1. Identification

1.1. Product identifier

Product Identity: N002-PDE /Nano Graphene Oxide Platelets
Alternate Names: N002-PDE /Nano Graphene Oxide Platelets

1.2. Relevant identified uses of the substance or mixture and uses advised against

Intended use: See Technical Data Sheet.
Application Method: See Technical Data Sheet.

1.3. Details of the supplier of the safety data sheet

Company Name: Angstron Materials, Inc.
1240 McCook Avenue
Dayton, Ohio 45404

Phone: (937) 331-9884
Fax: (937) 558-0606
www.AngstronMaterials.com

2. Hazard(s) identification

2.1. Classification of the substance or mixture

Eye Irrit. 2:H320: Causes eye irritation.
STOT SE 3: H335: May cause respiratory irritation.
Combustible Dust: May form combustible dust concentrations in air.

2.2. Label elements

Using the Toxicity Data listed in section 11 and 12 the product is labeled as follows.

Warning

H320 Causes eye irritation.

H335 May cause respiratory irritation.

May form combustible dust concentrations in air.
[Prevention]:

P210 Keep away from heat / sparks / open flames / hot surfaces - No smoking.

P240 Ground / bond container and receiving equipment.

P241 Use explosion-proof electrical / ventilating / light / equipment.

P261 Avoid breathing dust / fume / gas / mist / vapors / spray.

P264 Wash thoroughly after handling.

P271 Use only outdoors or in a well-ventilated area.

P280 Wear protective gloves / eye protection / face protection.

[Response]:

P304+312 IF INHALED: Call a POISON CENTER or doctor / physician if you feel unwell.

P305+351+338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do - continue rinsing.

P337+313 If eye irritation persists: Get medical advice / attention.

P340 Remove victim to fresh air and keep at rest in a position comfortable for breathing.

P370+378 In case of fire: Use extinguishing media listed in section 5 of SDS for extinction.

[Storage]:

P403+233 Store in a well-ventilated place. Keep container tightly closed.

P405 Store locked up.

[Disposal]:

P501 Dispose of contents / container in accordance with local / national regulations.

| 3. Composition/information on ingredients |
This product contains the following substances that present a hazard within the meaning of the relevant State and Federal Hazardous Substances regulations.

<table>
<thead>
<tr>
<th>Ingredient/Chemical Designations</th>
<th>Weight %</th>
<th>GHS Classification</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graphene Oxide</td>
<td>75 - 100</td>
<td>Eye Irrit. 2;H320</td>
<td>[1]</td>
</tr>
<tr>
<td>CAS Number: 1034343-98-0</td>
<td></td>
<td>STOT SE 3;H335</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Combustible Dust</td>
<td></td>
</tr>
<tr>
<td>Calcium carbonate</td>
<td>1 - 5</td>
<td>Not Classified</td>
<td>[1][2]</td>
</tr>
<tr>
<td>CAS Number: 0000471-34-1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In accordance with paragraph (i) of §1910.1200, the specific chemical identity and/or exact percentage (concentration) of composition has been withheld as a trade secret.

[1] Substance classified with a health or environmental hazard.

*The full texts of the phrases are shown in Section 16.

4. First aid measures

4.1. Description of first aid measures

**General**
In all cases of doubt, or when symptoms persist, seek medical attention. Never give anything by mouth to an unconscious person.

**Inhalation**
Remove to fresh air, keep patient warm and at rest. If breathing is irregular or stopped, give artificial respiration. If unconscious place in the recovery position and obtain immediate medical attention. Give nothing by mouth.

**Eyes**
Do not rub eyes or keep eyes closed. Irrigate copiously with clean water for at least 15 minutes, holding the eyelids apart and seek medical attention.

**Skin**
Remove contaminated clothing. Wash skin thoroughly with soap and water or use a recognized skin cleanser.

**Ingestion**
If swallowed obtain immediate medical attention. Keep at rest. Do NOT induce vomiting. In general no treatment is necessary unless large quantities are ingested.

4.2. Most important symptoms and effects, both acute and delayed

**Overview**
Mild eye irritation. Inhalation of particulate may cause respiratory irritation. Ingestion of large amounts may cause internal injury. Seek immediate medical advice for inhalation or ingestion exposure. This product contains nano-scale material as a light, highly dispersible powder. The toxicity of graphene oxide platelets has not been fully investigated. All exposure to graphene oxide platelets by inhalation or skin contact should be minimized. Graphene is electrically conductive and may cause a short circuit in electrical equipment. See section 2 for further details.

**Inhalation**
May cause respiratory irritation.

**Eyes**
Causes eye irritation.
5. Fire-fighting measures

5.1. Extinguishing media
Use water fog, foam, dry chemical, or carbon dioxide. Do not use solid water jet as that may create a dust cloud that can present an explosion hazard.

5.2. Special hazards arising from the substance or mixture
Wear appropriate protective clothing as described in Section 8. Consider the use of respiratory protection if exposure to airborne particles is possible during cleanup. Eliminate all sources of ignition.
Hazardous decomposition: Oxides of Carbon
Keep away from heat / sparks / open flames / hot surfaces - No smoking.
Ground / bond container and receiving equipment.
Use explosion-proof electrical / ventilating / light / equipment.
Avoid breathing dust / fume / gas / mist / vapors / spray.

5.3. Advice for fire-fighters
Do not enter fire area without full bunker gear, including positive pressure NIOSH self-contained breathing apparatus. Cool fire-exposed containers with water.

Dust generated in handling this material may present a potential fire and explosion hazard if suspended in air at high concentrations. Settled dust presents a fire hazard. Re-suspension of the dust into the air by vibration, traffic, material handling, etc. in high concentrations in the presence of an ignition source could result in a dust explosion. Graphene is electrically conductive and may cause a short circuit in electrical equipment providing an ignition source. Minimize the generation and accumulation of dust.

ERG Guide No. ----

6. Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures
Put on appropriate personal protective equipment (see section 8).
Wear appropriate protective clothing as described in Section 8. Consider the use of respiratory protection if exposure to airborne particles is possible during cleanup. Eliminate all sources of ignition.

6.2. Environmental precautions
Do not allow spills to enter drains or waterways.
Use good personal hygiene practices. Wash hands before eating, drinking, smoking or using toilet. Promptly remove soiled clothing and wash thoroughly before reuse.

6.3. Methods and material for containment and cleaning up
Collect spilled material in a manner that minimizes the generation of airborne dust. If a vacuum is used, high-efficiency, explosion proof equipment is required. Nonsparking tools should be used. Dust deposits should not be allowed to accumulate on surfaces, as these may form an explosive mixture if they are released into the atmosphere in sufficient concentrations. Avoid dispersal of dust in the air (i.e., clearing dust surfaces with compressed air.). Clean up residuals on surfaces with suitable floor detergent/soap cleaner and properly rinse and dry. This precaution will
7. Handling and storage

7.1. Precautions for safe handling
Avoid contact with eyes, skin and clothing. Do not breathe dusts. Wear protective clothing and equipment as described in Section 8. Use only with adequate ventilation. Do not eat, drink or smoke when using this material. Clean all work areas at the end of each shift as a minimum using either an explosion-proof HEPA vacuum cleaner or wet wiping methods. Workers should shower and change clothes before leaving the worksite at the end of their shift. All contaminated work clothing should be discarded or laundered to remove nanoparticles before reuse. Wash thoroughly with soap and water after handling. Minimize the generation and accumulation of dust. Keep dust away from open flames, hot surfaces and sources of ignition. Follow good housekeeping practices to keep surfaces, including areas overhead such as piping, drop ceilings, ductwork, etc. free from settled dust. Dry powders can build static electricity charges when subjected to friction of transfer and in mixing operations. Graphene may cause a short circuit in electrical equipment providing an ignition source for combustible dust deposits. Provide adequate precautions, such as electrical grounding and bonding, or inert atmospheres. See NIOSH guidance on safe handling of nanomaterials at http://www.cdc.gov/niosh/topics/nanotech/pubs.html

See section 2 for further details. - [Prevention]:

7.2. Conditions for safe storage, including any incompatibilities
Handle containers carefully to prevent damage and spillage. Store in closed containers away from sources of ignition and oxidizers. Incompatible materials: Keep away from strong oxidizers. See section 2 for further details. - [Storage]:

7.3. Specific end use(s)
No data available.

8. Exposure controls and personal protection

8.1. Control parameters

Exposure

<table>
<thead>
<tr>
<th>CAS No.</th>
<th>Ingredient</th>
<th>Source</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000471-34-1</td>
<td>Calcium carbonate</td>
<td>OSHA</td>
<td>TWA 10 mg/m3 (total) TWA 5 mg/m3 (resp)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ACGIH</td>
<td>No Established Limit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NIOSH</td>
<td>TWA 10 mg/m3 (total) TWA 5 mg/m3 (resp)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Supplier</td>
<td>No Established Limit</td>
</tr>
<tr>
<td>1034343-98-0</td>
<td>Graphene Oxide</td>
<td>OSHA</td>
<td>No Established Limit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ACGIH</td>
<td>No Established Limit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NIOSH</td>
<td>No Established Limit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Supplier</td>
<td>No Established Limit</td>
</tr>
</tbody>
</table>
The exposure limits for nuisance dust are: OSHA PEL: 15 mg/m3 (50 mppcf*) TWA, ACGIH 10 mg/m3.

8.2. Exposure controls

Respiratory  If needed, an approved respirator with high efficiency particulate filters may be used. For higher exposures, a supplied air respirator may be required. Respirator selection and use should be based on contaminant type, form and concentration. Follow applicable regulations and good Industrial Hygiene practice.

Eyes  Protective safety glasses recommended

Skin  Conventional work gloves and clothing.

Engineering Controls  Use only with adequate controls such as source enclosure or local exhaust ventilation to minimize worker exposure. For operations where airborne particulates are possible, in general technologies that are adequate for the control of asbestos fibers (for example: closed systems, enclosures with negative pressure and HEPA filtered exhaust, wet methods in conjunction local exhaust ventilation) should be effective in the control of engineered nanoparticles. It is recommended that all dust control equipment such as local exhaust ventilation and material transport systems involved in handling this product contain explosion relief vents or an explosion suppression system or an oxygen deficient environment. Ensure that dust handling systems (such as exhaust ducts, dust collectors, vessels and processing equipment) are designed in a manner to prevent the escape of dust into the work area (i.e. there is no leakage from the equipment).

Other Work Practices  Use good personal hygiene practices. Wash hands before eating, drinking, smoking or using toilet. Promptly remove soiled clothing and wash thoroughly before reuse.

See section 2 for further details. - [Prevention]:

9. Physical and chemical properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>Black Light, Fluffy Powder Solid</td>
</tr>
<tr>
<td>Odor</td>
<td>Characteristic</td>
</tr>
<tr>
<td>Odor threshold</td>
<td>Not determined</td>
</tr>
<tr>
<td>pH</td>
<td>Not Measured</td>
</tr>
<tr>
<td>Melting point / freezing point</td>
<td>Not Measured</td>
</tr>
<tr>
<td>Initial boiling point and boiling range</td>
<td>Not Measured</td>
</tr>
<tr>
<td>Flash Point</td>
<td>None</td>
</tr>
<tr>
<td>Evaporation rate (Ether = 1)</td>
<td>Not Measured</td>
</tr>
<tr>
<td>Flammability (solid, gas)</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>Upper/lower flammability or explosive limits</td>
<td>Upper Explosive Limit: Not Measured</td>
</tr>
<tr>
<td></td>
<td>Lower Explosive Limit: Not Measured</td>
</tr>
<tr>
<td>Vapor pressure (Pa)</td>
<td>Not Measured</td>
</tr>
<tr>
<td>Vapor Density</td>
<td>Not Measured</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>Not Measured</td>
</tr>
<tr>
<td>Solubility in Water</td>
<td>Insoluble</td>
</tr>
</tbody>
</table>
Partition coefficient n-octanol/water (Log Kow)  Not Measured
Auto-ignition temperature  Not Measured
Decomposition temperature  Not Measured
Viscosity (cSt)  Not Measured
Relative Density  ≤ 2.2 g/cm³

9.2. Other information
No other relevant information.

10. Stability and reactivity

10.1. Reactivity
Hazardous Polymerization will not occur.

10.2. Chemical stability
Stable under normal circumstances.

10.3. Possibility of hazardous reactions
Reactions with oxidizers may generate heat and may cause fire.

10.4. Conditions to avoid
Avoid heat, sparks, flames and all other sources of ignition.

10.5. Incompatible materials
Keep away from strong oxidizers.

10.6. Hazardous decomposition products
Oxides of Carbon

11. Toxicological information

Acute toxicity

Note: When no route specific LD50 data is available for an acute toxin, the converted acute toxicity point estimate was used in the calculation of the product's ATE (Acute Toxicity Estimate).

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Oral LD50, mg/kg</th>
<th>Skin LD50, mg/kg</th>
<th>Inhalation Vapor LC50, mg/L/4hr</th>
<th>Inhalation Dust/Mist LC50, mg/L/4hr</th>
<th>Inhalation Gas LC50, ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graphene Oxide - (1034343-98-0)</td>
<td>No data available</td>
<td>No data available</td>
<td>No data available</td>
<td>No data available</td>
<td>No data available</td>
</tr>
<tr>
<td>Calcium carbonate - (471-34-1)</td>
<td>6,450.00, Rat - Category: NA</td>
<td>No data available</td>
<td>No data available</td>
<td>No data available</td>
<td>No data available</td>
</tr>
</tbody>
</table>

Carcinogen Data

<table>
<thead>
<tr>
<th>CAS No.</th>
<th>Ingredient</th>
<th>Source</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000471-34-1</td>
<td>Calcium carbonate</td>
<td>OSHA, NTP</td>
<td>Select Carcinogen: No; Known: No; Suspected: No; Group 1: No; Group 2a: No; Group 2b: No; Group 3: No; Group 4: No;</td>
</tr>
</tbody>
</table>
1034343-98-0 | Graphene Oxide | OSHA | Select Carcinogen: No
| NTP | Known: No; Suspected: No
| IARC | Group 1: No; Group 2a: No; Group 2b: No; Group 3: No; Group 4: No;

### Classification

<table>
<thead>
<tr>
<th>Hazard Description</th>
<th>Category</th>
<th>Hazard Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute toxicity (oral)</td>
<td>---</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>Acute toxicity (dermal)</td>
<td>---</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>Acute toxicity (inhalation)</td>
<td>---</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>Skin corrosion/irritation</td>
<td>---</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>Serious eye damage/irritation</td>
<td>2B</td>
<td>Causes eye irritation.</td>
</tr>
<tr>
<td>Respiratory sensitization</td>
<td>---</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>Skin sensitization</td>
<td>---</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>Germ cell mutagenicity</td>
<td>---</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>Carcinogenicity</td>
<td>---</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>Reproductive toxicity</td>
<td>---</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>STOT-single exposure</td>
<td>3</td>
<td>May cause respiratory irritation.</td>
</tr>
<tr>
<td>STOT-repeated exposure</td>
<td>---</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>Aspiration hazard</td>
<td>---</td>
<td>Not Applicable</td>
</tr>
</tbody>
</table>

### 12. Ecological information

#### 12.1. Toxicity

No additional information provided for this product. See Section 3 for chemical specific data.

**Aquatic Ecotoxicity**

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>96 hr LC50 fish, mg/l</th>
<th>48 hr EC50 crustacea, mg/l</th>
<th>ErC50 algae, mg/l</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graphene Oxide - (1034343-98-0)</td>
<td>Not Available</td>
<td>Not Available</td>
<td>Not Available</td>
</tr>
<tr>
<td>Calcium carbonate - (471-34-1)</td>
<td>56,000.00, Gambusia affinis</td>
<td>Not Available</td>
<td>Not Available</td>
</tr>
</tbody>
</table>

#### 12.2. Persistence and degradability

Components are expected to be biodegradable.

#### 12.3. Bioaccumulative potential

Not Measured

#### 12.4. Mobility in soil

No data available.

#### 12.5. Results of PBT and vPvB assessment

This product contains no PBT/vPvB chemicals.

#### 12.6. Other adverse effects

No data available.
13. Disposal considerations

13.1. Waste treatment methods
Observe all federal, state and local regulations when disposing of this substance.

14. Transport information

<table>
<thead>
<tr>
<th>DOT (Domestic Surface Transportation)</th>
<th>IMO / IMDG (Ocean Transportation)</th>
<th>ICAO/IATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOT Number: Not Applicable</td>
<td>IMDG: Not Regulated</td>
<td>Not Regulated</td>
</tr>
<tr>
<td>UN Proper Shipping Name:</td>
<td>Sub Class: Not Applicable</td>
<td>Not Regulated</td>
</tr>
<tr>
<td>DOT Hazard Class(es):</td>
<td>IMDG: Not Applicable</td>
<td>Air Class: Not Applicable</td>
</tr>
<tr>
<td>Packing Group: Not Applicable</td>
<td>IMDG: Not Regulated</td>
<td>Not Regulated</td>
</tr>
</tbody>
</table>

14.5. Environmental hazards
IMDG: Marine Pollutant: No;

14.6. Special precautions for user
No further information

15. Regulatory information

Regulatory Overview
The regulatory data in Section 15 is not intended to be all-inclusive, only selected regulations are represented.

Toxic Substance Control Act (TSCA)
All components of this material are either listed or exempt from listing on the TSCA Inventory.

WHMIS Classification
D2B

US EPA Tier II Hazards
Fire: No
Sudden Release of Pressure: No
Reactive: No
Immediate (Acute): Yes
Delayed (Chronic): No

EPCRA 311/312 Chemicals and RQs:
To the best of our knowledge, there are no chemicals at levels which require reporting under this statute.

EPCRA 302 Extremely Hazardous:
To the best of our knowledge, there are no chemicals at levels which require reporting under this statute.

EPCRA 313 Toxic Chemicals:
To the best of our knowledge, there are no chemicals at levels which require reporting under this statute.
Proposition 65 - Carcinogens (>0.0%):  
To the best of our knowledge, there are no chemicals at levels which require reporting under this statute.

Proposition 65 - Developmental Toxins (>0.0%):  
To the best of our knowledge, there are no chemicals at levels which require reporting under this statute.

Proposition 65 - Female Repro Toxins (>0.0%):  
To the best of our knowledge, there are no chemicals at levels which require reporting under this statute.

Proposition 65 - Male Repro Toxins (>0.0%):  
To the best of our knowledge, there are no chemicals at levels which require reporting under this statute.

New Jersey RTK Substances (>1%):  
To the best of our knowledge, there are no chemicals at levels which require reporting under this statute.

Pennsylvania RTK Substances (>1%):  
To the best of our knowledge, there are no chemicals at levels which require reporting under this statute.

16. Other information

The information and recommendations contained herein are based upon data believed to be correct. However, no guarantee or warranty of any kind, expressed or implied, is made with respect to the information contained herein. We accept no responsibility and disclaim all liability for any harmful effects which may be caused by exposure to our products. Customers/users of this product must comply with all applicable health and safety laws, regulations, and orders.

The full text of the phrases appearing in section 3 is:

H320 Causes eye irritation.
H335 May cause respiratory irritation.

NFPA Ratings  
Health-1  Flammability-1  Reactivity-0

The information contained herein is furnished without warranty of any kind. The above information is believed to be correct but does not purport to be all inclusive and should be used only as a guide. Users should make independent determinations of the suitability and completeness of information from all sources to assure proper use and disposal of these materials and the safety and health of employees and customers.

End of Document