skin or clothing. Do not ingest. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Empty containers retain product residue and can be hazardous.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink. Store to minimize dust generation. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination. Do not store in unlabeled containers.

Section 8. Exposure controls/personal protection

Control parameters

United States

Occupational exposure limits

<table>
<thead>
<tr>
<th>Ingredient name</th>
<th>Exposure limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium oxide</td>
<td>ACGIH TLV (United States, 4/2014). TWA: 2 mg/m³ 8 hours. NIOSH REL (United States, 10/2013). TWA: 2 mg/m³ 10 hours. OSHA PEL (United States, 2/2013). TWA: 5 mg/m³ 8 hours. MSHA PEL TWA 8/40 hours: 5 mg/m³ OSHA PEL 23 (United States, 2/2013). TWA: 10 mg/m³ 8 hours. Form: Respirable TWA: 250 mmpcf 8 hours. Form: Respirable MNIOSH REL (United States, 10/2013). TWA: 0.05 mg/m³ 10 hours. Form: Respirable dust ACGIH TLV (United States, 4/2014). TWA: 0.025 mg/m³ 8 hours. Form: Respirable fraction MSHA PEL TWA 8/40 hours: 30 mg/m³(%SiO₂)+2 mg/m³ Form: Total dust 10 mg/m³(%SiO₂)+2 mg/m³ Form: Respirable dust</td>
</tr>
<tr>
<td>Crystalline silica, quartz</td>
<td></td>
</tr>
</tbody>
</table>
Section 8. Exposure controls/personal protection

### Occupational exposure limits

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>List name</th>
<th>TWA (8 hours) ppm</th>
<th>mg/m³</th>
<th>STEL (15 mins) ppm</th>
<th>mg/m³</th>
<th>Ceiling ppm</th>
<th>mg/m³</th>
<th>Other Notations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium oxide</td>
<td>US ACGIH 4/2014</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>[3]</td>
</tr>
<tr>
<td></td>
<td>AB 4/2009</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BC 7/2013</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ON 1/2013</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>QC 1/2014</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Crystalline silica, quartz</td>
<td>US ACGIH 4/2014</td>
<td>-</td>
<td>0.025</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>[a]</td>
</tr>
<tr>
<td></td>
<td>AB 4/2009</td>
<td>-</td>
<td>0.025</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>[b]</td>
</tr>
<tr>
<td></td>
<td>BC 7/2013</td>
<td>-</td>
<td>0.025</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>[c]</td>
</tr>
<tr>
<td></td>
<td>ON 1/2013</td>
<td>-</td>
<td>0.1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>[a]</td>
</tr>
<tr>
<td></td>
<td>QC 1/2014</td>
<td>-</td>
<td>0.1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>[d]</td>
</tr>
</tbody>
</table>

**[3]** Skin sensitization

**Form:** [a]Respirable fraction [b]Respirable particulate. [c]Respirable [d]Respirable dust

---

**Appropriate engineering controls:**
Use only with adequate ventilation. If user operations generate dust, fumes, gas, vapor or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. Engineering controls may be required to control the primary or secondary risks associated with this product.

**Environmental exposure controls:**
Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation.

---

**Individual protection measures**

**Hygiene measures:**
Wash hands, forearms and face thoroughly after handling chemical products. Before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

**Eye/face protection:**
Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: chemical splash goggles and/or face shield. If inhalation hazards exist, a full-face respirator may be required instead.

**Skin protection**

**Hand protection:**
Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.

**Body protection:**
Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

**Other skin protection:**
Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

**Respiratory protection:**
Use a properly fitted, particulate filter respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator. Wear an appropriate NIOSH approved respirator if concentration levels exceed the safe exposure limits.
Section 9. Physical and chemical properties

**Appearance**
- **Physical state**: Solid. [Crystalline.]
- **Color**: White.
- **Odor**: Odorless + soil like smell.
- **Odor threshold**: Not available.
- **pH**: 12.45 [Sat. soln.] at 25°C
- **Melting point**: 2570 to 2625°C (4658 to 4757°F)
- **Boiling point**: 2850°C (5162°F)
- **Flash point**: Not applicable.
- **Evaporation rate**: Not available.
- **Flammability (solid, gas)**: Not applicable.
- **Lower and upper explosive (flammable) limits**: Not applicable.
- **Vapor pressure**: Not available.
- **Vapor density**: Not available.
- **Relative density**: 3.25 to 3.28
- **Solubility**: Not available.
- **Solubility in water**: 0.125 g/100 g at 20°C
- **Partition coefficient: n-octanol/water**: Not available.
- **Auto-ignition temperature**: Not applicable.
- **Decomposition temperature**: Not applicable.
- **Viscosity**: Not available.
- **Vollatility**: Not available.
- **VOC (w/w)**: 0 % (w/w)

Section 10. Stability and reactivity

**Reactivity**: Reacts violently with water to form calcium hydroxide, generating heat.

**Chemical stability**: The product is stable.

**Possibility of hazardous reactions**: Exothermic reaction to water.

**Conditions to avoid**: Do not allow quicklime to come into contact with incompatible materials. e.g. Water, acids, reactive fluoridated compounds, reactive brominated compounds. reactive powered metals, organic acid anhydrides, nitro-organic compounds, reactive phosphorous compounds, interhalogenated compounds.

**Incompatible materials**: Reactive or incompatible with the following materials: oxidizing materials, acids and moisture.

**Hazardous decomposition products**: None.
Section 11. Toxicological information

Information on toxicological effects

Acute toxicity
There is no data available.

Irritation/Corrosion
There is no data available.

Sensitization
There is no data available.

Carcinogenicity

Classification

<table>
<thead>
<tr>
<th>Product/ingredient name</th>
<th>OSHA</th>
<th>IARC</th>
<th>NTP</th>
<th>ACGIH</th>
<th>EPA</th>
<th>NIOSH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystalline silica, quartz</td>
<td>-</td>
<td>1</td>
<td>Known to be a human carcinogen.</td>
<td>A2</td>
<td>-</td>
<td>+</td>
</tr>
</tbody>
</table>

Specific target organ toxicity (single exposure)

<table>
<thead>
<tr>
<th>Name</th>
<th>Category</th>
<th>Route of exposure</th>
<th>Target organs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium oxide</td>
<td>Category 3</td>
<td>Not applicable.</td>
<td>Respiratory tract irritation</td>
</tr>
</tbody>
</table>

Specific target organ toxicity (repeated exposure)

<table>
<thead>
<tr>
<th>Name</th>
<th>Category</th>
<th>Route of exposure</th>
<th>Target organs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystalline silica, quartz</td>
<td>Category 1</td>
<td>Inhalation</td>
<td>Kidneys, respiratory tract and testes</td>
</tr>
</tbody>
</table>

Aspiration hazard
There is no data available.

Information on the likely routes of exposure

: Dermal contact. Eye contact. Inhalation. Ingestion.

Potential acute health effects

Eye contact
: Causes serious eye damage.

Inhalation
: May cause respiratory irritation.

Skin contact
: Causes skin irritation.

Ingestion
: No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact
: Adverse symptoms may include the following:
  - pain
  - watering
  - redness

Inhalation
: Adverse symptoms may include the following:
  - respiratory tract irritation
  - coughing
  - burning sensation

Skin contact
: Adverse symptoms may include the following:
  - pain or irritation
  - redness
  - blistering may occur

Ingestion
: Adverse symptoms may include the following:
  - stomach pains
Section 11. Toxicological information

Delayed and immediate effects and also chronic effects from short and long term exposure

**Short term exposure**
- Potential immediate effects: No known significant effects or critical hazards.
- Potential delayed effects: No known significant effects or critical hazards.

**Long term exposure**
- Potential immediate effects: No known significant effects or critical hazards.
- Potential delayed effects: No known significant effects or critical hazards.

**Potential chronic health effects**
- General: Causes damage to organs through prolonged or repeated exposure.
- Carcinogenicity: May cause cancer if inhaled. Risk of cancer depends on duration and level of exposure.
- Mutagenicity: No known significant effects or critical hazards.
- Teratogenicity: No known significant effects or critical hazards.
- Developmental effects: No known significant effects or critical hazards.
- Fertility effects: No known significant effects or critical hazards.

**Numerical measures of toxicity**

**Acute toxicity estimates**
There is no data available.

Section 12. Ecological information

**Toxicity**

<table>
<thead>
<tr>
<th>Product/ingredient name</th>
<th>Result</th>
<th>Species</th>
<th>Exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium oxide</td>
<td>Chronic NOEC 100 mg/L Fresh water</td>
<td>Fish - Oreochromis niloticus - Juvenile (Fledgling, Hatchling, Weanling)</td>
<td>46 days</td>
</tr>
</tbody>
</table>

**Persistence and degradability**
There is no data available.

**Bioaccumulative potential**

<table>
<thead>
<tr>
<th>Product/ingredient name</th>
<th>LogP_{ow}</th>
<th>BCF</th>
<th>Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium oxide</td>
<td>-</td>
<td>2.34</td>
<td>low</td>
</tr>
</tbody>
</table>

**Mobility in soil**
- Soil/water partition coefficient ($K_{oc}$): Not available.

**Other adverse effects**
- No known significant effects or critical hazards.
Section 13. Disposal considerations

Disposal methods: The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling empty containers that have not been cleaned or rinsed out. Empty containers or liners may retain some product residues. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

<table>
<thead>
<tr>
<th></th>
<th>DOT</th>
<th>TDG</th>
<th>IMDG</th>
<th>IATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>UN number</td>
<td>Not regulated.</td>
<td>Not regulated.</td>
<td>Not regulated.</td>
<td>UN1910</td>
</tr>
<tr>
<td>UN proper shipping name</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>CALCIUM OXIDE</td>
</tr>
<tr>
<td>Transport hazard class(es)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>8</td>
</tr>
<tr>
<td>Packing group</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>III</td>
</tr>
<tr>
<td>Environmental hazards</td>
<td>No.</td>
<td>No.</td>
<td>No.</td>
<td>No.</td>
</tr>
<tr>
<td>Additional information</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

AERG: Not applicable.

Special precautions for user: Transport within user’s premises: always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code: Not available.

Section 15. Regulatory information

U.S. Federal regulations:

- TSCA 8(a) CDR Exempt/Partial exemption: Not determined
- United States inventory (TSCA 8b): Calcium Oxide is subject to inventory update reporting (IUR).
- RCRA classification: Calcium Oxide is not listed or classified.
- CWA-311: Calcium Oxide has been withdrawn from the Clean Water Act (CWA) list of hazardous substances. (11/13/79) (44FR65400).
- CERCLA: Calcium Oxide is not listed.
Section 15. Regulatory information

FDA: Calcium Oxide has been determined as “Generally Recognized As Safe” (GRAS) by FDA. See 21CFR184.1210. (CFR Title 21 Part 184 - - Direct food substances affirmed as generally recognized as safe).

Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs) : Not listed
Clean Air Act Section 602 Class I Substances : Not listed
Clean Air Act Section 602 Class II Substances : Not listed
DEA List I Chemicals (Precursor Chemicals) : Not listed
DEA List I Chemicals (Precursor Chemicals) : Not listed

SARA 302/304
Composition/information on ingredients
No products were found.
SARA 304 RQ : Not applicable.

SARA 311/312
Classification : Immediate (acute) health hazard
               Delayed (chronic) health hazard

Composition/information on ingredients

<table>
<thead>
<tr>
<th>Name</th>
<th>%</th>
<th>Fire hazard</th>
<th>Sudden release of pressure</th>
<th>Reactive</th>
<th>Immediate (acute) health hazard</th>
<th>Delayed (chronic) health hazard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium oxide</td>
<td>90 - 100</td>
<td>No.</td>
<td>No.</td>
<td>No.</td>
<td>Yes.</td>
<td>No.</td>
</tr>
<tr>
<td>Crystalline silica, quartz</td>
<td>0.0001 - 1</td>
<td>No.</td>
<td>No.</td>
<td>No.</td>
<td>No.</td>
<td>No.</td>
</tr>
</tbody>
</table>

SARA 313

<table>
<thead>
<tr>
<th>Product name</th>
<th>CAS number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Form R - Reporting requirements</td>
<td>Not listed</td>
<td>-</td>
</tr>
<tr>
<td>Supplier notification</td>
<td>Not listed</td>
<td>-</td>
</tr>
</tbody>
</table>

SARA 313 notifications must not be detached from the SDS and any copying and redistribution of the SDS shall include copying and redistribution of the notice attached to copies of the SDS subsequently redistributed.

State regulations
Massachusetts : The following components are listed: Calcium oxide; Crystalline silica, quartz
New York : None of the components are listed.
New Jersey : The following components are listed: Calcium oxide; Crystalline silica, quartz
Pennsylvania : The following components are listed: Calcium oxide; Crystalline silica, quartz

California Prop. 65
WARNING: This product contains a chemical known to the State of California to cause cancer.

<table>
<thead>
<tr>
<th>Ingredient name</th>
<th>Cancer</th>
<th>Reproductive</th>
<th>No significant risk level</th>
<th>Maximum acceptable dosage level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystalline silica, quartz</td>
<td>Yes.</td>
<td>No.</td>
<td>No.</td>
<td>No.</td>
</tr>
</tbody>
</table>
Section 15. Regulatory information

**Canada**

**Canadian lists**

- **Canadian NPR**: None of the components are listed.
- **CEPA Toxic substances**: None of the components are listed.
- **Canada inventory**: All components are listed or exempted.

**International lists**

**National inventory**

- **Australia**: All components are listed or exempted.
- **China**: All components are listed or exempted.
- **Europe**: All components are listed or exempted.
- **Japan**: All components are listed or exempted.
- **Malaysia**: Not determined.
- **New Zealand**: All components are listed or exempted.
- **Philippines**: All components are listed or exempted.
- **Republic of Korea**: All components are listed or exempted.
- **Taiwan**: Not determined.

Section 16. Other information

**Hazardous Material Information System (U.S.A.)**

- **Health**: 3
- **Flammability**: 0
- **Physical hazards**: 1

Common: Health ratings are based on a U.S. rating scale, with 1 representing minimal hazards or risks, and 4 representing significant hazards or risks. Although HMIS® ratings are not required on SDSs under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

The customer is responsible for determining the PPE code for this material.

**National Fire Protection Association (U.S.A.)**

- **Health**: 3
- **Flammability**: 0
- **Instability**: 1

Reprinted with permission from NFPA 704-2001, Identification of the Hazards of Materials for Emergency Response Copyright ©1997, National Fire Protection Association, Quincy, MA 02269. This reprinted material is not the complete and official position of the National Fire Protection Association, on the referenced subject which is represented only by the standard in its entirety.

Copyright ©2001, National Fire Protection Association, Quincy, MA 02269. This warning system is intended to be interpreted and applied only by properly trained individuals to identify fire, health and reactivity hazards of chemicals. The user is referred to certain limited number of chemicals with recommended classifications in NFPA 49 and NFPA 325, which would be used as a guideline only. Whether the chemicals are classified by NFPA or not, anyone using the 704 systems to classify chemicals does so at their own risk.

**History**

- **Date of issue mm/dd/yyyy**: 04/15/2015
- **Version**: 1
- **Prepared by**: KMK Regulatory Services Inc.

**Key to abbreviations**

- ATE = Acute Toxicity Estimate
- BCF = Bioconcentration Factor
- GHS = Globally Harmonized System of Classification and Labelling of Chemicals
- IATA = International Air Transport Association
- IBC = Intermediate Bulk Container
- IMDG = International Maritime Dangerous Goods
- LogPow = logarithm of the octanol/water partition coefficient
- MARPOL 73/78 = International Convention for the Prevention of Pollution From Ships
Section 16. Other information

1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
UN = United Nations

**Notice to reader**

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.

Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.
HIGH CALCIUM LIMESTONE

May cause cancer (state route of exposure if it is conclusively proven that no other routes of exposure cause hazard) - Causes damage to organs (or state all organs affected, if known) through prolonged or repeated exposure (state route of exposure if it is conclusively proven that no other routes of exposure cause hazard)

Obtain special instructions before use. - Do not handle until all safety precautions have been read and understood. - Do not breathe dust/fume/gas/mist/vapours/spray. - Wash hands thoroughly after handling. - Do not eat, drink or smoke when using this product. - Use personal protective equipment as required. - IF exposed or concerned: Get medical advice/attention. - Get medical advice/attention if you feel unwell.

Please refer to the original SDS for more information