1. Identification

Product identifier: Nitrogen Dioxide Calibration Gas
CAS #: Mixture
Other means of identification:
- SDS number: NOCG2
- Synonyms: INOcal® 10ppm Nitrogen Dioxide, 21% Oxygen, Balance Nitrogen

Recommended use:
Compressed gas used for calibration of INOmax® delivery devices.

Recommended restrictions:
None known.

Manufacturer/Importer/Supplier/Distributor information:

Manufacturer:
- Supplier:
  - Company name: INO Therapeutics LLC d/b/a Mallinckrodt Pharmaceuticals
  - Address: Perryville III Corporate Park
    53 Frontage Road, 3rd Floor, P.O. Box 9001
    Hampton, New Jersey 08827-9001, USA
  - Telephone number: 1-877-566-9466

Emergency telephone number:
1-800-424-9300 (CHEMTREC)

2. Hazard(s) identification

Physical hazards: Gases under pressure
Health hazards: Not classified.
Environmental hazards: Not classified.
OSHA defined hazards: Not classified.

Labeling:
Contains:
- NITROGEN, OXYGEN

Label elements:

Signal word: Warning
Hazard statement: Contains gas under pressure; may explode if heated.

Precautionary statement:
- Prevention: Observe good industrial hygiene practices.
- Response: Wash hands after handling.
- Storage: Protect from sunlight. Store in a well-ventilated place.
- Disposal: Dispose of waste and residues in accordance with local authority requirements.

Hazard(s) not otherwise classified (HNOC): Exposure to rapidly expanding gas or vaporizing liquid may cause frostbite ("cold burn").

Exposure may aggravate those with pre-existing eye, skin, or respiratory conditions.

Supplemental information:
None.

3. Composition/information on ingredients

Mixtures

Material name: Nitrogen Dioxide Calibration Gas
MSDS ID: NOCG2  Version #: 01  Revision date: 03-29-2016
### Chemical and Physical Properties

<table>
<thead>
<tr>
<th>Chemical name</th>
<th>Common name and synonyms</th>
<th>CAS number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen</td>
<td>Nitrogen; Nitrogen NF; LIN; Cryogenic Liquid Nitrogen</td>
<td>7727-37-9</td>
<td>78.9</td>
</tr>
<tr>
<td>Oxygen</td>
<td></td>
<td>132259-10-0</td>
<td>21</td>
</tr>
</tbody>
</table>

### Composition comments

All concentrations are in percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

### 4. First-aid measures

#### Inhalation

Move to fresh air. Call a physician if symptoms develop or persist.

#### Skin contact

Remove contaminated clothing. Wash off with soap and water. Get medical attention if irritation develops and persists. Wash contaminated clothing before reuse.

#### Eye contact

Rinse immediately with plenty of water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Get medical attention if irritation develops and persists.

#### Ingestion

Rinse mouth. Never give anything by mouth to a victim who is unconscious or is having convulsions. Do not induce vomiting. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs. Get medical attention if symptoms occur.

#### Most important symptoms/effects, acute and delayed

May cause frostbite or freezing of skin. Permanent eye damage including blindness could result.

#### Indication of immediate medical attention and special treatment needed

Provide general supportive measures and treat symptomatically.

#### General information

Frostbite: Do not remove clothes, but flush with copious amounts of lukewarm water. Call an ambulance and continue to flush during transportation to hospital. Do not rub affected area.

### 5. Fire-fighting measures

#### Flammable properties

The product is not flammable.

#### Suitable extinguishing media

Use any media suitable for the surrounding fires.

#### Unsuitable extinguishing media

Do not use water jet as an extinguisher, as this will spread the fire.

#### Specific hazards arising from the chemical

Contents under pressure. Fire or excessive heat may result in rupture of container due to release of significant amounts of gases. Ruptured cylinders may rocket. During fire, gases hazardous to health may be formed such as: Nitrogen Oxides. Carbon oxides.

#### Special protective equipment and precautions for firefighters

Firefighters must use standard protective equipment including flame retardant coat, helmet with face shield, gloves, rubber boots, and in enclosed spaces, SCBA.

#### Fire-fighting equipment/instructions

In case of fire: Stop leak if safe to do so. Do not move cargo or vehicle if cargo has been exposed to heat. ALWAYS stay away from tanks engulfed in flame. Move containers from fire area if you can do so without risk. Use water spray to cool unopened containers. For massive fire in cargo area, use unmanned hose holder or monitor nozzles, if possible. If not, withdraw and let fire burn out.

#### Specific methods

Cool containers exposed to flames with water until well after the fire is out.

#### General fire hazards

Pressurized container may explode when exposed to heat or flame.

### 6. Accidental release measures

#### Personal precautions, protective equipment and emergency procedures

Keep away from sources of ignition - No smoking. Keep out of low areas. Keep unnecessary personnel away. Keep people away from and upwind of spill/leak. Wear appropriate protective equipment and clothing during clean-up. Avoid breathing gas. Avoid breathing mist or vapor. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Ensure adequate ventilation. Local authorities should be advised if significant spillages cannot be contained. For personal protection, see section 8 of the SDS.
Material name: Nitrogen Dioxide Calibration Gas

MSDS ID: NOCG2    Version #: 01    Revision date: 03-29-2016

7. Handling and storage

Precautions for safe handling
DO NOT PRESSURIZE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND, OR EXPOSE SUCH CONTAINERS TO HEAT, STATIC ELECTRICITY, OR OTHER SOURCES OF ILLUMINATION; THEY MAY EXPLODE AND CAUSE INJURY OR DEATH. Prevent electrostatic charge build-up by using common bonding and grounding techniques. Avoid breathing gas. Avoid contact with eyes, skin, and clothing. Avoid prolonged exposure. When using, do not eat, drink or smoke. Provide adequate ventilation. Wear appropriate personal protective equipment. Wash thoroughly after handling. Observe good industrial hygiene practices.

Conditions for safe storage, including any incompatibilities
Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Store in original tightly closed container. Protect against physical damage and/or friction. Store in a cool, dry place. Store in a well-ventilated place. Protect from sunlight. Avoid high temperatures. Low temperatures. Store away from incompatible materials (see Section 10 of the SDS).

8. Exposure controls/personal protection

Occupational exposure limits
No exposure limits noted for ingredient(s).

Biological limit values
No biological exposure limits noted for the ingredient(s).

Appropriate engineering controls
Use explosion-proof equipment. Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. Ensure adequate ventilation, especially in confined areas. Eye wash facilities and emergency shower must be available when handling this product.

Individual protection measures, such as personal protective equipment

Eye/face protection
Wear safety glasses with side shields (or goggles). Chemical goggles are recommended.

Skin protection
Hand protection
Wear protective gloves. Thermally protective, chemical resistant gloves are recommended. If contact with forearms is likely, wear gauntlet style gloves.

Other
Respiratory protection
If airborne concentrations are above the applicable exposure limits, use NIOSH approved respiratory protection.

Thermal hazards
Wear appropriate thermal protective clothing, when necessary.

General hygiene considerations
When using, do not eat, drink or smoke. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

9. Physical and chemical properties

Appearance

Physical state
Gas.
Form
Compressed gas.
Color
Colorless in product concentration.

Odor
Odorless in product concentration (NO2 has pungent, acid odor at higher concentrations).

Odor threshold
0.4 - 5 ppm (detection for NO2)

pH
Not available.

Melting point/freezing point
15 °F (-9.44 °C)

Initial boiling point and boiling range
70 °F (21.11 °C)

Flash point
Not flammable.
<table>
<thead>
<tr>
<th><strong>Evaporation rate</strong></th>
<th>Not available.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Flammability (solid, gas)</strong></td>
<td>Not available.</td>
</tr>
<tr>
<td><strong>Upper/lower flammability or explosive limits</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Flammability limit - lower (%)</strong></td>
<td>Not available.</td>
</tr>
<tr>
<td><strong>Flammability limit - upper (%)</strong></td>
<td>Not available.</td>
</tr>
<tr>
<td><strong>Explosive limit - lower (%)</strong></td>
<td>Not available.</td>
</tr>
<tr>
<td><strong>Explosive limit - upper (%)</strong></td>
<td>Not available.</td>
</tr>
<tr>
<td><strong>Vapor pressure</strong></td>
<td>Not available.</td>
</tr>
<tr>
<td><strong>Vapor density</strong></td>
<td>Not available.</td>
</tr>
<tr>
<td><strong>Relative density</strong></td>
<td>Not available.</td>
</tr>
<tr>
<td><strong>Solubility(ies)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Solubility (water)</strong></td>
<td>0.02 @ 32 °F (0 °C) and 1 atm</td>
</tr>
<tr>
<td><strong>Partition coefficient (n-octanol/water)</strong></td>
<td>Not available.</td>
</tr>
<tr>
<td><strong>Auto-ignition temperature</strong></td>
<td>Not available.</td>
</tr>
<tr>
<td><strong>Decomposition temperature</strong></td>
<td>Not available.</td>
</tr>
<tr>
<td><strong>Viscosity</strong></td>
<td>Not available.</td>
</tr>
<tr>
<td><strong>Other information</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Explosive properties</strong></td>
<td>Contains gas under pressure; may explode if heated.</td>
</tr>
<tr>
<td><strong>Specific gravity</strong></td>
<td>1.44 g/l (Liquid at 68 °F)</td>
</tr>
</tbody>
</table>

**10. Stability and reactivity**

<table>
<thead>
<tr>
<th><strong>Reactivity</strong></th>
<th>The product is stable and non-reactive under normal conditions of use, storage and transport.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chemical stability</strong></td>
<td>Contains gas under pressure; may explode if heated.</td>
</tr>
<tr>
<td><strong>Possibility of hazardous reactions</strong></td>
<td>Hazardous polymerization does not occur.</td>
</tr>
<tr>
<td><strong>Conditions to avoid</strong></td>
<td>Protect against direct sunlight. Avoid heat, sparks, open flames and other ignition sources. Avoid high temperatures. Low temperatures. Contact with incompatible materials.</td>
</tr>
<tr>
<td><strong>Incompatible materials</strong></td>
<td>Strong oxidizing agents. Strong acids. Strong bases.</td>
</tr>
<tr>
<td><strong>Hazardous decomposition products</strong></td>
<td>Nitrogen oxides (NOx). Nitrogen dioxide decomposes in water to form nitric and nitrous acids.</td>
</tr>
</tbody>
</table>

**11. Toxicological information**

**Information on likely routes of exposure**

<table>
<thead>
<tr>
<th><strong>Ingestion</strong></th>
<th>Exposure to rapidly expanding gas or vaporizing liquid may cause frostbite (&quot;cold burn&quot;). However, ingestion is not likely to be a primary route of occupational exposure.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inhalation</strong></td>
<td>Prolonged or repeated inhalation may cause: Irritation.</td>
</tr>
<tr>
<td><strong>Skin contact</strong></td>
<td>May cause frostbite or freezing of skin.</td>
</tr>
<tr>
<td><strong>Eye contact</strong></td>
<td>Exposure to rapidly expanding gas or vaporizing liquid may cause frostbite (&quot;cold burn&quot;). Permanent eye damage including blindness could result.</td>
</tr>
<tr>
<td><strong>Symptoms related to the physical, chemical and toxicological characteristics</strong></td>
<td>May cause frostbite or freezing of skin. Permanent eye damage including blindness could result.</td>
</tr>
</tbody>
</table>

**Information on toxicological effects**

<table>
<thead>
<tr>
<th><strong>Acute toxicity</strong></th>
<th>Due to lack of data the classification is not possible.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chronic effects</strong></td>
<td>Prolonged inhalation may be harmful.</td>
</tr>
<tr>
<td><strong>Skin corrosion/irritation</strong></td>
<td>May cause frostbite or freezing of skin.</td>
</tr>
</tbody>
</table>
Serious eye damage/eye irritation
Exposure to rapidly expanding gas or vaporizing liquid may cause frostbite ("cold burn"). Permanent eye damage including blindness could result.

Respiratory or skin sensitization
Respiratory sensitization
Due to lack of data the classification is not possible.

Skin sensitization
Due to lack of data the classification is not possible.

Germ cell mutagenicity
No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.

Carcinogenicity
This product is not considered to be a carcinogen by IARC, ACGIH, NTP, or OSHA.

Reproductive toxicity
Due to lack of data the classification is not possible.

Specific target organ toxicity - single exposure
Due to lack of data the classification is not possible.

Specific target organ toxicity - repeated exposure
Due to lack of data the classification is not possible.

Aspiration hazard
Due to lack of data the classification is not possible.

12. Ecological information

Ecotoxicity
This product has no known eco-toxicological effects. Nitrogen dioxide decomposes in water to form nitric and nitrous acids.

Persistence and degradability
No data is available on the degradability of this product.

Bioaccumulative potential

Partition coefficient n-octanol / water (log Kow)
NITROGEN 0.67

Mobility in soil
No data available.

Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

13. Disposal considerations

Disposal instructions
Do not puncture, incinerate or crush. Waste materials should not be released into the environment. Dispose of contents/container in accordance with local/regional/national/international regulations.

Hazardous waste code
Waste codes should be assigned by the user based on the application for which the product was used. The waste code should be assigned in discussion between the user, the producer and the waste disposal company.

Waste from residues / unused products
Dispose of in accordance with local regulations.

Contaminated packaging
Empty gas cylinders should be returned to the vendor for recycling or refilling. Empty containers should be taken to an approved waste handling site for recycling or disposal. Since emptied containers may retain product residue, follow label warnings even after container is emptied.

14. Transport information

DOT

UN number UN1956
UN proper shipping name Compressed gas, n.o.s. (10 ppm Nitrogen dioxide, 21% Oxygen, Nitrogen)
Transport hazard class(es) Class 2.2
Subsidiary risk -
Label(s) 2.2
Packing group Not applicable.
Special precautions for user Read safety instructions, SDS and emergency procedures before handling.
ERG number 126

IATA

UN number UN1956
UN proper shipping name Compressed gas, n.o.s. (10 ppm Nitrogen dioxide, 21% Oxygen, Nitrogen)
Transport hazard class(es) Class 2.2
Subsidiary risk
- Not applicable.

Packing group
Not applicable.

Environmental hazards
No.

ERG Code
2L

Special precautions for user
Read safety instructions, SDS and emergency procedures before handling.

Other information
Passenger and cargo aircraft
Allowed.

Cargo aircraft only
Allowed.

IMDG
UN number
UN1956

UN proper shipping name
COMPRESSED GAS, N.O.S. (10 PPM NITROGEN DIOXIDE, 21% OXYGEN, NITROGEN)

Transport hazard class(es)
Class 2.2

Subsidiary risk
- Not applicable.

Packing group
Not applicable.

Environmental hazards
No.

Marine pollutant
F-C, S-V

EmS

Special precautions for user
Read safety instructions, SDS and emergency procedures before handling.

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

DOT

IATA; IMDG

15. Regulatory information

US federal regulations
This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

One or more components are not listed on TSCA.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)
Not regulated.

CERCLA Hazardous Substance List (40 CFR 302.4)
Not listed.

SARA 304 Emergency release notification
Not regulated.
Material name: Nitrogen Dioxide Calibration Gas  
SDS US  
MSDS ID: NOCG2  Version #: 01  Revision date: 03-29-2016

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)  
Not listed.

CERCLA (Superfund) reportable quantity  
None

Superfund Amendments and Reauthorization Act of 1986 (SARA)  
Hazard categories
- Immediate Hazard - No  
- Delayed Hazard - No  
- Fire Hazard - No  
- Pressure Hazard - Yes  
- Reactivity Hazard - No

SARA 302 Extremely hazardous substance  
Not listed.

SARA 311/312 Hazardous chemical  
No

Other federal regulations  
- Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List  
  Not regulated.
- Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)  
  Not regulated.
- Safe Drinking Water Act (SDWA)  
  Not regulated.

US state regulations  
- US. Massachusetts RTK - Substance List  
  NITROGEN (CAS 7727-37-9)
- US. New Jersey Worker and Community Right-to-Know Act  
  NITROGEN (CAS 7727-37-9)
- US. Pennsylvania Worker and Community Right-to-Know Law  
  NITROGEN (CAS 7727-37-9)
- US. Rhode Island RTK  
  Not regulated.
- US. California Proposition 65  
  California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65): This material is not known to contain any chemicals currently listed as carcinogens or reproductive toxins.

International Inventories  

<table>
<thead>
<tr>
<th>Country(s) or region</th>
<th>Inventory name</th>
<th>On inventory (yes/no)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>Australian Inventory of Chemical Substances (AICS)</td>
<td>No</td>
</tr>
<tr>
<td>Canada</td>
<td>Domestic Substances List (DSL)</td>
<td>No</td>
</tr>
<tr>
<td>Canada</td>
<td>Non-Domestic Substances List (NDLS)</td>
<td>No</td>
</tr>
<tr>
<td>China</td>
<td>Inventory of Existing Chemical Substances in China (IECSC)</td>
<td>Yes</td>
</tr>
<tr>
<td>Europe</td>
<td>European Inventory of Existing Commercial Chemical Substances (EINECS)</td>
<td>No</td>
</tr>
<tr>
<td>Europe</td>
<td>European List of Notified Chemical Substances (ELINCS)</td>
<td>No</td>
</tr>
<tr>
<td>Japan</td>
<td>Inventory of Existing and New Chemical Substances (ENCS)</td>
<td>No</td>
</tr>
<tr>
<td>Korea</td>
<td>Existing Chemicals List (ECL)</td>
<td>No</td>
</tr>
<tr>
<td>New Zealand</td>
<td>New Zealand Inventory</td>
<td>Yes</td>
</tr>
<tr>
<td>Philippines</td>
<td>Philippine Inventory of Chemicals and Chemical Substances (PICCS)</td>
<td>No</td>
</tr>
<tr>
<td>Country(s) or region</td>
<td>Inventory name</td>
<td>On inventory (yes/no)*</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>---------------------------------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>United States &amp; Puerto Rico</td>
<td>Toxic Substances Control Act (TSCA) Inventory</td>
<td>No</td>
</tr>
</tbody>
</table>

*A “Yes” indicates that all components of this product comply with the inventory requirements administered by the governing country(s) A “No” indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

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

<table>
<thead>
<tr>
<th>Issue date</th>
<th>03-29-2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Version #</td>
<td>01</td>
</tr>
</tbody>
</table>

NFPA Ratings

| 1 | 0 | 0 | SA |

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