

SIGNIFICANT REVISION OF AUTHORITY-TO-CONSTRUCT  
PERMIT #1962-M1-1TR

**Materion Advanced Materials Technologies and Services Corp.**  
**North Facility**



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January 24, 2020

Ms. Regan Eyerman  
Permitting Section  
Air Quality Program (AQP)  
Albuquerque Environmental Health Department  
PO Box 1293  
Albuquerque, NM 87103

*Re: Significant Revision of Authority to Construct Permit 1962-M1-1TR, Materion Advanced Materials Technologies and Services Corporation.*

Dear Ms. Eyerman,

Trinity Consultants, on behalf of Materion Advanced Materials Technologies and Services Corporation (Materion), is submitting this application for a Significant Revision of Authority-to-Construct (ATC) Permit 1962-M1-1TR, for the Materion North facility, located at 5941 Midway Park Blvd. NE, Albuquerque.

The modification in this application includes the addition of a new thermal sprayer (Unit PS-07) and dust collector (Unit DC-06).

Enclosed is a hard copy of the application which consists of the Application Checklist, Application Summary, and the Air Quality Long Form Application. If you have any questions or comments about this application, please do not hesitate to call me at (505) 266-6611 or contact me by email at [jzenker@trinityconsultants.com](mailto:jzenker@trinityconsultants.com). Alternatively, you may contact Mr. Richard Vitale with Materion at (505) 342-5518 or by email at [Richard.Vitale@materion.com](mailto:Richard.Vitale@materion.com).

Sincerely,

Jake Zenker  
Consultant

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## 1. SUMMARY

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This document is an application for a Significant Revision of Authority-To-Construct Permit #1962-M1-1TR for the North facility (North) owned and operated by Materion Advanced Materials Technologies and Services Corp. (Materion). The facility is located at 5941 Midway Park Blvd. NE in Albuquerque, New Mexico (UTM 353,862 m E, 3,890,794 m N) and is currently operating. Materion seeks to add an additional thermal sprayer unit (unit PS-07) to their North facility.

Table 1-1 below provides an overview of the proposed changes to the current North facility permit.

**Table 1-1. Proposed Revisions to Authority-To-Construct Permit #1962-M1-1TR**

<b>Unit</b>	<b>Description</b>	<b>Action</b>
CC3	Continuous Casting Furnace	Will remain as currently permitted in Authority-to-Construct Permit 1962-M2-1TR
A1	Belt Annealing Furnace	Will remain as currently permitted in Authority-to-Construct Permit 1962-M2-1TR
IF1	Induction Furnace	Will remain as currently permitted in Authority-to-Construct Permit 1962-M2-1TR
IF2	Induction Furnace	Will remain as currently permitted in Authority-to-Construct Permit 1962-M2-1TR
EG1	Emergency Generator	Will remain as currently permitted in Authority-to-Construct Permit 1962-M2-1TR
AG1	Melting Furnace	Will remain as currently permitted in Authority-to-Construct Permit 1962-M2-1TR
AG2	Melting Furnace	Will remain as currently permitted in Authority-to-Construct Permit 1962-M2-1TR
FUM-05	TMD Cast Target Reconditioning	Will remain as currently permitted in Authority-to-Construct Permit 1962-M2-1TR
CAST-02	TMD Cast Target Reconditioning	Will remain as currently permitted in Authority-to-Construct Permit 1962-M2-1TR
LT-14	TMD Finishing Process	Will remain as currently permitted in Authority-to-Construct Permit 1962-M2-1TR
LT-15	TMD Finishing Process	Will remain as currently permitted in Authority-to-Construct Permit 1962-M2-1TR
MLL-09	TMD Finishing Process	Will remain as currently permitted in Authority-to-Construct Permit 1962-M2-1TR
PS-02	TMD Finishing Process	Will remain as currently permitted in Authority-to-Construct Permit 1962-M2-1TR
FS-01	TMD Form Spray Process	Will remain as currently permitted in Authority-to-Construct Permit 1962-M2-1TR
PS-05	TMD Strip, Grit Blast, and Bond Coat	Will remain as currently permitted in Authority-to-Construct Permit 1962-M2-1TR
PS-03	TMD Strip, Grit Blast, and Bond Coat	Will remain as currently permitted in Authority-to-Construct Permit 1962-M2-1TR
PS-04	TMD Strip, Grit Blast, and Bond Coat	Will remain as currently permitted in Authority-to-Construct Permit 1962-M2-1TR
PS-06	TMD Strip, Grit Blast, and Bond Coat	Will remain as currently permitted in Authority-to-Construct Permit 1962-M2-1TR
PS-01	TMD Thermal Spray	Will remain as currently permitted in Authority-to-Construct Permit 1962-M2-1TR
PS-07	Thermal Spray	New Equipment

## 2. PROCESS DESCRIPTION

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This section describes the processes currently taking place at the North facility and the units/processes which are being added in this permit application.

### PROCESSES CURRENTLY AT NORTH FACILITY

Materion North produces precious metal fabricated products. The primary metal is silver produced with a high-degree of purity or alloyed with copper, tin, zinc, nickel, and/or palladium. The North facility processes customer supplied, non-toxic, silver bearing material including pure silver shot, bars, billets, or scrap trimmings. The processing of silver bearing materials can include the following steps: melting, milling, annealing, alloying, chemical/mechanical finishing. The saleable products are pure silver or silver alloy in the form of bars, strips, rods, and machined products.

#### Silver Products

The air pollutant emissions from the natural gas-fired annealing furnace (A1) are typical for an external combustion unit including NO<sub>x</sub>, CO, VOC, SO<sub>2</sub> and particulates. There are two electrically powered furnaces including the continuous casting furnace (CC3) and annealing furnace (IF1). IF2 is an identical unit to IF1 and will be used as a backup unit to IF1 if needed. It is stored onsite but not connected or operational. The continuous casting furnace (CC3) is not a source of NO<sub>x</sub>, CO, VOC nor SO<sub>2</sub> emissions by virtue of being electrically powered. In the case of the continuous casting furnace, the melting is performed without the use of fluxes or other additives that would result in NO<sub>x</sub> or particulate emissions. However, some silver/zinc alloys may be produced in the continuous casting furnace which would have particulate emissions. The melting in this furnace is performed in a nitrogen atmosphere which mitigates the oxidation of zinc into zinc oxide. There are no emissions of NO<sub>x</sub> associated with this. In the annealing process, only heating and not melting of the metals takes place. No fluxes or additives are used in the annealing process that would result in particulate emissions. Figure 2 shows the silver strip process flow.

#### Silver Targets

Pure silver cast billets are heated in an annealing furnace (IF1) and then hot pressed using a mechanical press.

#### Target Products

The sputtering target production process flow is summarized in Figure 3. The air pollutant emissions from the natural gas-fired melting furnaces (AG1, AG2) are typical for external combustion units including NO<sub>x</sub>, CO, VOC, SO<sub>2</sub> and particulates.

The steps in the target production process are:

1. Melting high purity precious metals and alloys thereof in a gas fired furnace (AG1, AG2). Casting the metal into graphite molds to form rectangular billets.
2. A series of elongating and annealing steps are conducted on the billet to achieve a certain dimension and grain refinement. The precious metal billet is run through a rolling mill which elongates and work hardens the billet. The piece is then run through the mesh belt electric annealing furnace (BA1) which makes the billet soft again so that further rolling reductions are possible. For the majority of targets the electric annealing furnace is operated under normal atmospheric conditions e.g. ambient pressure with a normal atmospheric composition. For some alloys, (approximately 20% of production) the annealing process requires an oxygen free condition.

3. When the billet meets the required dimensions it is put in a flattening press to remove rolling mill induced waves.
4. The billet is loaded into a CNC milling machine or lathe to produce a dimensionally precise shape to meet customer requirements.
5. The precious metal target is cleaned, QC inspected and packaged for shipment to the customer.

### **Cast Target Reconditioning**

Used rotatable Tin and Indium alloy sputtering targets are returned by customers for reconditioning and recasting. The targets are heated with a handheld propane burner (CAST-02) until the alloy is soft enough to remove by scraping it off with hand tools inside a reconditioning hood (FUM-05). The recovered alloy is recycled internally or sent off-site for refining, depending upon quality. Unit CAST-02 will be vented to the room.

### **Form Spray Process**

In the form spray process, solid metals are melted in an electric melt chamber, then sprayed onto a rotating tube in unit FS-01. Argon is used as a blanket gas and as a carrier medium for the sprayed metals. MAPP (stabilized mixture of methylacetylene and propadiene) gas cylinders are used for some alloys to pre-heat the spray nozzle immediately prior to melting. Overspray is exhausted to a dedicated cartridge style dust collector (DC-11) which is located outside of the main building. The dust collector has a collection efficiency of 99.99% and is considered inherent to the process as the materials collected are recycled and have monetary value. The remaining emissions from the dust collector are emitted to the atmosphere through a dedicated stack.

### **Stripping, Grit Blast, and Bond Coat Process**

Stripping and grit blast/bond coat processing occurs on SiAl alloy targets which are returned from the customer for re-use of the backing tube. These targets are locally heated by hand with oxy-propane torches (PS-05), which causes the coating to spall and fall off. At this point, the stripped and new tubes are grit blasted with Alumina grit to roughen and clean the surface (PS-03). A NiAl bonding layer is then applied using wire bonding equipment (PS-04 and PS-06). Alumina grit is reclaimed and reused until it has broken down into particles small enough to be lifted by the exhaust system. All emissions are exhausted to a cartridge dust collector (DC-01) which is located outside of the building. The dust collector has a collection efficiency of 99.95% and is considered inherent to the process as the materials collected are recycled and have monetary value.

### **Thermal Spray Process**

Powders are inserted into a plasma plume and discharged onto a rotating water cooled tube to deposit a coating on the clean targets (units PS-01 and PS-07). Overspray material is exhausted through a cyclone separator and cartridge dust collectors (DC-05 and DC-06) for recycling and reuse of the powders. Any remaining powder not collected in DC-05 is discharged to the atmosphere. DC-05 and DC-06 operate at a 99.97% control efficiency. Trace amounts of Ni are due to the presence of a Ni based bonding layer from prior operational steps. Zn is sprayed on the same unit, but using wire bond technology.

### **Finishing Process**

The finishing process includes the machining and polishing of purchased, cast and sprayed sputter targets and tubes. Alloy targets that need to be machined are done so on lathes (LT-14 and LT-15) and a mill (MLL-09), with metal chips collected for disposal and isopropanol used as a coolant/lubricant. Units LT-14, LT-15, and MLL-09 will be vented to the room. These targets are then polished with Scotch-Brite pads while on the lathes, without coolant. Harder alloys are polished with a belt sander using diamond belts (PS-02), with the dust captured and exhausted to a cartridge dust collector (DC-02). The dust collector operates at 99.95% control efficiency and exhausts to the atmosphere. Isopropanol is used as a final wipe down cleaning agent for all targets.

### **Other Sources**

The site includes a Baldor 150-hp natural-gas fired emergency backup generator (EG1). The emergency backup generator is limited to operate no more than 200 hours per year.

## **STARTUP, SHUTDOWN, MAINTENANCE & MALFUNCTION**

All process equipment at Materion is operated in batch mode. Start-up and shutdown of process equipment is part of normal daily operation. During bag house maintenance or in the event of a malfunction, the associated furnaces will be shut down. The Air Quality Division will be notified in the event that abnormal emissions from malfunction, start-up, and/or shutdown exceed permitted limits.

## **FUGITIVE EMISSIONS**

Any emissions from facility processes are generated inside the building and routed to one of the main stacks which is then sent to a dust collector/baghouse or to the atmosphere through a general exhaust stack. As a result of this facility setup, there are no fugitive emissions.

## **EXEMPT UNITS**

### **Powder Blending**

Powder blending operations combine specified amounts of powder materials for use as feed to the plasma spray process. The materials are initially transferred on a downdraft table which captures any dust emissions. The downdraft table emissions are vented to the room. The materials are screened with an Argon blanket, and then mixed in an enclosed “Vee” type blender (BLD-01).

### **TMD Vertical Casting**

Vertical casting operations (CAST-01 and CAST-05) include melting Tin and Indium alloys in electrically heated furnaces. The liquid metals are then cast into vertical molds to form cylinders of alloys. Propane fired burners are used to ensure the molten metals remain liquid while the mold cavity is filled. After cooling, the molds are opened and the cast rotatables are sent to finishing. These casting units are electric and therefore have to emissions associated with them.

### **Cast Target Reconditioning**

Used rotatable Tin and Indium alloy sputtering targets are returned by customers for reconditioning and recasting. The targets are heated with a handheld propane burner (CAST-02) until the alloy is soft enough to remove by scraping it off with hand tools. The recovered alloy is recycled internally or sent off-site for refining, depending upon quality.

### **Finishing Process**

The finishing process includes the machining and polishing of purchased, cast and sprayed sputter targets and tubes. Alloy targets that need to be machined are done so on lathes (LT-14 and LT-15) and a mill (MLL-09), with metal chips collected for disposal and isopropanol used as a coolant/lubricant. These targets are then polished with Scotch-Brite pads while on the lathes, without coolant.

### 3. EMISSION CALCULATIONS

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This permit application includes the addition of a new thermal sprayer (unit PS-07) and dust collector (DC-06) that are assumed to have the same emissions as the existing thermal sprayer (unit PS-01). All other equipment previously permitted in ATC Permit 1962-M1 will remain unchanged. The methodology for calculating the emissions from each unit is listed below.

#### EMISSION CALCULATION DESCRIPTIONS

##### **Units AG1 and AG2 – Natural Gas-Fired Melting Furnaces**

The emissions from the natural gas-fired melting furnaces (AG1, AG2) are typical for external combustion units including NO<sub>x</sub>, CO, VOC, SO<sub>2</sub>, particulate matter, and HAPs. Emission factors from AP-42 Tables 1.4-1 and 1.4-2 were used to calculate emissions from these units. Total HAPs were calculated using GRI-HAPCalc 3.01. A heat rate of 1 MMBtu/hr was used as a conservative measure. It was assumed that TSP = PM<sub>10</sub> = PM<sub>2.5</sub>. These units are controlled by baghouse BH-1 which operates at 99.9% control efficiency. As a conservative measure, the uncontrolled emission rate is the requested emission rate.

##### **Units IF1 and IF2 – Electric Induction Furnaces**

Metals are melted in the electric induction furnaces (IF1 or backup unit IF2) under a natural gas atmosphere to maintain a low oxygen environment. The emissions from this process are calculated assuming that the natural gas used to create the low-oxygen atmosphere during the melt is completely combusted. Emission factors from AP-42 Tables 1.4-1 and 1.4-2 were used to calculate emissions from this unit. Total HAPs were calculated using GRI-HAPCalc 3.01. These units are controlled by baghouse BH-1 which operates at 99.9% control efficiency. As a conservative measure, the uncontrolled emission rate is the requested emission rate.

##### **Unit CC3 – Electric Continuous Casting Furnace**

Unit CC3 is not a source of CO, VOC nor SO<sub>2</sub> emissions by virtue of being electrically powered. During typical operation, melting is performed without the use of fluxes or other additives that would result in NO<sub>x</sub> or particulate emissions. Melting is performed under a nitrogen atmosphere but there are no emissions of NO<sub>x</sub> associated with this.

Some silver/zinc alloys may be produced in the continuous casting furnace which would result in particulate emissions. Particulate emissions from zinc usage in Unit CC3 were calculated based on 500 pounds of zinc used per year. An emission factor from AP-42 Table 12.9-2 for brass, a zinc-containing alloy, was used. This is a good proxy for silver alloyed with zinc. It was assumed that TSP = PM<sub>10</sub> = PM<sub>2.5</sub>. The fugitive component of the emission factor was added as a conservative measure; there will not be fugitive emissions associated with operation at the North facility. This unit is controlled by baghouse BH-1 which operates at 99.9% control efficiency. As a conservative measure, the uncontrolled emission rate is the requested emission rate.

##### **Unit A1 – Natural Gas-Fired Belt Annealing Furnace**

The emissions from the natural gas-fired belt annealing furnace (A1) are typical for an external combustion unit including NO<sub>x</sub>, CO, VOC, SO<sub>2</sub>, particulate matter, and HAPs. Emission factors from AP-42 Tables 1.4-1 and 1.4-2 were used to calculate emissions from these units. Total HAPs were calculated using GRI-HAPCalc 3.01. It was assumed that TSP = PM<sub>10</sub> = PM<sub>2.5</sub>.

### **Unit EG1 – Emergency Generator**

The emergency generator is permitted to operate for a maximum of 200 hours per year. Emissions of NO<sub>x</sub>, CO, and VOC were calculated using typical manufacturer's data provided by Baldor. Emission factors from AP-42 Table 3.2-3 were used to calculate emissions of SO<sub>2</sub> and particulates. It was assumed that TSP = PM<sub>10</sub> = PM<sub>2.5</sub>. Total HAPs was calculated using GRI-HAPCalc 3.01. Controlled annual emissions are based on 200 hours of operation per year.

### **Unit FUM-05 – Tube Recycling Equipment**

Emissions for NO<sub>x</sub>, CO, VOC, SO<sub>2</sub>, and TSP are based on the emission factors from AP-42 Section 1.5, Table 1.5-1 for LPG combustion. It was conservatively assumed that the TSP emissions were equal to PM<sub>10</sub> and PM<sub>2.5</sub> emissions. The SO<sub>2</sub> emissions were based on 5 grains of Sulfur per 100 scf from pipeline quality gas. The emissions from Indium and Tin were calculated using a material balance of the incoming material and the material post-processing. All emissions were based on 8,760 hours of operation.

### **Unit PS-02 – Tube Polishing Equipment**

Emissions from tube polishing equipment were calculated using material balance of the incoming material and the outgoing post-process material. There are no combustion emissions associated with these units. It was conservatively assumed that the TSP emissions were equal to PM<sub>10</sub> and PM<sub>2.5</sub> emissions. All emissions were based on 8,760 hours of operation.

### **Unit FS-01 – Form Spray Equipment**

Emissions from form spray equipment were calculated using material balance of the incoming material and the outgoing post-process material. There are no combustion emissions associated with these units. It was conservatively assumed that the TSP emissions were equal to PM<sub>10</sub> and PM<sub>2.5</sub> emissions. PM emissions from this unit are controlled with a dust collector. All emissions were based on 8,760 hours of operation.

### **Unit PS-05 – Strip**

Emissions for NO<sub>x</sub>, CO, VOC, SO<sub>2</sub>, and TSP are based on the emission factors from AP-42 Section 1.5, Table 1.5-1 for LPG combustion. It was conservatively assumed that the TSP emissions were equal to PM<sub>10</sub> and PM<sub>2.5</sub> emissions. The SO<sub>2</sub> emissions were based on 5 grains of Sulfur per 100 scf from pipeline quality gas. PM emissions from this unit are controlled with a dust collector. All emissions were based on 8,760 hours of operation.

### **Units PS-03, PS-04, and PS-06 – Strip, Grit Blast, and Bond Coat**

Emissions from strip, grit blast, and bond coat were calculated using material balance of the incoming material and the outgoing post-process material. There are no combustion emissions associated with these units. It was conservatively assumed that the TSP emissions were equal to PM<sub>10</sub> and PM<sub>2.5</sub> emissions. All emissions were based on 8,760 hours of operation. Since a Nickel product is being processed by these units, there will be emissions of HAPs. PM emissions from this unit are controlled with a dust collector. These emissions are being calculated using a material balance of the products containing Nickel.

### **Units PS-01 & PS-07 – Thermal Spray Equipment**

Emissions from thermal spray equipment were calculated using material balance of the incoming material and the outgoing post-process material. There are no combustion emissions associated with these units. It was conservatively assumed that the TSP emissions were equal to PM<sub>10</sub> and PM<sub>2.5</sub> emissions. PM emissions from this unit are controlled with dust collectors. All emissions were based on 8,760 hours of operation.



Emissions Summary

Uncontrolled Emissions																
Unit	NO <sub>x</sub>		CO		VOC		SO <sub>2</sub>		TSP		PM <sub>10</sub>		PM <sub>2.5</sub>		TOTAL HAP	
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
CC3	-	-	-	-	-	-	-	-	5.71E-04	0.0025	5.71E-04	0.0025	5.71E-04	0.0025	-	-
A1	0.39	1.71	0.33	1.43	0.021	0.094	0.0023	0.010	0.030	0.13	0.030	0.13	0.030	0.13	0.010	0.045
IF1/IF2	0.0075	0.033	0.0063	0.028	4.13E-04	0.0018	4.50E-05	1.97E-04	5.70E-04	0.0025	5.70E-04	0.0025	5.70E-04	0.0025	0.0026	0.011
EG1	1.38	0.14	22.04	2.20	0.53	0.053	5.95E-04	5.95E-05	0.020	0.0020	0.020	0.0020	0.020	0.0020	0.074	0.01
AG1	0.025	0.11	0.021	0.092	0.0014	0.0060	1.50E-04	6.57E-04	0.0019	0.0083	0.0019	0.0083	0.0019	0.0083	6.39E-04	0.0028
AG2	0.025	0.11	0.021	0.092	0.0014	0.0060	1.50E-04	6.57E-04	0.0019	0.0083	0.0019	0.0083	0.0019	0.0083	6.39E-04	0.0028
FUM-05	7.07E-04	0.0031	4.08E-04	0.0018	5.44E-05	2.38E-04	2.72E-05	1.19E-04	0.0018	0.0077	0.0018	0.0077	0.0018	0.0077	0.014	0.063
PS-02	-	-	-	-	-	-	-	-	0.049	0.22	0.049	0.22	0.049	0.22	0.0023	0.010
FS-01	-	-	-	-	-	-	-	-	0.77	3.38	0.77	3.38	0.77	3.38	-	-
PS-05	0.0016	0.0070	9.17E-04	0.0040	1.22E-04	5.36E-04	6.12E-05	2.68E-04	0.17	0.75	0.17	0.75	0.17	0.75	0.014	0.063
PS-03, PS-04, PS-06	-	-	-	-	-	-	-	-	11.4840	50.300	11.4840	50.300	11.4840	50.300	3.25E-04	0.0014
PS-01	-	-	-	-	-	-	-	-	0.0098	0.043	0.0098	0.043	0.0098	0.043	3.49E-04	0.0015
PS-07	-	-	-	-	-	-	-	-	0.0098	0.043	0.0098	0.043	0.0098	0.043	3.49E-04	0.0015
<b>Total</b>	<b>1.83</b>	<b>2.11</b>	<b>22.42</b>	<b>3.86</b>	<b>0.55</b>	<b>0.16</b>	<b>0.0034</b>	<b>0.012</b>	<b>12.55</b>	<b>54.89</b>	<b>12.55</b>	<b>54.89</b>	<b>12.55</b>	<b>54.89</b>	<b>0.12</b>	<b>0.21</b>

Controlled Emissions																
Unit	NO <sub>x</sub>		CO		VOC		SO <sub>2</sub>		TSP		PM <sub>10</sub>		PM <sub>2.5</sub>		TOTAL HAP	
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
CC3	-	-	-	-	-	-	-	-	5.71E-07	2.50E-06	5.71E-07	2.50E-06	5.71E-07	2.50E-06	-	-
A1	0.39	1.71	0.33	1.43	0.021	0.094	0.0023	0.010	0.030	0.13	0.030	0.13	0.030	0.13	0.010	0.045
IF1/IF2	0.0075	0.033	0.0063	0.028	4.13E-04	0.0018	4.50E-05	1.97E-04	5.70E-04	0.0025	5.70E-04	0.0025	5.70E-04	0.0025	0.0026	0.011
EG1	1.38	0.14	22.04	2.20	0.53	0.053	5.95E-04	6.0E-05	0.020	0.0020	0.020	0.0020	0.020	0.0020	0.074	0.01
AG1	0.025	0.11	0.021	0.092	0.0014	0.0060	1.50E-04	6.57E-04	0.0019	0.0083	0.0019	0.0083	0.0019	0.0083	6.39E-04	0.0028
AG2	0.025	0.11	0.021	0.092	0.0014	0.0060	1.50E-04	6.57E-04	0.0019	0.0083	0.0019	0.0083	0.0019	0.0083	6.39E-04	0.0028
FUM-05	7.07E-04	0.0031	4.08E-04	0.0018	5.44E-05	2.38E-04	2.7E-05	1.2E-04	0.0018	0.0077	0.0018	0.0077	0.0018	0.0077	0.014	0.063
PS-02	-	-	-	-	-	-	-	-	2.47E-05	1.08E-04	2.47E-05	1.08E-04	2.47E-05	1.08E-04	1.15E-06	5.05E-06
FS-01	-	-	-	-	-	-	-	-	7.71E-05	3.38E-04	7.71E-05	3.38E-04	7.71E-05	3.38E-04	-	-
PS-05	0.0016	0.0070	9.17E-04	0.0040	1.22E-04	5.36E-04	6.12E-05	2.68E-04	8.56E-05	3.75E-04	8.56E-05	3.75E-04	8.56E-05	3.75E-04	0.014	0.063
PS-03, PS-04, PS-06	-	-	-	-	-	-	-	-	0.0057	0.025	0.0057	0.025	0.0057	0.025	1.63E-07	0.0000
PS-01	-	-	-	-	-	-	-	-	0.0098	0.043	0.0098	0.043	0.0098	0.043	3.49E-04	0.0015
PS-07	-	-	-	-	-	-	-	-	0.0098	0.043	0.0098	0.043	0.0098	0.043	3.49E-04	0.0015
<b>Total</b>	<b>1.83</b>	<b>2.11</b>	<b>22.42</b>	<b>3.86</b>	<b>0.55</b>	<b>0.16</b>	<b>0.0034</b>	<b>0.012</b>	<b>0.081</b>	<b>0.27</b>	<b>0.081</b>	<b>0.27</b>	<b>0.081</b>	<b>0.27</b>	<b>0.12</b>	<b>0.20</b>



## Electrical Induction Casting Furnace

Emission Point: BH1  
 Process Units: CC3  
 Unit Type: Electrical Induction Casting Furnaces

**Inputs:**

Emission Factor<sup>1</sup>: 20 lb/ton  
 Zinc Usage: 500 lb/yr  
 Control Efficiency<sup>2</sup>: 99.9%

	PM <sup>3</sup>	Units	Notes
Uncontrolled Emissions	0.0025	tpy	Emission Factor (lb/ton) * Zinc Usage lb/yr / 2000 lb/ton
	5.71E-04	lb/hr	Annual Emissions (tpy) / 8760 hr/yr * 2000 lb/ton
Controlled Emissions	2.50E-06	tpy	Uncontrolled Annual Emissions (tpy) * (1 - Control Efficiency)
	5.71E-07	lb/hr	Uncontrolled Hourly Emissions (tpy) * (1 - Control Efficiency)

**Notes:**

- 1 AP-42 Table 12.9-2: Uncontrolled PM emission factor for electric induction furnaces for Brass and Copper (SCC 3-04-002-24) This emission factor was used since brass is a zinc containing alloy.
- 2 A nominal baghouse control efficiency of 99.9 % is assumed.
- 3 TSP, PM<sub>10</sub> and PM<sub>2.5</sub> are all assumed to be PM (Total) as a conservative measure. Particulates are emitted only when silver is alloyed with zinc. (See Section 2, Silver Products)

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## Belt Annealing Furnace

Emission Point: A1  
Unit Type: Natural Gas-Fired Belt Annealing Furnace

### Inputs:

Rated Capacity 3,900 MBtu/hr  
Fuel Heat Value 1,000 Btu/scf  
Hours of Operation 8,760 hr/yr

	NO <sub>x</sub>	CO	VOC	SO <sub>2</sub>	PM <sup>1</sup>	HAP <sup>2</sup>	Units	Notes
Emission Factors	100	84	5.5	0.6	7.6	-	lb/MMscf	AP-42 Tables 1.4-1 & 2
Hourly Emissions	0.39	0.33	0.021	0.0023	0.030	0.010	lb/hr	Annual Emissions * 8760 hr/yr * 2000 lb/ton
Annual Emissions	1.71	1.43	0.094	0.010	0.13	0.045	tpy	Rating * 1/hhv * Hrs * EF * 1 ton / 2000 lb

### Notes:

- 1 TSP, PM<sub>10</sub> and PM<sub>2.5</sub> are assumed to be PM (Total) as a conservative measure.
- 2 Total HAP from GRI HAPCalc 3.01.



## Induction Furnace

Process Unit: IF1 or IF2 (backup)

Unit Type: Induction Furnace

### Inputs:

Fuel Heat Rate: 75 Mbtu/hr

Fuel Heat Value: 1000 Btu/scf

Total Fuel Usage: 75 scf/hr

7.5E-05 MMscf/hr

Annual Fuel Usage: 0.66 MMscf/yr

Hours of Operation: 8,760 hours

### Notes:

Heat Rate (MBtu/hr) \* 1000 / Heat Value (Btu/scf)

Fuel Usage (MMscf/hr) \* 8760 hr/yr

	NO <sub>x</sub>	CO	VOC	SO <sub>2</sub>	PM <sup>1</sup>	HAPs <sup>2</sup>	Units	Notes
Emission Factors	100	84	5.5	0.6	7.6		lb/MMscf	AP-42 Table 1.4-1 & 2
Hourly Emissions	0.0075	0.0063	4.1E-04	4.5E-05	5.7E-04	0.0026	lb/hr	EF (lb/MMscf) * Fuel Usage (MMscf/hr)
Annual Emissions	0.033	0.028	0.0018	1.97E-04	0.0025	0.011	tpy	Hourly Emissions (lb/hr) * 8760 hr/yr / 2000 (lb/ton)

### Notes:

1 TSP, PM10 and PM2.5 are assumed to be PM (Total), as a conservative measure.

2 Total HAPs calculated using GRI-HAPCalc 3.01 using 1 MMBtu/hr as a conservative approach.



## Emergency Generator

Emission Unit: EG1  
 Source Description: Natural Gas Emergency Generator

### Engine Rating

150 hp Baldor Specifications  
 112 kW Baldor Specifications

### Fuel Consumption

Hours of Operation: 200 hr/yr  
 Fuel Heat Value: 1000 Btu/scf  
 Heat input: 1.012 MMBtu/hr  
 Annual Fuel Usage: 0.20 MMscf/yr

### Emission Calculations

	NO <sub>x</sub>	CO	VOC	SO <sub>2</sub>	PM <sup>1</sup>	HAP <sup>3</sup>	Units	Notes
Emission Factors				0.000588	0.01941		lb/MMBtu	AP-42 Table 3.2-3 (7/00)
	624	10000	240				g/hr	Manufacturer Data <sup>2</sup>
Hourly Emissions	<b>1.38</b>	<b>22.04</b>	<b>0.53</b>	<b>5.95E-04</b>	<b>0.020</b>	<b>0.074</b>	lb/hr	
Annual Emissions	<b>0.14</b>	<b>2.20</b>	<b>0.053</b>	<b>5.95E-05</b>	<b>0.0020</b>	<b>0.0074</b>	tpy	

**Notes:**

- <sup>1</sup> TSP, PM<sub>10</sub> and PM<sub>2.5</sub> are assumed to be PM (Total), as a conservative measure.
- <sup>2</sup> Provided by Baldor; Conservatively calculated using the maximum value of ranges reported.
- <sup>3</sup> Total HAPs from GRI HAPCalc 3.01



## Melting Furnaces

Emission Points: AG1, AG2  
 Unit Type: Natural Gas-Fired Melting Furnaces

### Inputs

Fuel Heating Rate: 250 MBtu/hr  
 Hours of Operation: 8760 hr/yr  
 Fuel Heat Value: 1000 Btu/scf

	NO <sub>x</sub>	CO	VOC	SO <sub>2</sub>	TSP <sup>1</sup>	HAP <sup>2</sup>	Units	Notes
Emissions Factors	100	84	5.5	0.6	7.6		lb/MMscf	AP-42 Table 1.4-1 & 2
Hourly Emissions	0.025	0.021	0.0014	0.00015	0.0019	6.39E-04	lb/hr	Heating Rate (Mbtu/hr) / Heat Value (Btu/scf) * EF (lb/ MMscf)
Annual Emissions	0.11	0.092	0.0060	0.00066	0.0083	0.0028	tpy	Hourly Emissions (lb/hr) * Hours of Operation (hr) / 2000 (lb/ton)

### Notes:

- 1 TSP, PM<sub>10</sub> and PM<sub>2.5</sub> are assumed to be PM (Total), as a conservative measure.
- 2 Total HAP emissions are reference from GRI HAPCalc 3.01.



## Form Spray Equipment

Emission Point: DC-11  
 Process Units: FS-01  
 Unit Type: Form Spray Equipment

Dust Collector Control Efficiency: 99.99%

Material	Total <sup>1</sup> (lb/yr)	Material Component	Component Mass percent (%)	Incoming Material (lb/yr)	Sprayed Target Product (lb/yr)	Deposited in Chamber (lb/yr)	Exhaust from DC-11 (lb/yr) <sup>3</sup>	Captured Solids (lb/yr)
ZnSn <sup>1</sup>	114,388	Zn	52%	59,481.76	47,585.20	10,706.80	0.12	1189.2
		Sn	48%	54,906.24	43,924.80	9,883.20	0.11	1097.8
ZnSnSb <sup>2</sup>	38,129	Zn	50%	19,064.50	15,251.50	3,431.50	0.038	3431.5
		Sn	48%	18,301.92	14,641.44	3,294.24	0.037	3294.2
		Sb	2%	762.58	610.06	137.26	0.0015	137.3
In	92,568	In	100%	92,568.00	74,054.00	16,662.00	0.19	1850.0
Sn	92,568	Sn	100%	92,568.00	74,054.00	16,662.00	0.19	1850.0
Argon	5,719	Argon	100%	5,719.00	-	-	5719.00	-
MAPP Gas	88.1	MAPP Gas	100%	88.13	-	-	88.13	-

	Uncontrolled Emissions							
	Ar	Zn	Sn	Sb	In	CO <sub>2</sub>	Total PM <sup>4</sup>	Units
Hourly Emissions	6.5E-01	1.8E-01	3.8E-01	1.7E-03	2.1E-01	1.0E-02	7.7E-01	lb/hr
Annual Emissions	2.9E+00	7.9E-01	1.7E+00	7.6E-03	9.3E-01	4.4E-02	3.4E+00	tons

	Controlled Emissions							
	Ar	Zn	Sn	Sb	In	CO <sub>2</sub>	Total PM <sup>4</sup>	Units
Hourly Emissions	6.5E-01	1.8E-05	3.8E-05	1.7E-07	2.1E-05	1.0E-02	7.7E-05	lb/hr
Annual Emissions	2.9E+00	7.9E-05	1.7E-04	7.6E-07	9.3E-05	4.4E-02	3.4E-04	tons

**Notes:**

- 1 Material usages are based on material purchases at other like-kine Materion Facilities.
- 2 Based on chemical compositions provided by Materion ZnSn is 52% Zn and 48% Sn.
- 3 Based on chemical compositions provided by Materion ZnSnSb is 50% Zn, 48% Sn, 2% Sb.
- 4 Emissions are routed to Dust Collector DC-11 which has a control efficiency of 99.99%.
- 5 TSP, PM<sub>10</sub> and PM<sub>2.5</sub> are assumed to be PM (Total), as a conservative measure.



## Thermal Spray Equipment

Emission Point: DC-05 & DC-06  
 Process Units: PS-01 & PS-07  
 Unit Type: Thermal Spray Equipment

### Materials Processed<sup>1</sup>

Incoming Material			Sprayed Target Material (Product)			Captured Solid Material (Solid Waste)		
SiAl	123,975	lb/yr	SiAl	53,309	lb/yr	SiAl	70,630	lb/yr
TiO <sub>2</sub>	23,858	lb/yr	TiO <sub>2</sub>	10,259	lb/yr	TiO <sub>2</sub>	13,592	lb/yr
SiB	18,315	lb/yr	SiB	7,876	lb/yr	SiB	10,434	lb/yr
NiW <sup>2</sup>	21,291	lb/yr	NiW <sup>2</sup>	9,155	lb/yr	NiW <sup>2</sup>	12,130	lb/yr
W	36,068	lb/yr	W	15,509	lb/yr	W	20,549	lb/yr
Zn	64,798	lb/yr	Zn	27,863	lb/yr	Zn	36,916	lb/yr
Ar	22,351	lb/yr	Ar	0	lb/yr	Ar	0	lb/yr

### Emission Rates per Unit<sup>3,4,5</sup>

	SiAl	TiO <sub>2</sub>	SiB	Ni	W	Zn	Ar	Total PM <sup>5</sup>	Units
Hourly Emissions	4.1E-03	8.0E-04	5.7E-04	3.5E-04	1.8E-03	2.2E-03	2.6E+00	9.8E-03	lb/hr
Annual Emissions	1.8E-02	3.5E-03	2.5E-03	1.5E-03	8.0E-03	9.5E-03	1.1E+01	4.3E-02	tons/yr

#### Notes:

- 1 Estimated material usages were provided by Materion based on existing operations at other facilities outside of NM.
- 2 Based on chemical compositions provided by Materion NiW is 51% Ni and 49% W.
- 3 Emission rates were determined by comparing the incoming materials to the materials collected after diamond belt polishing and the dust collector.
- 4 PS-01 and PS-07 emissions are routed to Dust Collectors DC-05 and DC-06.
- 5 TSP, PM<sub>10</sub> and PM<sub>2.5</sub> are assumed to be PM (Total), as a conservative measure.



### Tube Polishing Equipment

Emission Point: DC-02  
 Process Unit: PS-02  
 Unit Type: Tube Polishing Equipment

Diamond Belt  
 Polisher Dust 0.50%  
 Machining Chips 10.0%  
 Dust Collector  
 Control Efficiency 99.95%

	Material	Total Usage (lb/yr)	Material Component	% of Material	Incoming Material (lb/yr)	Chips (lb/yr)	Lathe Dust
Soft Alloys	ZnSn	91,510	Zn	90%	82,359.00	8,235.90	41.2
			Sn	10%	9,151.00	915.10	4.6
	ZnSnSb	30,503	Zn	90%	27,452.70	2,745.27	13.7
			Sn	8%	2,440.24	244.02	1.2
			Sb	2%	610.06	61.01	0.3
	In	74,054	In	100%	74,054.00	7,405.40	37.0
	Sn	160,010	Sn	100%	160,010.00	16,001.00	80.0
	InSn	57,304	In	90%	51,573.60	5,157.36	25.8
			Sn	10%	5,730.40	573.04	2.9
	Zn	27,863	Zn	100%	27,863.00	2,786.30	13.9
ZnAl	99,180	Zn	98%	97,196.40	9,719.64	48.6	
		Al	2%	1,983.60	198.36	1.0	

	Material	Total Usage (lb/yr)	Material Component	% of Material	Incoming Material (lb/yr)	Chips (lb/yr)	Diamond Belt Polish (lb/yr)	DC-02 Exhaust (lb/yr)	Captured Dust (lb/hr)
Hard Alloys	SiAl	53,309	SiAl	100%	53,309.00	5,330.90	239.89	0.120	239.77
			TiO2	100%	10,259.00	1,025.90	46.17	0.023	46.14
	SiB	7,876	SiB	100%	7,876.00	787.60	35.44	0.018	35.42
	NiW	9,155	Ni	49%	4,485.95	448.60	20.19	0.010	20.18
			W	51%	4,669.05	466.91	21.01	0.011	21.00
	W	15,509	W	100%	15,509.00	1,550.90	69.79	0.035	69.76

Uncontrolled Emissions												
	SiAl	TiO2	SiB	Ni	W	Zn	Sn	In	Sb	Al	Total PM <sup>3</sup>	Units
Hourly Emissions	2.7E-02	5.3E-03	4.0E-03	2.3E-03	1.0E-02	-	-	-	-	-	4.9E-02	lb/hr
Yearly Emissions	1.2E-01	2.3E-02	1.8E-02	1.0E-02	4.5E-02	-	-	-	-	-	2.2E-01	tons/yr

Maximum Emissions <sup>1,2</sup>												
	SiAl	TiO2	SiB	Ni	W	Zn	Sn	In	Sb	Al	Total PM <sup>3</sup>	Units
Hourly Emissions	1.4E-05	2.6E-06	2.0E-06	1.2E-06	5.2E-06	-	-	-	-	-	2.5E-05	lb/hr
Yearly Emissions	6.0E-05	1.2E-05	8.9E-06	5.0E-06	2.3E-05	-	-	-	-	-	1.1E-04	tons/yr

**Notes:**

- Unit PS-02 accounts for emissions from hard alloys.
- All emissions are routed to a dust collector (Unit DC-02), which has a control efficiency of 99.95%.
- TSP, PM<sub>10</sub> and PM<sub>2.5</sub> are assumed to be PM (Total), as a conservative measure.



TMD Strip, Grit Blast, and Bond Coat

Emission Point: DC-01  
 Process Units: PS-03, PS-04, PS-05, PS-06  
 Unit Type: TMD Strip, Grit Blast, and Bond Coat

Material and Fuel Throughputs	
Stripping Tubes	1000 per year
New Tubes	1250 per year
	4500 lb/yr
Total Fuel Usage	1071.4 gal/yr
	0.122 gal/hr
	0.011 MMBtu/hr

Materials Processed <sup>2</sup>	
Al Grit	67,500 lb/yr
NiAl Wire	7,439 lb/yr
Cu Wire	661 lb/yr
SiAl	26,654 lb/yr
Argon	3,719 lb/yr

PS-05 Emission Factors <sup>1</sup>	
NO <sub>x</sub>	13.0 lb/10 <sup>3</sup> gal
CO	7.5 lb/10 <sup>3</sup> gal
VOC	1.0 lb/10 <sup>3</sup> gal
SO <sub>2</sub>	0.50 lb/10 <sup>3</sup> gal
TSP	0.70 lb/10 <sup>3</sup> gal

Materials Recovered from Grit Blast and Stripping	
NiAl <sup>3</sup>	3,719 lb/yr
Cu	331 lb/yr

Dust Collector Control Efficiency <sup>4</sup> :	99.95%
--------------------------------------------------	--------

Captured Dust	
Alumina	67,466 lb/yr
NiAl	3,717 lb/yr
Cu	330 lb/yr
SiAl	26,641 lb/yr

Uncontrolled Emissions										
	Process Units	NO <sub>x</sub>	CO	VOC	SO <sub>2</sub>	PM	Ni	PM <sub>10</sub> <sup>5</sup>	HAPs <sup>6,7</sup>	Units
Hourly Emissions	PS-05	1.6E-03	9.2E-04	1.2E-04	6.1E-05	1.7E-01	-	1.7E-01	1.4E-02	lb/hr
	PS-03, PS-04, PS-06	-	-	-	-	1.1E+01	3.3E-04	1.1E+01	3.3E-04	lb/hr
Annual Emissions	PS-05	7.0E-03	4.0E-03	5.4E-04	2.7E-04	7.5E-01	-	7.5E-01	6.3E-02	ton/yr
	PS-03, PS-04, PS-06	-	-	-	-	5.0E+01	1.4E-03	5.0E+01	1.4E-03	ton/yr

Controlled Emissions										
	Process Units	NO <sub>x</sub>	CO	VOC	SO <sub>2</sub>	PM	Ni	PM <sub>10</sub> <sup>5</sup>	HAPs <sup>6</sup>	Units
Hourly Emissions	PS-05	1.6E-03	9.2E-04	1.2E-04	6.1E-05	8.6E-05	-	8.6E-05	1.4E-02	lb/hr
	PS-03, PS-04, PS-06	-	-	-	-	5.7E-03	1.6E-07	5.7E-03	1.6E-07	lb/hr
Annual Emissions	PS-05	7.0E-03	4.0E-03	5.4E-04	2.7E-04	3.8E-04	-	3.8E-04	6.3E-02	ton/yr
	PS-03, PS-04, PS-06	-	-	-	-	2.5E-02	7.1E-07	2.5E-02	7.1E-07	ton/yr

Notes:

- 1 Emission factors for combustion associated with Unit PS-05 are from AP-42 Section 1.5, Table 1.5-1 for propane.
- 2 Estimated material usages were provided by Materion based on existing operations at other facilities outside of NM.
- 3 Based on chemical compositions provided by Materion NiAl is 95% Ni and 5% Al.
- 4 Emissions from all units are routed to dust collector DC-01
- 5 TSP, PM<sub>10</sub> and PM<sub>2.5</sub> are assumed to be PM (Total), as a conservative measure.
- 6 HAP emissions from PS-05 combustion were calculated using GRI-HAPCalc 3.01.
- 7 HAP emissions from PS-03, PS-04, and PS-06 are from PM emission generated from nickel.



## Tube Recycling Equipment

Process Unit: FUM-05  
 Unit Type: Tube Recycling Equipment

Material and Fuel Usage	
Returned Tubes	500 per year
Raw Material	143,260 lb/yr
Recovered Tin	91,677 lb/yr
Recovered Indium	51,568 lb/yr
Waste Material	15.0 lb/yr
	2,000 lb/yr
Fuel Usage (propane)	476 gal/yr
	0.054 gal/hr
	0.0050 MMBtu/hr

Emission Factors <sup>1</sup>	
NO <sub>x</sub>	13.0 lb/10 <sup>3</sup> gal
CO	7.5 lb/10 <sup>3</sup> gal
VOC	1.0 lb/10 <sup>3</sup> gal
SO <sub>2</sub>	0.50 lb/10 <sup>3</sup> gal
TSP	0.70 lb/10 <sup>3</sup> gal

	Uncontrolled Emissions								Units
	NO <sub>x</sub>	CO	VOC	SO <sub>2</sub> <sup>2</sup>	PM <sup>3</sup>	Indium <sup>4</sup>	Tin <sup>4</sup>	HAPs <sup>5</sup>	
Hourly Emissions	7.1E-04	4.1E-04	5.4E-05	2.7E-05	1.8E-03	6.0E-04	1.1E-03	1.4E-02	lb/hr
Yearly Emissions	0.0031	0.0018	0.00024	0.00012	7.7E-03	2.6E-03	4.9E-03	6.3E-02	tons

	Controlled Emissions								Units
	NO <sub>x</sub>	CO	VOC	SO <sub>2</sub> <sup>2</sup>	TSP <sup>3</sup>	Indium <sup>4</sup>	Tin <sup>4</sup>	HAPs <sup>5</sup>	
Hourly Emissions	7.1E-04	4.1E-04	5.4E-05	2.7E-05	1.8E-03	6.0E-04	1.1E-03	1.4E-02	lb/hr
Yearly Emissions	0.0031	0.0018	0.00024	0.00012	7.7E-03	2.6E-03	4.9E-03	6.3E-02	tons

Notes

- 1 Emission factors for combustion are referenced from AP-42 Section 1.5, Table 1.5-1 for Propane fuel.
- 2 5 grains of Sulfur/ 100 scf is assume for the SO<sub>2</sub> emission factor (EF = 0.1S lb/10<sup>3</sup> gal, where S = 5 gr/100 scf; EF = 0.5 lb/10<sup>3</sup> gal) .
- 3 TSP, PM<sub>10</sub> and PM<sub>2.5</sub> are assumed to be PM (Total), as a conservative measure.
- 4 Based on chemical compositions provided by Materion target tubes are 35% Indium, 65% Tin.
- 5 HAP emissions were calculated using GRI-HAPCalc 3.01.

## 4. APPLICABLE REGULATIONS

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The following discussion addresses applicable regulations, and regulations that may appear to be applicable but are not. All applicable and non-applicable regulations addressed here are included in 20 NMAC 11 and the Code of Federal Regulations, Title 40.

### APPLICABLE NEW MEXICO ADMINISTRATIVE CODE REGULATIONS

The following New Mexico regulations apply:

- 20.11.1 NMAC General Provisions
- 20.11.2 NMAC Permit Fees
- 20.11.5 NMAC Visible Contaminants
- 20.11.41 NMAC Authority to Construct

### APPLICABLE FEDERAL REQUIREMENTS

Applicable federal regulations are discussed here.

- **40 CFR 63 Subpart A – General Provisions**  
This subpart is applicable as 40 CFR 63 Subpart ZZZZ applies.
- **40 CFR 63 Subpart ZZZZ - National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines**  
For purposes of MACT ZZZZ applicability, the unit is considered a new area source as it commenced construction after June 12, 2006. "New" emergency engines as defined in the subpart, must meet the requirements of the New Source Performance Standards under either Subpart IIII or Subpart JJJJ, if applicable. As detailed in the below applicability determination for NSPS JJJJ, the unit is not subject to the requirements of Subpart JJJJ pursuant to 40 CFR 60.5230(a)(4)(iv). Although the unit is subject to MACT ZZZZ, there are no applicable requirements as defined in 40 CFR 63 Subpart ZZZZ or 40 CFR 60 Subpart JJJJ.

### NON-APPLICABLE FEDERAL REQUIREMENTS

Some requirements may appear to apply to this facility when in fact they do not. Non-applicability is discussed here.

- **40 CFR 50 – National Ambient Air Quality Standards**  
40 CFR 50 establishes National Ambient Air Quality Standards but does not directly impose requirements on a specific stationary source and is therefore not applicable.
- **40 CFR 60, Subpart A – General Provisions**  
This subpart is referenced by other NSPSs applicable to the facility and is therefore applicable only in the event that an NSPS is applicable. No NSPSs apply to this facility.
- **40 CFR 60 Subpart JJJJ - Standards of Performance for Stationary Spark Ignition Internal Combustion Engines**  
Although Unit EG1 commenced construction after June 12, 2006, the engine was manufactured before January 1, 2009. Per §60.4230(a)(4)(iv), Unit EG1 is not subject to requirements under Subpart JJJJ. This

subpart does not apply. A record of this applicability determination will be kept on site as required under §63.10(b).

- **40 CFR 61 – National Emissions Standards for Hazardous Air Pollutants (NESHAP)**  
No 40 CFR 61 NESHAPs apply to this facility. In the case of asbestos demolition, Subpart M of 40 CFR 61 may apply.
- **40 CFR 63, Subpart FFFFFFFF – NESHAP for Secondary Copper Smelting Area Sources**  
As defined in 63.11158, “*Secondary copper smelter means a facility that processes copper scrap in a blast furnace and converter or that uses another pyrometallurgical purification process to produce anode copper from copper scrap, including low-grade copper scrap. A facility where recycled copper scrap or copper alloy scrap is melted to produce ingots or for direct use in a manufacturing process is not a secondary copper smelter.*” This facility does not engage in the activities for which Subpart FFFFFFFF applies since the scrap processed by the facility contains negligible amounts of copper.
- **40 CFR 63, Subpart TTTTTT – NESHAP for Secondary Nonferrous Metals Processing Area Sources**  
As defined in 63.11472, “*Secondary nonferrous metals processing facility means a brass and bronze ingot making, secondary magnesium processing, or secondary zinc processing plant that uses furnace melting operations to melt post-consumer nonferrous metal scrap to make products including bars, ingots, blocks, or metal powders.*” This facility does not engage in the activities defined for which Subpart TTTTTT applies since the scrap processed by the facility contains negligible amounts of nonferrous metals as defined above.
- **40 CFR 68 – Accidental Release Prevention Program**  
This regulation does not apply. This regulation arises from section 112 (r) of the Clean Air Act and establishes thresholds based on inventoried quantity of specific substances in process. This facility does not manufacture, process, use, store, or otherwise handle regulated substances in excess of the quantities specified in 40 CFR 68.

Excerpt from Tables 1 and 4 to §68.130— List of Regulated Toxic/Flammable Substances Stored and Used at the Materion North Facility and Threshold Quantities for Applicability of 40 CFR 68.

Chemical name	CAS No.	Maximum Stored on Site (lbs)	Threshold quantity (lbs)
Hydrogen	1333-74-0	56.5	10,000

Notes to Table 1:

1. Nitric acid is used at the North facility but, at maximum 70% concentration, does not meet the applicability requirement of 80% concentration specified in 40 CFR 68.
2. Hydrochloric acid used at the facility is purchased and stored at concentrations less than 37%. As such, limits imposed by 112(r) do not apply. The table entry for HCL is thus for informational purposes only.

## 5. AIR DISPERSION MODELING

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An air dispersion modeling waiver was submitted to the CABQ on January 3, 2020. A modeling waiver was granted for all pollutants on January 10, 2020 via email. This correspondence is attached.

## Jake Zenker

---

**From:** Stonesifer, Jeff W. <JStonesifer@cabq.gov>  
**Sent:** Friday, January 10, 2020 3:24 PM  
**To:** Jake Zenker  
**Cc:** Eyerman, Regan V.; Tavarez, Isreal L.; Mike Celente; Roger Balcerak; Richard R. Vitale; Armando Zarrazola; Paul Muniz  
**Subject:** RE: Materion North Facility - Modeling Waiver

Jake,

The Air Quality Program has reviewed the request for a modeling waiver for the Materion's North Facility permit. We agree with Trinity Consultants that only particulate emissions will be increasing and only very slightly. Modeling does not need to be submitted with this application to modify Materion's permit #1962-M1-1TR.

Regards,



### JEFF STONESIFER

senior environmental health scientist | environmental health department

o 505.767.5624

m 505.250.2689

[cabq.gov/environmentalhealth/](http://cabq.gov/environmentalhealth/)

---

**From:** Jake Zenker <JZenker@trinityconsultants.com>  
**Sent:** Friday, January 3, 2020 12:12 PM  
**To:** Stonesifer, Jeff W. <JStonesifer@cabq.gov>  
**Cc:** Eyerman, Regan V. <reyerman@cabq.gov>; Tavarez, Isreal L. <ITavarez@cabq.gov>; Mike Celente <MCelente@trinityconsultants.com>; Roger Balcerak <Roger.Balcerak@materion.com>; Richard R. Vitale <Richard.Vitale@materion.com>; Armando Zarrazola <Armando.Zarrazola@materion.com>; Paul Muniz <Paul.Muniz@materion.com>  
**Subject:** Materion North Facility - Modeling Waiver

Jeff,

Please review the modeling waiver request for the modification of the Materion North Facility permit, which may be downloaded [here](#). We appreciate your prompt attention to this waiver request.

Please contact me if you have an questions or require any additional information regarding this document.

Best Regards,  
Jake

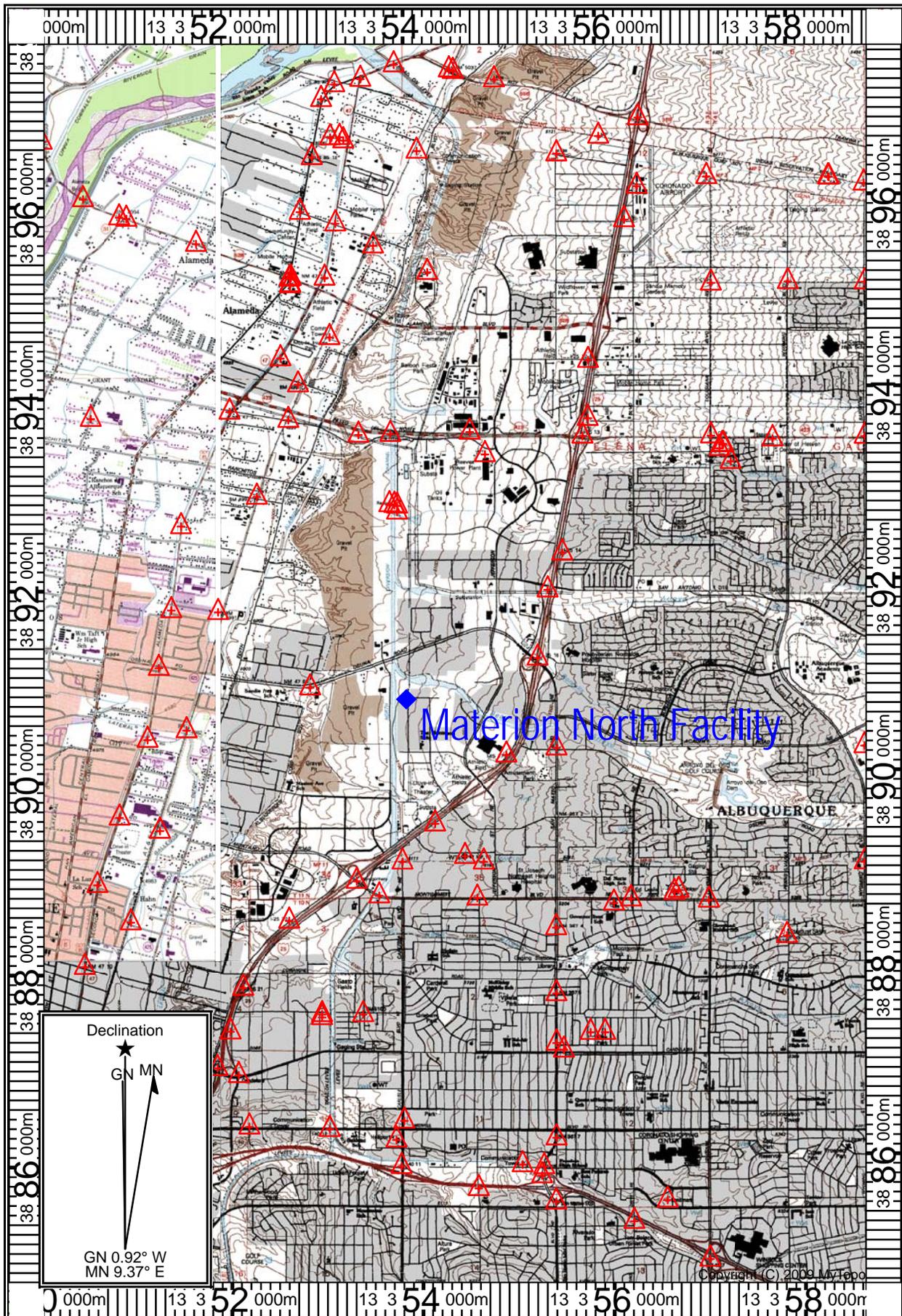
---

**Jake Zenker**

The following figures are attached:

- Map showing the location of the facility
- Plot flow diagrams
  - Silver Strip (Figure 1)
  - Target Products (Figure 2)
  - Process equipment process flow diagram (Figure 3)

# Area Map



Map Name: ALAMEDA  
Print Date: 11/21/16

Scale: 1 inch = 4,761 ft.  
Map Center: 13 0354437 E 38911

Horizontal Datum: WGS84

Chancell Rd NE

N Channel Trail

5941 Midway Park Blvd NE

DC-06

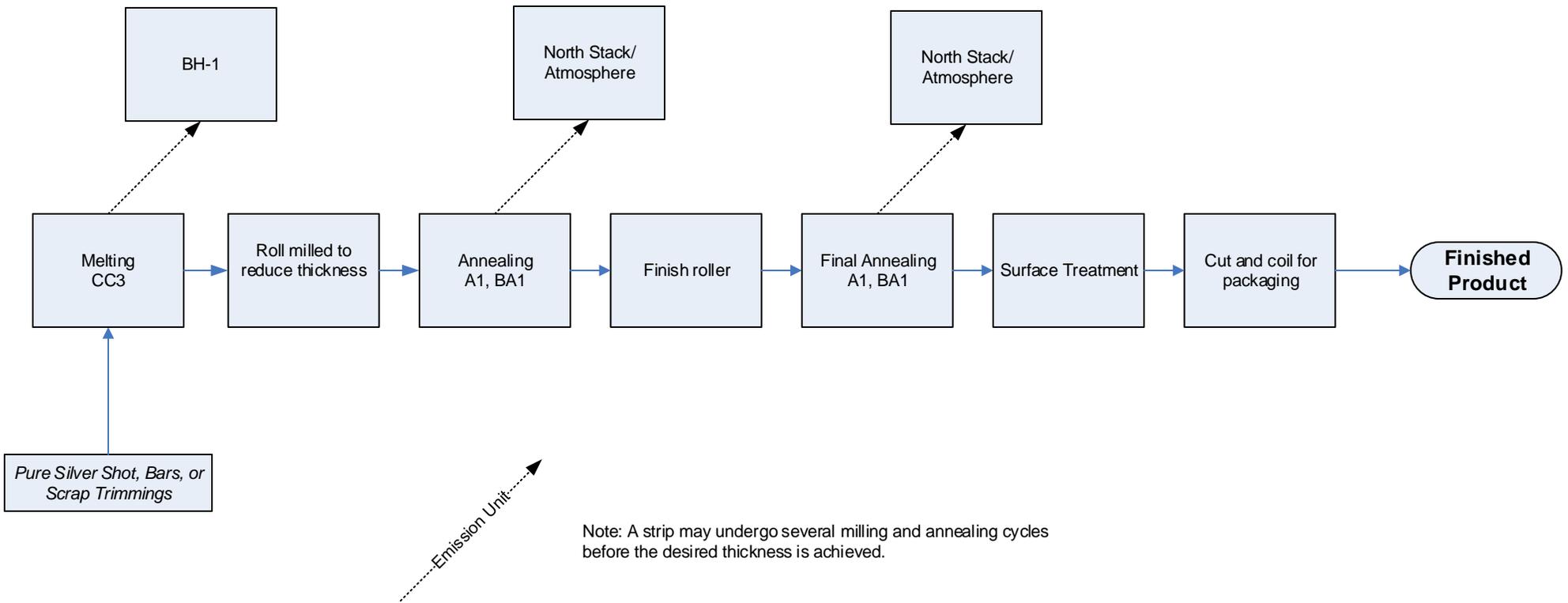
Midway Park Blvd NE

Midway Pl NE

200 ft



# Figure 1 - Metal Strip Process Flow



Note: A strip may undergo several milling and annealing cycles before the desired thickness is achieved.

# Figure 2 - Target Products Process Flow Diagram

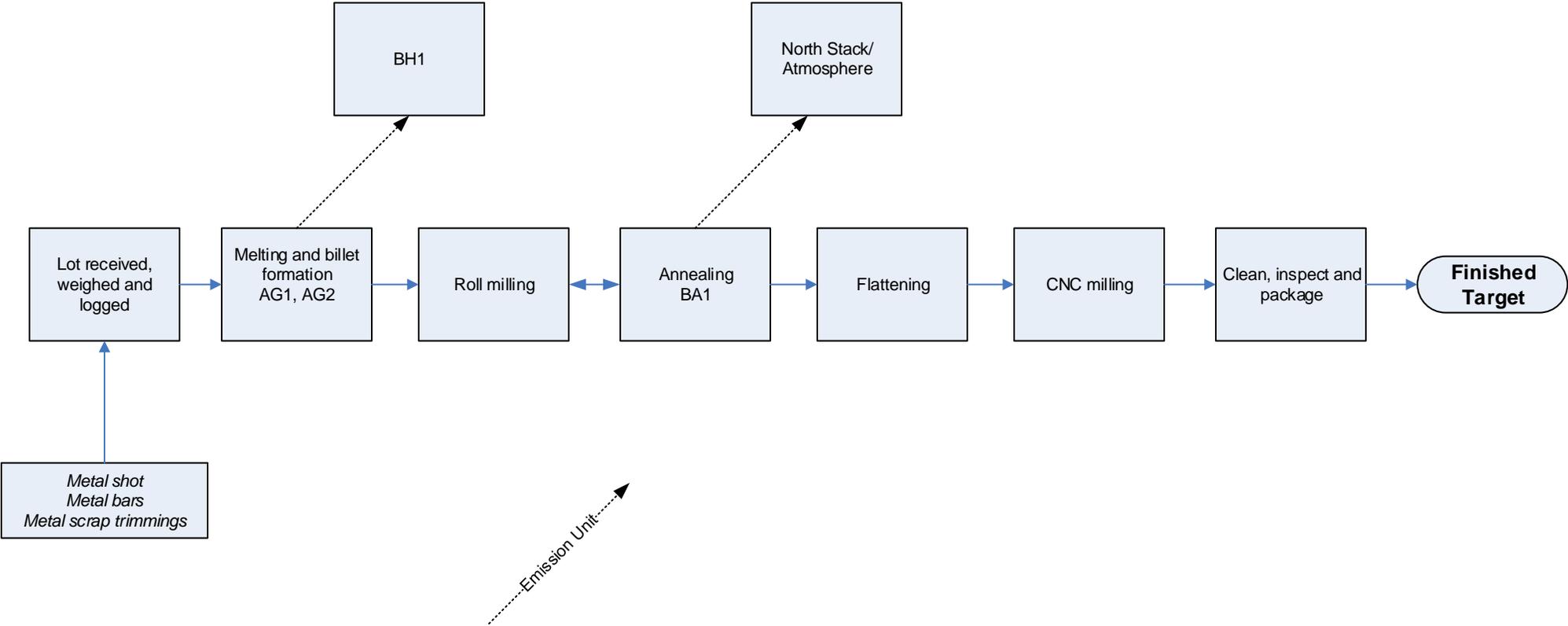


Figure 3 – Process Equipment

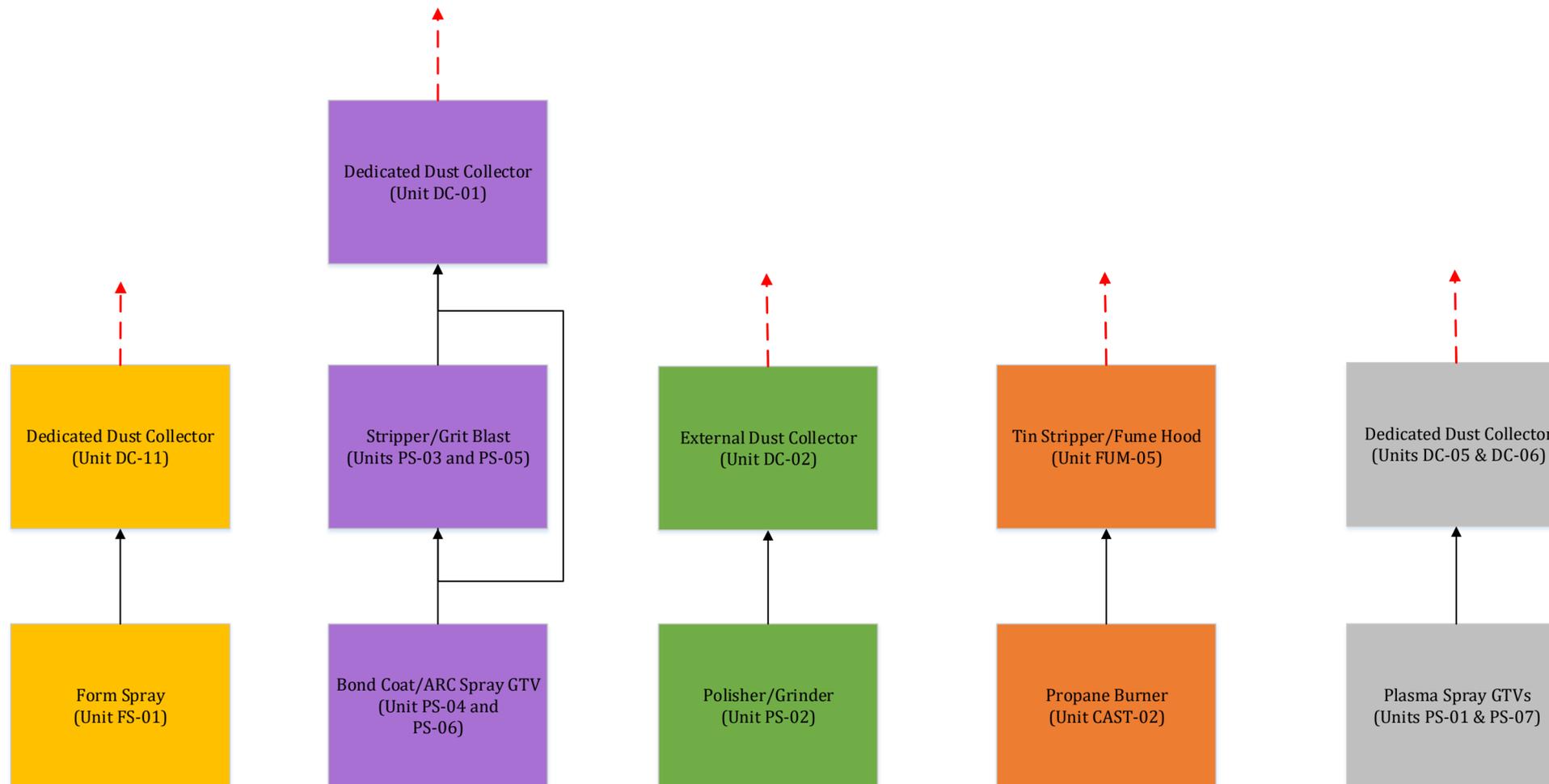


Materion Advanced Materials Technologies and Services Corp.  
North Facility

Equipment Process Flow Legend



Source Air of Emissions



## 7. PERMIT APPLICATION FORMS AND PROOF OF REVIEW FEE PAYMENT

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The following permit application forms are attached:

- Pre-Application Request Form
- Pre-Application Meeting Checklist
- Application Checklist
- Permit Application Long Form
- Permit Application Review Fee Checklist
- Public Notice Checklist
- Notice of Intent to Construct Form

Proof of payment of the permit application review fees is also attached.



# Pre-Permit Application Meeting Request Form

## Air Quality Program- Environmental Health Department

Please complete appropriate boxes and email to [aqd@cabq.gov](mailto:aqd@cabq.gov) or mail to:

Environmental Health Department  
 Air Quality Program  
 P.O. Box 1293  
 Room 3047  
 Albuquerque, NM 87103

<b>Name:</b>	<b>Armando Zarrazola, Paul Muniz, Roger Balcerak (Materion); Jake Zenker (Trinity Consultants)</b>
<b>Company/Organization:</b>	Materion Corporation, North Facility
<b>Point of Contact: (phone number and email): Preferred form of contact (circle one):</b> Phone            E-mail	Phone: (505) 342-5511 (Armando Zarrazola) (505) 266-6611 (Jake Zenker) Email: <a href="mailto:Armando.Zarrazola@materion.com">Armando.Zarrazola@materion.com</a> <a href="mailto:jzenker@trinityconsultants.com">jzenker@trinityconsultants.com</a>
<b>Preferred meeting date/times:</b>	As soon as possible.
<b>Description of Project:</b>	An additional thermal sprayer that will be controlled by a filter. The unit will coat target material with metals, which will generate metallic PM and is expected to generate pollutants and emission rates similar to the thermal sprayer currently installed at the facility (Unit PS-01).

City of Albuquerque- Environmental Health Department  
 Air Quality Program- Permitting Section  
 Phone: (505) 768-1972                      Email: [aqd@cabq.gov](mailto:aqd@cabq.gov)



# City of Albuquerque

## Environmental Health Department

### Air Quality Program



## Pre-Permit Application Meeting Checklist

Any person seeking a permit under 20.11.41 NMAC, Authority-to-Construct Permits, shall do so by filing a written application with the Department. Prior to submitting an application, the applicant shall contact the department in writing and request a pre-application meeting for information regarding the contents of the application and the application process. This checklist is provided to aid the applicant and **a copy must be submitted with the application.**

Applications that are ruled incomplete because of missing information will delay any determination or the issuance of the permit. The Department reserves the right to request additional relevant information prior to ruling the application complete in accordance with 20.11.41 NMAC.

Name: Richard Vitale

Contact: [Richard.Vitale@materion.com](mailto:Richard.Vitale@materion.com)

Company/Business: Materion Corporation – North Facility

- Fill out and submit a Pre-Permit Application Meeting Request form  
⇒ Available online at <http://www.cabq.gov/airquality>
- Emission Factors and Control Efficiencies  
Notes: The purpose of this modification is to add an additional thermal spray that will have identical emissions to the existing unit PS-01.
- Air Dispersion modeling guidelines and protocol  
Notes: Materion, Trinity, and the CABQ discussed the requirements to model 1-hour NO<sub>x</sub> and PM standards. A modeling waiver request was thereafter submitted and granted for all pollutants and standards on 1/10/2020.
- Department Policies  
Notes: Other general department policies were discussed during the meeting.
- Air quality permit fees  
Notes: Permit fees were not discussed directly, the ~~the~~ CABQ confirmed that this permit application would be considered a significant revision. The appropriate fee option is selected in the permit review form, which is accompanied with a check.

Ver. 11/13

City of Albuquerque- Environmental Health Department  
Air Quality Program- Permitting Section  
Phone: (505) 768-1972 Email: [aqd@cabq.gov](mailto:aqd@cabq.gov)

- ☑ Public notice requirements
  - ☑ Replacement Part 41 Implementation
    - ☑ 20.11.41.13 B. Applicant's public notice requirements
      - ☑ Providing public notice to neighborhood association/coalitions  
Notes: Following the pre-application meeting, Regan Eyerman provided neighborhood associations and coalitions that would be contacted on 12/23/2019.
  - ☑ Posting and maintaining a weather-proof sign  
Notes: Materion received water proof signs and posted these at their facility in conspicuous locations.

- ☑ Regulatory timelines
  - 30 days to rule application complete
  - 90 days to issue completed permit
  - Additional time allotted if there is significant public interest and/or a significant air quality issue
    - Public Information Hearing
    - Complex permitting action

Notes: The regulatory timelines were discussed. Materion impressed upon the CABQ the importance of issuing this permit modification in a timely manner.



# City of Albuquerque

## Environmental Health Department

### Air Quality Program



### Permit Application Checklist

Any person seeking a permit under 20.11.41 NMAC, Authority-to-Construct Permits, shall do so by filing a written application with the Department. Prior to ruling a submitted application complete each application submitted shall contain the required items listed below. **This checklist must be returned with the application.**

Applications that are ruled incomplete because of missing information will delay any determination or the issuance of the permit. The Department reserves the right to request additional relevant information prior to ruling the application complete in accordance with 20.11.41 NMAC.

All applicants shall:

1.  Fill out and submit the *Pre-permit Application Meeting Request* form
  - a.  Attach a copy to this application
2.  Attend the pre-permit application meeting
  - a.  Attach a copy of the completed *Pre-permit Application Meeting Checklist* to this application
3.  Provide public notice to the appropriate parties
  - a.  Attach a copy of the completed *Notice of Intent to Construct* form to this form
    - i. Neighborhood Association(s): See attached memo of Neighborhood Associations provided by the City of Albuquerque on 12/23/19
    - ii. Coalition(s): See attached memo of Neighborhood Coalitions provided by the City of Albuquerque on 12/23/19
    - iii.  Attach a copy of the completed *Public Sign Notice Guideline* form
4. Fill out and submit the *Permit Application*. All applications shall:
  - A.  be made on a form provided by the Department. Additional text, tables, calculations or clarifying information may also be attached to the form.
  - B.  at the time of application, include documentary proof that all applicable permit application review fees have been paid as required by 20 NMAC 11.02. Please refer to the attached permit application worksheet.
  - C.  contain the applicant's name, address, and the names and addresses of all other owners or operators of the emission sources.
  - D.  contain the name, address, and phone number of a person to contact regarding questions about the facility.

- E.  indicate the date the application was completed and submitted
- F.  contain the company name, which identifies this particular site.
- G.  contain a written description of the facility and/or modification including all operations affecting air emissions.
- H.  contain the maximum and standard operating schedules for the source after completion of construction or modification in terms of hours per day, days per week, and weeks per year.
- I.  provide sufficient information to describe the quantities and nature of any regulated air contaminant (including any amount of a hazardous air pollutant) that the source will emit during:
  - Normal operation
  - Maximum operation
  - Abnormal emissions from malfunction, start-up and shutdown
- J.  include anticipated operational needs to allow for reasonable operational scenarios to avoid delays from needing additional permitting in the future.
- K.  contain a map, such as a 7.5-minute USGS topographic quadrangle, showing the exact location of the source; and include physical address of the proposed source.
- L.  contain an aerial photograph showing the proposed location of each process equipment unit involved in the proposed construction, modification, relocation, or technical revision of the source except for federal agencies or departments involved in national defense or national security as confirmed and agreed to by the department in writing.
- M.  contain the UTM zone and UTM coordinates.
- N.  include the four-digit Standard Industrialized Code (SIC) and the North American Industrial Classification System (NAICS).
- O.  contain the types and **potential emission rate** amounts of any regulated air contaminants the new source or modification will emit. Complete appropriate sections of the application; attachments can be used to supplement the application, but not replace it.
- P.  contain the types and **controlled** amounts of any regulated air contaminants the new source or modification will emit. Complete appropriate sections of the application; attachments can be used to supplement the application, but not replace it.
- Q.  contain the basis or source for each emission rate (include the manufacturer's specification sheets, AP-42 Section sheets, test data, or other data when used as the source).

- R.  contain all calculations used to estimate **potential emission rate** and **controlled emissions**.
- S.  contain the basis for the estimated control efficiencies and sufficient engineering data for verification of the control equipment operation, including if necessary, design drawings, test reports, and factors which affect the normal operation (e.g. limits to normal operation).
- T.  contain fuel data for each existing and/or proposed piece of fuel burning equipment.
- U.  contain the anticipated maximum production capacity of the entire facility and the requested production capacity after construction and/or modification.
- V.  contain the stack and exhaust gas parameters for all existing and proposed emission stacks.
- W.  provide an ambient impact analysis using a atmospheric dispersion model approved by the US Environmental Protection Agency (EPA), and the Department to demonstrate compliance with the ambient air quality standards for the City of Albuquerque and Bernalillo County (See 20.11.01 NMAC). If you are modifying an existing source, the modeling must include the emissions of the entire source to demonstrate the impact the new or modified source(s) will have on existing plant emissions.
- X.  contain a preliminary operational plan defining the measures to be taken to mitigate source emissions during malfunction, startup, or shutdown.
- Y.  contain a process flow sheet, including a material balance, of all components of the facility that would be involved in routine operations. Indicate all emission points, including fugitive points.
- Z.  contain a full description, including all calculations and the basis for all control efficiencies presented, of the equipment to be used for air pollution control. This shall include a process flow sheet or, if the Department so requires, layout and assembly drawings, design plans, test reports and factors which affect the normal equipment operation, including control and/or process equipment operating limitations.
- AA.  contain description of the equipment or methods proposed by the applicant to be used for emission measurement.
- BB.  be signed under oath or affirmation by a corporate officer, authorized to bind the company into legal agreements, certifying to the best of his or her knowledge the truth of all information submitted.



# Notice of Intent to Construct

Under 20.11.41.13B NMAC, the owner/operator is required to *provide public notice by certified mail or electronic mail to the designated representative(s) of the recognized neighborhood associations and recognized coalitions that are with-in one-half mile of the exterior boundaries of the property on which the source is or is proposed to be located* if they propose to construct or establish a new facility or make modifications to an existing facility that is subject to 20.11.41 NMAC – Construction Permits. **A copy of this form must be included with the application.**

Applicant’s Name and Address: Materion Advanced Materials Technologies and Services Corp. - North, 5941 Midway Park Blvd. NE, Albuquerque, NM 87109

Owner / Operator’s Name and Address: Materion Advanced Materials Technologies and Services Corp., 5941 Midway Park Place NE, Albuquerque, NM 87109

Actual or Estimated Date the Application will be submitted to the Department: January 20, 2020

Exact Location of the Source or Proposed Source: North - 5941 Midway Park Blvd. NE, Albuquerque, NM 87109

Description of the Source: Rolling, drawing, extruding, spraying, machining, annealing and casting of non-ferrous metals.

Nature of the Business: Rolling, drawing, extruding, spraying, machining, annealing and casting of non-ferrous metals.

Process or Change for which the permit is requested: Adding a new thermal sprayer with a dust collector control.

Preliminary Estimate of the Maximum Quantities of each regulated air contaminant the source will emit:

### Previous Construction Permit

Pollutant	Pounds per Hour Emission Rate (lb/hr)	Tons per Year Emission Rate (tpy)
CO	22.4	3.9
NO <sub>x</sub>	1.83	2.11
SO <sub>2</sub>	0.0034	0.012
VOC	0.55	0.16
PM <sub>10</sub>	0.079	0.26
PM <sub>2.5</sub>	0.079	0.26
VHAP	-	-

### Net Changes in Emissions

Pollutant	Pounds per Hour Emission Rate (lb/hr)	Tons per Year Emission Rate (tpy)
CO	-	-
NO <sub>x</sub>	-	-
SO <sub>2</sub>	-	-
VOC	-	-
PM <sub>10</sub>	+0.0016	+0.0095
PM <sub>2.5</sub>	+0.0016	+0.0095
VHAP	-	-

Maximum Operating Schedule: 24 hours/day, 5 days/week, 52 weeks/year.

Normal Operating Schedule: 24 hours/day, 5 days/week, 52 weeks/year.

Ver.11/13

Current Contact Information for Comments and Inquires:

Name: Richard Vitale  
Address: 5941 Midway Park Place NE, Albuquerque, NM 87109  
Phone Number: (505) 342-5518  
E-Mail Address: [Richard.Vitale@materion.com](mailto:Richard.Vitale@materion.com)

If you have any comments about the construction or operation of the above facility, and you want your comments to be made as part of the permit review process, you must submit your comments in writing to the address below:

Environmental Health Manager  
Stationary Source Permitting  
Albuquerque Environmental Health Department  
Air Quality Program  
PO Box 1293  
Albuquerque, New Mexico 87103  
(505) 768-1972

Other comments and questions may be submitted verbally.

Please refer to the company name and facility name, as used in this notice or send a copy of this notice along with your comments, since the Department may not have received the permit application at the time of this notice. Please include a legible mailing address with your comments. Once the Department has performed a preliminary review of the application and its air quality impacts, if required, the Department's notice will be published in the legal section of the Albuquerque Journal and mailed to neighborhood associations and neighborhood coalitions near the facility location or near the facility proposed location.



**Tim Keller,  
Mayor**

**Public Participation**

**List of Neighborhood Associations,  
Neighborhood Coalitions and Interested Parties  
MEMORANDUM**



**Leon Espinoza, Acting  
Director**

**To:** File  
**From:** Regan Eyerman  
 Senior Environmental Health Scientist  
**Subject:** Determination of Neighborhood Associations and Coalitions  
 within 0.5 miles of Materion Advanced Materials North Facility, 5941 Midway Park Blvd NE,  
 Albuquerque, NM 87109; and Interested Parties registered with the Air Quality Program  
**Date:** December 24, 2019

**DETERMINATION:**

On December 23, 2019 I used the City of Albuquerque Zoning Advanced Map Viewer (<http://sharepoint.cabq.gov/gis>) to review which City of Albuquerque (COA) Neighborhood Associations (NAs) and Neighborhood Coalitions (NCs) and which Bernalillo County (BC) NAs and NCs are located within 0.5 miles of Materion Advanced Materials North Facility, 5941 Midway Park Blvd NE, Albuquerque, NM 87109.

I then used the City of Albuquerque Office of Neighborhood Coordination’s Monthly Master NA List dated December 2019 and the Bernalillo County Monthly Neighborhood Association December 2019 Excel file to determine the contact information for each NA and NC located within 0.5 miles of Materion Advanced Materials North Facility, 5941 Midway Park Blvd NE, Albuquerque, NM 87109. Additionally, on December 24, 2019, I checked the Interested Parties Excel Sheet to include the individuals that have requested to be notified of all permitting actions subject to public participation by department through the Air Quality Website.

The table below contains the contact information, which will be used in the applicant’s public notice.

<b>City of Albuquerque and/or BC Association or Coalition, and Interested Parties</b>	<b>Name</b>	<b>Email or Mailing Address</b>
Alameda North Valley NA	Mark Rupert	<a href="mailto:mwr505@hotmail.com">mwr505@hotmail.com</a>
	Steve Wentworth	<a href="mailto:anvanews@aol.com">anvanews@aol.com</a>
District 4 Coalition of HOA	Daniel Regan	<a href="mailto:direganabq@gmail.com">direganabq@gmail.com</a>
	Michael Pridham	<a href="mailto:michael@drpridham.com">michael@drpridham.com</a>
	NA Email	<a href="mailto:sect.dist4@gmail.com">sect.dist4@gmail.com</a>
North Edith Corridor	Evelyn Harris	<a href="mailto:grumpyeh46@comcast.net">grumpyeh46@comcast.net</a>
	Christine Benavidez	<a href="mailto:christinebnvdz@aol.com">christinebnvdz@aol.com</a>
North Valley Coalition	Peggy Norton	<a href="mailto:peggynorton@yahoo.com">peggynorton@yahoo.com</a>
	Doyle Kimbrough	<a href="mailto:newmexmba@aol.com">newmexmba@aol.com</a>
	NA Email	<a href="mailto:nvcabq@gmail.com">nvcabq@gmail.com</a>

Vista Del Norte Alliance	James Souter Janelle Johnson	PO Box 6270, Albuquerque 87197
	NA Email	<a href="mailto:vistadelnorte@me.com">vistadelnorte@me.com</a>
Holly Frontier	Katharine Boyer	<a href="mailto:katharine.boyer@hollyfrontier.com">katharine.boyer@hollyfrontier.com</a>
None	Esther Abeyta	<a href="mailto:sjna1@live.com">sjna1@live.com</a>
None	Steven Abeyta	<a href="mailto:stevenabeyta@gmail.com">stevenabeyta@gmail.com</a>
Acme Environmental, Inc.	Brett Engel	<a href="mailto:acmebrettengel@gmail.com">acmebrettengel@gmail.com</a>
U.S. Fish & Wildlife Service	JenniferOwen-White	<a href="mailto:jennifer_owenwhite@fws.gov">jennifer_owenwhite@fws.gov</a>
Friends of Valle de Oro National Wildlife Refuge	Aryn LaBrake	<a href="mailto:aryn@friendsofvalledeoro.org">aryn@friendsofvalledeoro.org</a>
The University of New Mexico	William Monette	<a href="mailto:wmonette@unm.edu">wmonette@unm.edu</a>

## Jake Zenker

---

**From:** Jake Zenker  
**Sent:** Thursday, January 23, 2020 3:17 PM  
**To:** mwr505@hotmail.com; anvanews@aol.com; dlreganabq@gmail.com; michael@drpridham.com; sect.dist4@gmail.com; grumpyeh46@comcast.net; christinebnvdz@aol.com; peggynorton@yahoo.com; newmexmba@aol.com; nvcabq@gmail.com; vistadelnorte@me.com; katharine.boyer@hollyfrontier.com; sjna1@live.com; stevenabeyta@gmail.com; acmebrettengel@gmail.com; jennifer\_owenwhite@fws.gov; aryn@friendsofvalledeoro.org; wmonette@unm.edu  
**Subject:** 20.11.41 NMAC Required Notice of Intent to Construct  
**Attachments:** Materion North Public Notice.pdf; Materion North\_Public Notice Cover Letter.pdf

Dear Neighborhood Association/Coalition Representative,

The local air quality Construction Permit regulation 20.11.41 NMAC requires that registered representatives of neighborhood associations and coalitions within a half mile of a facility proposing to apply for an air quality permit application be notified in advance of permit application. Therefore, you are receiving the required attached public notice regarding Materion Advanced Materials Technologies and Services Corp. proposed Significant Revision to the ATC Permit 1962-M1-1TR for the North location. This facility is located at 5941 Midway Park NE, Albuquerque, NM 87109.

Please see the attached *Cover Letter* and *Notice of Intent to Construct* form for more information and directions if you might have related comments or questions.

Thanks,

.....  
**Jake Zenker**  
Consultant

### Trinity Consultants

9400 Holly Avenue | Bldg 3 Suite 300 | Albuquerque, NM 87122

Office: **505-266-6611** | Mobile: 484-356-5607

Email: [jzenker@TrinityConsultants.com](mailto:jzenker@TrinityConsultants.com) | Website: [www.TrinityConsultants.com](http://www.TrinityConsultants.com)

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**PROPOSED AIR QUALITY CONSTRUCTION PERMIT**

**Project Name:** [Illegible]  
**Project Address:** [Illegible]  
**Permit Number:** [Illegible]

**Project Description:** [Illegible]

**Permit Conditions:** [Illegible]

Parameter	Standard	Value
PM <sub>10</sub>	0.15	0.15
PM <sub>2.5</sub>	0.075	0.075
O <sub>3</sub>	0.12	0.12
CO	4.0	4.0
SO <sub>2</sub>	0.03	0.03
NO <sub>x</sub>	0.07	0.07

**Permittee:** [Illegible]  
**Issued:** [Illegible]



### PROPOSED AIR QUALITY CONSTRUCTION PERMIT

1. Applicant Name: California Construction Address: 1000 California Blvd, Ste. 100, Irvine, CA 92618  
 Phone or Fax Number: 714-261-1100 E-mail: caconstruction@earthlink.net  
 County: Orange Permit Number: 1000-111-000 Date: 10/10/00

2. Date of Construction: 10/10/00 Project Name: California Construction  
 3. Description of the Project: California Construction  
 4. Location of the Project: California Construction

5. Estimated Emissions of the Project (tons per year) as reported by construction the owner and user

Pollutant	Site Construction Phase		Site Operation & Maintenance	
	Construction	Operation	Construction	Operation
CO	0.15	0.05	0.15	0.05
NOx	0.05	0.05	0.05	0.05
PM10	0.05	0.05	0.05	0.05
PM2.5	0.05	0.05	0.05	0.05
VOC	0.05	0.05	0.05	0.05
SO2	0.05	0.05	0.05	0.05
CH4	0.05	0.05	0.05	0.05

6. Applicant Signature: [Signature]  
 Name: California Construction  
 7. Permit Fee: California Construction

8. Date of Issuance: California Construction  
 9. Permit Number: California Construction

10. Department: California Construction  
 11. Date: California Construction

THIS PERMIT SHALL BE VALID FOR THE DEPARTMENT'S PERIOD OF ACTION ON THE PERMIT APPLICATION.



**Albuquerque Environmental Health Department - Air Quality Program**

Please mail this application to **P.O. Box 1293, Albuquerque, NM 87103**

or hand deliver between 8:00am - 5:00pm Monday - Friday to:

**3rd Floor, Suite 3023 - One Civic Plaza NW, Albuquerque, New Mexico 87103**

**(505) 768 - 1972 aqd@cabq.gov (505) 768 - 1977 (Fax)**



**Application for Air Pollutant Sources in Bernalillo County  
Source Registration (20.11.40 NMAC) and Construction Permits (20.11.41 NMAC)**

**Clearly handwritten or type**

**Corporate Information**

**Submittal Date: 1/24/2020**

1. Company Name: Materion Advanced Materials Technologies and Services Corp.
2. Street Address: 5941 Midway Park NE Zip: 87109
3. Company City: Albuquerque 4. Company State: NM 5. Company Phone: (505) 342-5518 6. Company Fax: N/A
7. Company Mailing Address: 5941 Midway Park Blvd, NE Zip: 87109
8. Company Contact and Title: Richard Vitale – Plant Manager 9. Phone: (505) 342-5518
10. E-mail: Richard.Vitale@materion.com

**Stationary Source (Facility) Information: [Provide a plot plan (legal description/drawing of facility property) with overlay sketch of facility processes; Location of emission points; Pollutant type and distances to property boundaries]**

1. Facility Name: Materion Corporation North 2. Street Address: 5941 Midway Park Blvd N.E., Suite A
3. City: Albuquerque 4. State: NM 5. Facility Phone: (505) 342-5518 6. Facility Fax: N/A
7. Facility Mailing Address (Local): 5941 Midway Park Blvd NE Zip: 87109
8. Latitude - Longitude or UTM Coordinates of Facility: UTM N: 3,890,774 m UTM E: 353,885 m
9. Facility Contact and Title: Richard Vitale – Plant Manager 10. Phone: (505) 342-5518
11. E-mail: Richard.Vitale@materion.com

**General Operation Information (if any further information request does not pertain to your facility, write N/A on the line or in the box)**

1. Facility Type (description of your facility operations): Rolling, drawing, extruding, spraying, machining, annealing and casting of non-ferrous metals
2. Standard Industrial Classification (SIC 4 digit #): 3341
3. North American Industry Classification System (NAICS Code #): 331492
4. Is facility currently operating in Bernalillo County. Yes If yes, date of original construction: 1976  
If no, planned startup is: N/A
5. Is facility permanent: Yes If no, give dates for requested temporary operation - from N/A through N/A
6. Is facility process equipment new: Yes If no, give actual or estimated manufacture or installation dates in the Process Equipment Table.
7. Is application for a modification, expansion, or reconstruction (altering process, or adding, or replacing process equipment, etc.) to an existing facility which will result in a change in emissions Yes. If yes, give the manufacture date of modified, added, or replacement equipment in the Process Equipment Table modification date column, or the operation changes to existing process/equipment which cause an emission increase.

8. Is facility operation (circle one) [Continuous Intermittent  Batch]
9. Estimated % of production Jan-Mar 25% Apr-Jun 25% Jul-Sep 25% Oct-Dec 25%
10. Current or requested operating times of facility: 24 hours/day, 5 days/week, 52 weeks/year.
11. Business hrs: 6 am to 6 pm
12. Will there be special or seasonal operating times other than shown above: No If yes, explain: N/A
13. Raw materials processed: Pure silver (shot, bar, scrap trimmings), alloying metals (copper, tin, nickel, palladium)
14. Saleable item(s) produced: Pure silver and silver alloys in strip, rod, and machined form, recycled targets.
15. Permitting Action Being Requested
- New Permit  Permit Modification  Technical Permit Revision  Administrative Permit Revision
- Current Permit #: 1962-M1-1TR Current Permit #: \_\_\_\_\_ Current Permit #: \_\_\_\_\_

**Application for Air Pollutant Sources in Bernalillo County  
Source Registration (20.11.40 NMAC) and Construction Permits (20.11.41 NMAC)**

**PROCESS EQUIPMENT TABLE**

**(Generator-Crusher-Screen-Conveyor-Boiler-Mixer-Spray Guns-Saws-Sander-Oven-Dryer-Furnace-Incinerator, etc.) Match the Process Equipment Units listed on this Table to the same numbered line if also listed on Emissions & Stack Table (page 6).**

Process Equipment Unit	Manufacturer	Model #	Serial #	Manufacture Date	Installation Date	Modification Date	Size or Process Rate (Hp;kW;Btu;ft <sup>3</sup> ;lbs; tons;yd <sup>3</sup> ;etc.)	Fuel Type
1. AG1 Melting Furnace	Custom-Built (Academy)	N/A	N/A	Unknown	Jan 2013	N/A	250 MBtu/hr	Natural Gas
2. AG2 Melting Furnace	Custom-Built (Academy)	N/A	N/A	Unknown	Jan 2013	N/A	250 MBtu/hr	Natural Gas
3. IF1 Induction Furnace	Inductotherm	Inducto 500	45080-07	Unknown	Jan 2013	N/A	75 MBtu/hr	Electric
4. IF2 Induction Furnace	Inductotherm	Unknown	Unknown	Unknown	2009	N/A	75 MBtu/hr	Electric
5. CC3 Continuous Casting Furnace	Rautomead	RT850	SMH007	2006	2007	N/A	N/A	Electric
6. A1 Belt Annealing Furnace	Drever	DWG 31536-A	J3645.01	1982	2007	N/A	3,900 MBtu/hr	Natural Gas
7. EG1 Emergency Generator	Baldor	IGLC80N-G	P0806100001	2008	2009	N/A	150 hp	Natural Gas
8. FUM-05 Cast Target Reconditioning	Custom	Custom	Custom	2008	Feb 2017	N/A	Approximately 500 tubes/yr	Propane
9. PS-02 Finishing Process	Custom/Baldor	B2-3C	P0103	Unknown	Feb 2017	N/A	Approximately 3300 finished targets/yr	N/A
10. FS-01 Form Spray Process	Custom	Custom	Custom	2012	Feb 2017	N/A	Approximately 800 tubes/yr	N/A
11. PS-05 Strip, Grit Blast, and Bond Coat	Custom	Custom	Custom	Unknown	Feb 2017	N/A	Approximately 1,000 stripping tubes/yr and 1,250 new tubes/yr	Propane
12. PS-03, PS-04, PS-06 Strip, Grit Blast, and Bond Coat	S&H Industries Metallization Ltd. Sulzer Metco	F-300DM Unknown Unknown	40005 Unknown Unknown	2004 Unknown Unknown	Feb 2017	N/A	Approximately 1,000 stripping tubes/yr and 1,250 new tubes/yr	Propane
13. PS-01 Thermal Spray	Lynn	Unknown	Unknown	Unknown	Feb 2017	N/A	Approximately 1,750 tubes/yr	N/A
13. PS-07 Thermal Spray	GTV	Unknown	Unknown	Unknown	TBD	N/A	Approximately 1,750 tubes/yr	N/A

1. Basis for Equipment Size or Process Rate (Manufacturers data, Field Observation/Test, etc.): Manufacturer's data, field observation  
Submit information for each unit as an attachment

**Application for Air Pollutant Sources in Bernalillo County  
Source Registration (20.11.40 NMAC) and Construction Permits (20.11.41 NMAC)**

**TABLE EXEMPTED SOURCES AND EXEMPTED ACTIVITIES**

**(Generator-Crusher-Screen-Conveyor-Boiler-Mixer-Spray Guns-Saws-Sander-Oven-Dryer-Furnace-Incinerator, etc.) Match the Process Equipment Units listed on this Table to the same numbered line if also listed on Emissions & Stack Table (page 6).**

Process Equipment Unit	Manufacturer	Model #	Serial #	Manufacture Date	Installation Date	Modification Date	Size or Process Rate (Hp;kW;Btu;ft <sup>3</sup> ;lbs; tons;yd <sup>3</sup> ;etc.)	Fuel Type
1. BLD-01 Powder Blending	Custom	Custom	Custom	Unknown	Feb 2017	N/A	Approximately 800 tubes/yr	N/A
2. CAST-01 and CAST-05 Vertical Casting	Custom	Custom	Custom	Unknown	Feb 2017	N/A	Approximately 500 tubes/yr	Electric Units
3. CAST-02 Cast Target Reconditioning	Generic	Unknown	Unknown	Unknown	Feb 2017	N/A	Approximately 500 tubes/yr	Propane
4. LT-14, LT-15, MLL-09 Finishing Process	Kingston EisenMach ACCU II	MKS-G 260 Unknown Unknown	Unknown Unknown Unknown	2008 Unknown Unknown	Feb 2017	N/A	Approximately 3300 finished targets/yr	N/A
5.							HR. YR.	
6.							HR. YR.	
7.							HR. YR.	
8.							HR. YR.	
9.							HR. YR.	
10.							HR. YR.	
11.							HR. YR.	
12.							HR. YR.	
13.							HR. YR.	
14.							HR. YR.	
15.							HR. YR.	

1. Basis for Equipment Size or Process Rate (Manufacturers data, Field Observation/Test, etc.) \_\_\_\_\_  
Submit information for each unit as an attachment

**NOTE: Copy this table if additional space is needed (begin numbering with 16., 17., etc.)**

**Application for Air Pollutant Sources in Bernalillo County  
Source Registration (20.11.40 NMAC) and Construction Permits (20.11.41 NMAC)**

**UNCONTROLLED EMISSIONS OF INDIVIDUAL AND COMBINED PROCESSES**

(Process potential under physical/operational limitations during a 24 hr/day and 365 day/year = 8,760 hrs)

Process Equipment Unit*	Carbon Monoxide (CO)	Oxides of Nitrogen (NOx)	Nonmethane Hydrocarbons NMHC (VOCs)	Oxides of Sulfur (SOx)	Total Suspended Particulate Matter (TSP)	Method(s) used for Determination of Emissions (AP-42, Material balance, field tests, manufacturers data, etc.)
1. AG1	1. 0.021 lbs/hr	0.025 lbs/hr	0.0014 lbs/hr	1.50E-4 lbs/hr	0.0019 lbs/hr	AP-42 Tables 1.4-1 & 1.4-2
	1a. 0.092 tons/yr	0.11 tons/yr	0.0060 tons/yr	6.57E-4 tons/yr	0.0083 tons/yr	
2. AG2	2. 0.021 lbs/hr	0.025 lbs/hr	0.0014 lbs/hr	1.50E-4 lbs/hr	0.0019 lbs/hr	AP-42 Tables 1.4-1 & 1.4-2
	2a. 0.092 tons/yr	0.11 tons/yr	0.0060 tons/yr	6.57E-4 tons/yr	0.0083 tons/yr	
3. IF1	3. 0.0063 lbs/hr	0.0075 lbs/hr	4.13E-4 lbs/hr	4.50E-5 lbs/hr	5.70E-4 lbs/hr	AP-42 Tables 1.4-1 & 1.4-2
	3a. 0.028 tons/yr	0.033 tons/yr	0.0018 tons/yr	1.97E-4 tons/yr	0.0025 tons/yr	
4. IF2 <sup>1</sup>	4. 0.0 lbs/hr	0.0 lbs/hr	0.0 lbs/hr	0.0 lbs/hr	0.0 lbs/hr	AP-42 Tables 1.4-1 & 1.4-2
	4a. 0.0 tons/yr	0.0 tons/yr	0.0 tons/yr	0.0 tons/yr	0.0 tons/yr	
5. CC3	5. - lbs/hr	- lbs/hr	- lbs/hr	- lbs/hr	0.00057 lbs/hr	AP-42 Table 12.9-2, Maximum zinc usage rate of 500 lb/yr
	5a. - tons/yr	- tons/yr	- tons/yr	- tons/yr	0.0025 tons/yr	
6. A1	6. 0.33 lbs/hr	0.39 lbs/hr	0.021 lbs/hr	0.0023 lbs/hr	0.030 lbs/hr	AP-42 Tables 1.4-1 & 1.4-2
	6a. 1.43 tons/yr	1.71 tons/yr	0.094 tons/yr	0.010 tons/yr	0.13 tons/yr	
7. EG1	7. 22.04 lbs/hr	1.38 lbs/hr	0.53 lbs/hr	5.95E-4 lbs/hr	0.020 lbs/hr	Manufacturer's data, AP-42 Table 3.2-3
	7a. 2.20 tons/yr	0.14 tons/yr	0.053 tons/yr	5.95E-5 tons/yr	0.0020 tons/yr	
8. FUM-05	8. 4.08E-04 lbs/hr	7.07E-04 lbs/hr	5.44E-05 lbs/hr	2.72E-05 lbs/hr	0.0018 lbs/hr	AP-42 Section 1.5, Table 1.5-1
	8a. 0.0018 tons/yr	0.0031 tons/yr	2.38E-04 tons/yr	1.12E-04 tons/yr	0.0077 tons/yr	
9. PS-02	9. - lbs/hr	- lbs/hr	- lbs/hr	- lbs/hr	0.049 lbs/hr	Material Balance
	9a. - tons/yr	- tons/yr	- tons/yr	- tons/yr	0.22 tons/yr	
10. FS-01	10. - lbs/hr	- lbs/hr	- lbs/hr	- lbs/hr	0.77 lbs/hr	Material Balance
	10a. - tons/yr	- tons/yr	- tons/yr	- tons/yr	3.38 tons/yr	
11. PS-05	11. 9.17E-04 lbs/hr	0.0016 lbs/hr	1.22E-04 lbs/hr	6.12E-05 lbs/hr	0.17 lbs/hr	AP-42 Section 1.5, Table 1.5-1
	11a. 0.0040 tons/yr	0.0070 tons/yr	5.36E-04 tons/yr	2.68E-04 tons/yr	0.75 tons/yr	
12. PS-03, PS-04, PS-06	12. - lbs/hr	- lbs/hr	- lbs/hr	- lbs/hr	11.48 lbs/hr	AP-42 Section 1.5, Table 1.5-1
	12a. - tons/yr	- tons/yr	- tons/yr	- tons/yr	50.3 tons/yr	
13. PS-01	13. - lbs/hr	- lbs/hr	- lbs/hr	- lbs/hr	0.0098 lbs/hr	Material Balance
	13a. - tons/yr	- tons/yr	- tons/yr	- tons/yr	0.043tons/yr	
14. PS-07	14. - lbs/hr	- lbs/hr	- lbs/hr	- lbs/hr	0.0098 lbs/hr	Material Balance
	14a. - tons/yr	- tons/yr	- tons/yr	- tons/yr	0.043tons/yr	
Totals of Uncontrolled Emissions (1 - 13)	22.42 lbs/hr	1.83 lbs/hr	0.55 lbs/hr	0.0034 lbs/hr	12.55 lbs/hr	
	3.86 tons/yr	2.11 tons/yr	0.16 tons/yr	0.012 tons/yr	54.89 tons/yr	

<sup>1</sup> IF1 and IF2 are identical units. Unit IF2 will only operate in the case that unit IF1 is not operational. Unit IF2 is in storage as a backup unit for IF1.

**If your facility does not require a registration or permit, based on above emissions, complete the remainder of this application to determine if a registration or permit would be required for Toxic or Hazardous air pollutants used at your facility.**

**Application for Air Pollutant Sources in Bernalillo County  
Source Registration (20.11.40 NMAC) and Construction Permits (20.11.41 NMAC)**

**CONTROLLED EMISSIONS OF INDIVIDUAL AND COMBINED PROCESSES**

**(Based on current operations with emission controls OR requested operations with emission controls)**

Process Equipment Units listed on this Table should match up to the same numbered line and Unit as listed on Uncontrolled Table (pg. 3)

Process Equipment Unit	Carbon Monoxide (CO)		Oxides of Nitrogen (NOx)	Nonmethane Hydrocarbons NMHC (VOCs)	Oxides of Sulfur (SOx)	Total Suspended Particulate Matter (TSP)	Control Method	% Efficiency
	1.	0.021 lbs/hr	0.025 lbs/hr	0.0014 lbs/hr	1.50E-4 lbs/hr	0.0019 lbs/hr		
1. AG1	1a.	0.092 tons/yr	0.11 tons/yr	0.0060 tons/yr	6.57E-4 tons/yr	0.0083 tons/yr	N/A	N/A
	2.	0.021 lbs/hr	0.025 lbs/hr	0.0014 lbs/hr	1.50E-4 lbs/hr	0.0019 lbs/hr		
2. AG2	2a.	0.092 tons/yr	0.11 tons/yr	0.0060 tons/yr	6.57E-4 tons/yr	0.0083 tons/yr	N/A	N/A
	3.	0.0063 lbs/hr	0.0075 lbs/hr	4.13E-4 lbs/hr	4.50E-5 lbs/hr	5.70E-4 lbs/hr		
3. IF1	3a.	0.028 tons/yr	0.033 tons/yr	0.0018 tons/yr	1.97E-4 tons/yr	0.0025 tons/yr	N/A	N/A
	4.	0.0 lbs/hr	0.0 lbs/hr	0.0 lbs/hr	0.0 lbs/hr	0.0 lbs/hr		
4. IF2 <sup>1</sup>	4a.	0.0 tons/yr	0.0 tons/yr	0.0 tons/yr	0.0 tons/yr	0.0 tons/yr	N/A	N/A
	5.	- lbs/hr	- lbs/hr	- lbs/hr	- lbs/hr	5.71E-07 lbs/hr		
5. CC3	5a.	- tons/yr	- tons/yr	- tons/yr	- tons/yr	2.5E-06 tons/yr	Baghouse	99%
	6.	0.33 lbs/hr	0.39 lbs/hr	0.021 lbs/hr	0.0023 lbs/hr	0.030 lbs/hr		
6. A1	6a.	1.43 tons/yr	1.71 tons/yr	0.094 tons/yr	0.010 tons/yr	0.13 tons/yr	N/A	N/A
	7.	22.04 lbs/hr	1.38 lbs/hr	0.53 lbs/hr	5.95E-4 lbs/hr	0.020 lbs/hr		
7. EG1	7a.	2.20 tons/yr	0.14 tons/yr	0.053 tons/yr	5.95E-5 tons/yr	0.0020 tons/yr	Operating Hours	N/A
	8.	4.08E-04 lbs/hr	7.07E-04 lbs/hr	5.44E-05 lbs/hr	2.72E-05 lbs/hr	0.0018 lbs/hr		
8. FUM-05	8a.	0.0018 tons/yr	0.0031 tons/yr	2.38E-04 tons/yr	1.12E-04 tons/yr	0.0077 tons/yr	N/A	N/A
	9.	- lbs/hr	- lbs/hr	- lbs/hr	- lbs/hr	2.47E-05 lbs/hr		
9. PS-02	9a.	- tons/yr	- tons/yr	- tons/yr	- tons/yr	1.08E-04 tons/yr	Dust Collector	99.95%
	10.	- lbs/hr	- lbs/hr	- lbs/hr	- lbs/hr	7.11E-05 lbs/hr		
10. FS-01	10a.	- tons/yr	- tons/yr	- tons/yr	- tons/yr	3.38E-04 tons/yr	Dust Collector	99.99%
	11.	9.17E-04 lbs/hr	0.0016 lbs/hr	1.22E-04 lbs/hr	6.12E-05 lbs/hr	8.56E-05 lbs/hr		
11. PS-05	11a.	0.0040 tons/yr	0.0070 tons/yr	5.36E-04 tons/yr	2.68E-04 tons/yr	3.75E-04 tons/yr	8,760 hours	99.95%
	12.	- lbs/hr	- lbs/hr	- lbs/hr	- lbs/hr	0.0057 lbs/hr		
12. PS-03, PS-04, PS-06	12a.	- tons/yr	- tons/yr	- tons/yr	- tons/yr	0.025 tons/yr	8,760 hours	99.95%
	13.	- lbs/hr	- lbs/hr	- lbs/hr	- lbs/hr	0.0098 lbs/hr		
13. PS-01	13a.	- tons/yr	- tons/yr	- tons/yr	- tons/yr	0.043 tons/yr	8,760 hours	99.97%
	14.	- lbs/hr	- lbs/hr	- lbs/hr	- lbs/hr	0.0098 lbs/hr		
14. PS-07	14a.	- tons/yr	- tons/yr	- tons/yr	- tons/yr	0.043 tons/yr	8,760 hours	99.97%
	<b>Totals of Controlled Emissions (1 - 13)</b>		22.42 lbs/hr	1.83 lbs/hr	0.55 lbs/hr	0.0034 lbs/hr		
		3.86 tons/yr	2.11 tons/yr	0.16 tons/yr	0.012 tons/yr	0.27 tons/yr		

<sup>1</sup> IF1 and IF2 are identical units. Unit IF2 will only operate in the case that unit IF1 is not operational. Unit IF2 is in storage as a backup unit for IF1.

1. Basis for Control Equipment % Efficiency (Manufacturers data, Field Observation/Test, AP-42, etc.): Controlled emissions from unit EG1 are based on 200 hours of operation per year.

2. Explain and give estimated amounts of any Fugitive Emission associated with facility processes: See discussion in Section 3.

**Application for Air Pollutant Sources in Bernalillo County  
Source Registration (20.11.40 NMAC) and Construction Permits (20.11.41 NMAC)**

**\*\*TOXIC EMISSIONS\*\***

**VOLATILE, HAZARDOUS, & VOLATILE HAZARDOUS AIR POLLUTANT EMISSION TABLE**

Product Categories (Coatings, Solvents, Thinners, etc.)	Volatile Organic Compound (VOC), Hazardous Air Pollutant (HAP), or Volatile Hazardous Air Pollutant (VHAP) Primary To The Representative As Purchased Product	Chemical Abstract Service Number (CAS) Of VOC, HAP, Or VHAP From Representative As Purchased Product	VOC, HAP, Or VHAP Concentration Of Representative As Purchased Product (pounds/gallon, or %)	1. How were Concentrations Determined (CPDS, MSDS, etc.)	Total Product Purchases For Category	(-)	Quantity Of Product Recovered & Disposed For Category	(=)	Total Product Usage For Category
I. Total HAPs from Combustion	Total HAPs	N/A	N/A	GRI-HAPCalc 3.01	1156.3 lbs/yr	(-)	0 lbs/yr	(=)	1156.3 lbs/yr
					gal/yr		gal/yr		gal/yr
II. Metallurgical Testing <sup>2</sup>	Isopropyl Alcohol	67-63-0	100%	N/A	- lbs/yr	(-)	- lbs/yr	(=)	- lbs/yr
					- gal/yr		- gal/yr		- gal/yr
III. Metallurgical Testing <sup>2</sup>	Sulfuric Acid	7664-93-9	98%	N/A	- lbs/yr	(-)	- lbs/yr	(=)	- lbs/yr
					- gal/yr		- gal/yr		- gal/yr
IV. Metallurgical Testing <sup>2</sup>	Hydrogen Peroxide	7722-84-1	30%	N/A	- lbs/yr	(-)	- lbs/yr	(=)	- lbs/yr
					- gal/yr		- gal/yr		- gal/yr
V. Metallurgical Testing <sup>2</sup>	Hydrochloric Acid	7647-01-0	35%	N/A	- lbs/yr	(-)	- lbs/yr	(=)	- lbs/yr
					- gal/yr		- gal/yr		- gal/yr
VI. Metallurgical Testing <sup>2</sup>	Nitric Acid	7697-37-2	80%	N/A	- lbs/yr	(-)	- lbs/yr	(=)	- lbs/yr
					- gal/yr		- gal/yr		- gal/yr
VII. Tube Polishing Equipment; Vee Blending; Strip, Grit Blast, and Bond Coat; and Thermal Spray Equipment	Nickel	7440-02-0	99.95%	Material Balance	10,220 lbs/yr	(-)	10,215 lbs/yr	(=)	2.51 lbs/yr
					- gal/yr		- gal/yr		- gal/yr
VIII. Form Spraying Equipment and Tube Polishing Equipment	Antimony	7440-36-0	100%	Material Balance	0.31 lbs/yr	(-)	lbs/yr	(=)	0.31 lbs/yr
					- gal/yr		- gal/yr		- gal/yr
IX.					lbs/yr	(-)	lbs/yr	(=)	lbs/yr
					gal/yr		gal/yr		gal/yr
X.					lbs/yr	(-)	lbs/yr	(=)	lbs/yr
					gal/yr		gal/yr		gal/yr
TOTAL >>>>>>>					11,377lbs/yr	(-)	10215 lbs/yr	(=)	1,159 lbs/yr
					gal/yr		gal/yr		gal/yr

1. Basis for percent (%) determinations (Certified Product Data Sheets, Material Safety Data Sheets, etc.). Submit, as an attachment, information on one (1) product from each Category listed above which best represents the average of all the products purchased in that Category. Copy this Table if additional space is needed (begin numbering with XI., XII., etc.)

2. **Note:** These chemicals are used in small quantities for metallurgical testing under an exhaust hood (L1). The emissions from the testing operations are negligible due to the limited hours of testing and small quantities of reagent used.

**\*\*NOTE: A REGISTRATION IS REQUIRED, AT MINIMUM, FOR ANY AMOUNT OF HAP OR VHAP EMISSION.  
A PERMIT MAY BE REQUIRED FOR THESE EMISSIONS, DETERMINED ON A CASE-BY-CASE EVALUATION.**

**Application for Air Pollutant Sources in Bernalillo County  
Source Registration (20.11.40 NMAC) and Construction Permits (20.11.41 NMAC)**

**MATERIAL AND FUEL STORAGE TABLE**

**(Tanks, barrels, silos, stockpiles, etc.) Copy this table if additional space is needed (begin numbering with 6., 7., etc.)**

Storage Equipment	Product Stored	Capacity (bbls - tons gal - acres, etc)	Above or Below Ground	Construction (welded, riveted) & Color	Install Date	Loading Rate	Offloading Rate	True Vapor Pressure	Control Equipment	Seal Type	% Eff.
1. Cases	Nitric Acid	42 lbs/case	Above	Brown glass bottles	N/A	1,000 lbs/yr	1,000 lbs/yr	N/A	N/A	N/A	N/A
2. Cases	Hydrochloric acid	40 lbs/case	Above	Brown plastic bottles	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3. Barrels	Sodium bisulfate	400 lb.	Above	Tan Paper	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4. Bags	Copper filtercake	1900 lb.	Above	White Paper	N/A	N/A	N/A	N/A	N/A	N/A	N/A
5. Box	Crucibles & Refractory	20 lb.	Above	Tan cardboard	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6. Drums	Slag	500 lb.	Above	Black Steel	N/A	N/A	N/A	N/A	N/A	N/A	N/A
7. Bags	Sodium Hydroxide	50 lb.	Above	White Plastic	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8. Bags	Refractory cement	50 lb.	Above	Tan Paper	N/A	N/A	N/A	N/A	N/A	N/A	N/A
9. Bags	Cast Set	50 lb.	Above	Tan paper	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10. Bags	Silica Sand	100 lb.	Above	White Paper	N/A	N/A	N/A	N/A	N/A	N/A	N/A
11. Cylinder	Acetylene	145 cf.	Above	Tan Steel	N/A	N/A	N/A	N/A	N/A	N/A	N/A
12. Cylinder	Oxygen	281 cf.	Above	Green Steel	N/A	N/A	N/A	N/A	N/A	N/A	N/A
13. Tank	Nitrogen liquid	6000 gal	Above	Tan Steel	N/A	N/A	N/A	N/A	N/A	N/A	N/A
14. Cylinder	Nitrogen	304 cf.	Above	Orange Steel	N/A	N/A	N/A	N/A	N/A	N/A	N/A
15. Cylinder	Helium	291 cf.	Above	Blue Steel	N/A	N/A	N/A	N/A	N/A	N/A	N/A
16. Cylinder	Argon	336 cf.	Above	Brown Steel	N/A	N/A	N/A	N/A	N/A	N/A	N/A
17. Drum	Baghouse Dust	250 lb.	Above	Black Steel	N/A	N/A	N/A	N/A	N/A	N/A	N/A
18. Cases	Clay graphite crucibles	50 lb.	Above	White paper	N/A	N/A	N/A	N/A	N/A	N/A	N/A
19. Cases	Graphite	50 lb	Above	White Paper	N/A	N/A	N/A	N/A	N/A	N/A	N/A
20. Cases	Mirachem 500 degreaser	40 lbs/case	Above	Brown plastic bottles	N/A	N/A	N/A	N/A	N/A	N/A	N/A
21. Cylinder	Hydrogen	291 cf.	Above	Blue Steel	N/A	N/A	N/A	N/A	N/A	N/A	N/A
22. Cases	Isopropyl Alcohol	40 lbs/case	Above	Brown plastic bottles	N/A	N/A	N/A	N/A	N/A	N/A	N/A
23. Trailer	Hydrogen	4,100 cf.	Above	Tank	N/A	N/A	N/A	N/A	N/A	N/A	N/A
24. Cases	Sulfuric Acid	~60 lbs/case	Above	Plastic bottles	N/A	N/A	N/A	N/A	N/A	N/A	N/A
25. Cases	Hydrogen Peroxide	~45 lbs/case	Above	Plastic bottles	N/A	N/A	N/A	N/A	N/A	N/A	N/A

26. Drum	Proprietary Metal Product Powder	<55 gal	Above	Black Steel	N/A	N/A	N/A	N/A	N/A	N/A	N/A
27. Cylinder	Helium	144 cu ft	Above	Blue Steel	2014	N/A	N/A	2400 PSI	N/A	N/A	N/A
28. Tank	Argon	690 Gal	Above	Brown Steel	2014	N/A	N/A	175 PSIG	N/A	N/A	N/A
29. Case	Hydrogen	12-300 lb cylinders	Above	Blue Steel	N/A	N/A	N/A	N/A	N/A	N/A	N/A
30. Cylinder	CO	Unknown	Above	Green Steel	N/A	N/A	N/A	N/A	N/A	N/A	N/A

1. Basis for Loading/Offloading Rate (Manufacturers data, Field Observation/Test, etc.) Submit information for each unit as an attachment  
N/A

2. Basis for Control Equipment % Efficiency (Manufacturers data, Field Observation/Test, AP-42, etc.) Submit information for each unit as an attachment  
N/A

**Application for Air Pollutant Sources in Bernalillo County  
Source Registration (20.11.40 NMAC) and Construction Permits (20.11.41 NMAC)**

**STACK AND EMISSION MEASUREMENT TABLE**

**If any equipment from the Process Equipment Table (Page 2) is also listed in this Stack Table, use the same numbered line for the Process Equipment unit on both Tables to show the association between the Process Equipment and its Stack. Copy this table if additional space is needed (begin numbering with 6., 7., etc.).**

Process Equipment	Pollutant (CO,NOx,TS P,Toluene,etc)	Control Equipment	Control Efficiency	Stack Height & Diameter in feet	Stack Temp.	Stack Velocity & Exit Direction	Emission Measurement Equipment Type	Range-Sensitivity-Accuracy-
1. AG1 Melting Furnace	NO <sub>x</sub> , CO, VOC, SO <sub>2</sub> , PM, HAP	Bag house (BH-1)	99.9% for Particulates	29 ft. – H 2 ft. - D	150 °F – 200 °F	8,000 ft <sup>3</sup> /min – V Exit - Upward	N/A	N/A
2. AG2 Melting Furnace	NO <sub>x</sub> , CO, VOC, SO <sub>2</sub> , PM, HAP							
3. IF1 Induction Furnace	NO <sub>x</sub> , CO, VOC, SO <sub>2</sub> , PM, HAP							
4. IF2 Induction Furnace	NO <sub>x</sub> , CO, VOC, SO <sub>2</sub> , PM, HAP							
5. CC3 Continuous Casting Furnace	PM							
6. A1 Belt Annealing Furnace	NO <sub>x</sub> , CO, VOC, SO <sub>2</sub> , PM, HAP	N/A	N/A	28 ft. – H 1 ft. - D	300 °F	600 ft <sup>3</sup> /min – V Exit – Upward	N/A	N/A
7. EG1 Emergency Generator	NO <sub>x</sub> , CO, VOC, SO <sub>2</sub> , PM, HAP	N/A	N/A	12 ft. – H 0.4 ft. – D	900 °F	1,000 ft <sup>3</sup> /min – V Exit – Upward	N/A	N/A
8. FUM-05 Cast Target Reconditioning	NO <sub>x</sub> , CO, VOC, SO <sub>2</sub> , PM, HAP	N/A	N/A	45 ft – H 0.38 ft - D	Ambient	Stack Velocity - TBD Exit - Upward	N/A	N/A
9. PS-02 Finishing Process	PM, HAP	DC-02	99.95%	45 ft – H 1 ft by 0.67 ft - D	Ambient	Stack Velocity - TBD Exit - Horizontal	N/A	N/A
10. FS-01 Form Spray Process	PM	DC-11	99.99%	45 ft – H 0.83 ft - D	Ambient	Stack Velocity - TBD Exit - Downward	N/A	N/A
11. PS-05 Strip, Grit Blast, and Bond Coat	NO <sub>x</sub> , CO, VOC, SO <sub>2</sub> , PM, HAP	DC-01	99.95%	45 ft – H 1 ft by 1.33 ft - D	Ambient	Stack Velocity - TBD Exit - Horizontal	N/A	N/A
12. PS-03, PS-04, PS-06 Strip, Grit Blast, and Bond Coat	PM, HAP	DC-01	99.95%	45 ft – H 1 ft by 1.33 ft - D	Ambient	Stack Velocity - TBD Exit - Horizontal	N/A	N/A
13. PS-01 Thermal Spray	PM, HAP	DC-05	99.97%	45 ft – H 0.80 ft by 0.88 ft - D	85 F	3,054 ft/min Exit - Upward	N/A	N/A
14. PS-07 Thermal Spray	PM, HAP	DC-06	99.97%	20 ft – H 4 ft by 8.8 ft - D	85 F	217 ft/min Exit - Upward	N/A	N/A

1. Basis for Control Equipment % Efficiency (Manufacturers data, Field Observation/Test,AP-42, etc.) Submit information for each unit as an attachment  
Nominal for baghouses



I, the undersigned, a responsible officer of the applicant company, certify that to the best of my knowledge, the information stated on this application, together with associated drawings, specifications, and other data, give a true and complete representation of the existing, modified existing, or planned new stationary source with respect to air pollution sources and control equipment. I also understand that any significant omissions, errors, or misrepresentations in these data will be cause for revocation of part or all of the resulting registration or permit.

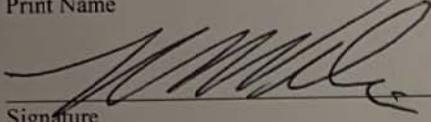
Signed this 23<sup>rd</sup> day of January, 2020

Richard R. Vitale

Print Name

Plant Manager

Print Title



Signature





# City of Albuquerque

## Environmental Health Department

### Air Quality Program



## Permit Application Review Fee Instructions

All source registration, authority-to-construct, and operating permit applications for stationary or portable sources shall be charged an application review fee according to the fee schedule in 20.11.2 NMAC. These filing fees are required for both new construction, reconstruction, and permit modifications applications. Qualified small businesses as defined in 20.11.2 NMAC may be eligible to pay one-half of the application review fees and 100% of all applicable federal program review fees.

Please fill out the permit application review fee checklist and submit with a check or money order payable to the "City of Albuquerque Fund 242" and either:

1. be delivered in person to the Albuquerque Environmental Health Department, 3<sup>rd</sup> floor, Suite 3023 or Suite 3027, Albuquerque-Bernalillo County Government Center, south building, One Civic Plaza NW, Albuquerque, NM or,
2. mailed to Attn: Air Quality Program, Albuquerque Environmental Health Department, P.O. Box 1293, Albuquerque, NM 87103.

The department will provide a receipt of payment to the applicant. The person delivering or filing a submittal shall attach a copy of the receipt of payment to the submittal as proof of payment. Application review fees shall not be refunded without the written approval of the manager. If a refund is requested, a reasonable professional service fee to cover the costs of staff time involved in processing such requests shall be assessed. Please refer to 20.11.2 NMAC (effective January 10, 2011) for more detail concerning the "Fees" regulation as this checklist does not relieve the applicant from any applicable requirement of the regulation.



# City of Albuquerque

## Environmental Health Department Air Quality Program



### Permit Application Review Fee Checklist

Please completely fill out the information in each section. Incompleteness of this checklist may result in the Albuquerque Environmental Health Department not accepting the application review fees. If you should have any questions concerning this checklist, please call 768-1972.

#### I. COMPANY INFORMATION:

Company Name	Materion Corporation		
Company Address	5941 Midway Park Blvd. NE, Albuquerque, NM 87109		
Facility Name	North Facility		
Facility Address	5941 Midway Park Blvd. NE, Albuquerque, NM 87109		
Contact Person	Richard Vitale		
Contact Person Phone Number	(505) 342-5518		
Are these application review fees for an existing permitted source located within the City of Albuquerque or Bernalillo County?	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	
If yes, what is the permit number associated with this modification?	Permit # 1962-M1-1TR		
Is this application review fee for a Qualified Small Business as defined in 20.11.2 NMAC? (See Definition of Qualified Small Business on Page 4)	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	

#### II. STATIONARY SOURCE APPLICATION REVIEW FEES:

If the application is for a new stationary source facility, please check all that apply. If this application is for a modification to an existing permit please see Section III.

Check All That Apply	Stationary Sources	Review Fee	Program Element
<b>Air Quality Notifications</b>			
	AQN New Application	\$573.00	2801
	AQN Technical Amendment	\$313.00	2802
	AQN Transfer of a Prior Authorization	\$313.00	2803
<input checked="" type="checkbox"/>	<i>Not Applicable</i>	<i>See Sections Below</i>	
<b>Stationary Source Review Fees (Not Based on Proposed Allowable Emission Rate)</b>			
	Source Registration required by 20.11.40 NMAC	\$ 584.00	2401
	A Stationary Source that requires a permit pursuant to 20.11.41 NMAC or other board regulations and are not subject to the below proposed allowable emission rates	\$ 1,168.00	2301
<input checked="" type="checkbox"/>	<i>Not Applicable</i>	<i>See Sections Below</i>	
<b>Stationary Source Review Fees (Based on the Proposed Allowable Emission Rate for the single highest fee pollutant)</b>			
	Proposed Allowable Emission Rate Equal to or greater than 1 tpy and less than 5 tpy	\$876	2302
	Proposed Allowable Emission Rate Equal to or greater than 5 tpy and less than 25 tpy	\$1,752	2303
	Proposed Allowable Emission Rate Equal to or greater than 25 tpy and less than 50 tpy	\$3,503	2304
	Proposed Allowable Emission Rate Equal to or greater than 50 tpy and less than 75 tpy	\$5,255	2305
	Proposed Allowable Emission Rate Equal to or greater than 75 tpy and less than 100 tpy	\$7,006	2306
	Proposed Allowable Emission Rate Equal to or greater than 100 tpy	\$8,758	2307
<input checked="" type="checkbox"/>	<i>Not Applicable</i>	<i>See Section Above</i>	

<b>Federal Program Review Fees (In addition to the Stationary Source Application Review Fees above)</b>			
	40 CFR 60 - "New Source Performance Standards" (NSPS)	\$1,168	2308
	40 CFR 61 - "Emission Standards for Hazardous Air Pollutants (NESHAPs)	\$1,168	2309
	40 CFR 63 - (NESHAPs) Promulgated Standards	\$1,168	2310
	40 CFR 63 - (NESHAPs) Case-by-Case MACT Review	\$11,677	2311
	20.11.61 NMAC, Prevention of Significant Deterioration (PSD) Permit	\$5,838	2312
	20.11.60 NMAC, Non-Attainment Area Permit	\$5,838	2313
<input checked="" type="checkbox"/>	<i>Not Applicable</i>	<i>Not Applicable</i>	

### III. MODIFICATION TO EXISTING PERMIT APPLICATION REVIEW FEES:

If the permit application is for a modification to an existing permit, please check all that apply. If this application is for a new stationary source facility, please see Section II.

Check All That Apply	Modifications	Review Fee	Program Element
<b>Modification Application Review Fees (Not Based on Proposed Allowable Emission Rate)</b>			
<input checked="" type="checkbox"/>	Proposed modification to an existing stationary source that requires a permit pursuant to 20.11.41 NMAC or other board regulations and are not subject to the below proposed allowable emission rates	\$ 1,168.00	2321
	<i>Not Applicable</i>	<i>See Sections Below</i>	
<b>Modification Application Review Fees (Based on the Proposed Allowable Emission Rate for the single highest fee pollutant)</b>			
	Proposed Allowable Emission Rate Equal to or greater than 1 tpy and less than 5 tpy	\$876	2322
	Proposed Allowable Emission Rate Equal to or greater than 5 tpy and less than 25 tpy	\$1,752	2323
	Proposed Allowable Emission Rate Equal to or greater than 25 tpy and less than 50 tpy	\$3,503	2324
	Proposed Allowable Emission Rate Equal to or greater than 50 tpy and less than 75 tpy	\$5,255	2325
	Proposed Allowable Emission Rate Equal to or greater than 75 tpy and less than 100 tpy	\$7,006	2326
	Proposed Allowable Emission Rate Equal to or greater than 100 tpy	\$8,758	2327
<input checked="" type="checkbox"/>	<i>Not Applicable</i>	<i>See Section Above</i>	
<b>Major Modifications Review Fees (In addition to the Modification Application Review Fees above)</b>			
	20.11.60 NMAC, Permitting in Non-Attainment Areas	\$5,838	2333
	20.11.61 NMAC, Prevention of Significant Deterioration	\$5,838	2334
<input checked="" type="checkbox"/>	<i>Not Applicable</i>	<i>Not Applicable</i>	
<b>Federal Program Review Fees (This section applies only if a Federal Program Review is triggered by the proposed modification) (These fees are in addition to the Modification and Major Modification Application Review Fees above)</b>			
	40 CFR 60 - "New Source Performance Standards" (NSPS)	\$1,168	2328
	40 CFR 61 - "Emission Standards for Hazardous Air Pollutants (NESHAPs)	\$1,168	2329
	40 CFR 63 - (NESHAPs) Promulgated Standards	\$1,168	2330
	40 CFR 63 - (NESHAPs) Case-by-Case MACT Review	\$11,677	2331
	20.11.61 NMAC, Prevention of Significant Deterioration (PSD) Permit	\$5,838	2332
	20.11.60 NMAC, Non-Attainment Area Permit	\$5,838	2333
<input checked="" type="checkbox"/>	<i>Not Applicable</i>	<i>Not Applicable</i>	



**IV. ADMINISTRATIVE AND TECHNICAL REVISION APPLICATION REVIEW FEES:**

If the permit application is for an administrative or technical revision of an existing permit issued pursuant to 20.11.41 NMAC, please check one that applies.

Check One	Revision Type	Review Fee	Program Element
	Administrative Revisions	\$ 250.00	2340
	Technical Revisions	\$ 500.00	2341
<input checked="" type="checkbox"/>	<i>Not Applicable</i>	<i>See Sections II, III or V</i>	

**V. PORTABLE STATIONARY SOURCE RELOCATION FEES:**

If the permit application is for a portable stationary source relocation of an existing permit, please check one that applies.

Check One	Portable Stationary Source Relocation Type	Review Fee	Program Element
	No New Air Dispersion Modeling Required	\$ 500.00	2501
	New Air Dispersion Modeling Required	\$ 750.00	2502
<input checked="" type="checkbox"/>	<i>Not Applicable</i>	<i>See Sections II, III or V</i>	

**VI. Please submit a check or money order in the amount shown for the total application review fee.**

Section Totals	Review Fee Amount
Section II Total	\$ 0.00
Section III Total	\$ 1,168.00
Section IV Total	\$ 0.00
Section V Total	\$ 0.00
<b>Total Application Review Fee</b>	<b>\$ 1,168.00</b>

I, the undersigned, a responsible official of the applicant company, certify that to the best of my knowledge, the information stated on this checklist, give a true and complete representation of the permit application review fees which are being submitted. I also understand that an incorrect submittal of permit application reviews may cause an incompleteness determination of the submitted permit application and that the balance of the appropriate permit application review fees shall be paid in full prior to further processing of the application.

Signed this 10<sup>th</sup> day of January 2020  
Richard R. Vtabe Plant Manager  
 Print Name Print Title  
[Signature]  
 Signature

**Definition of Qualified Small Business** as defined in 20.11.2 NMAC:

“Qualified small business” means a business that meets all of the following requirements:

- (1) a business that has 100 or fewer employees;
- (2) a small business concern as defined by the federal Small Business Act;
- (3) a source that emits less than 50 tons per year of any individual regulated air pollutant, or less than 75 tons per year of all regulated air pollutants combined; and
- (4) a source that is not a major source or major stationary source.

**Note:** Beginning January 1, 2011, and every January 1 thereafter, an increase based on the consumer price index shall be added to the application review fees. The application review fees established in Subsection A through D of 20.11.2.18 NMAC shall be adjusted by an amount equal to the increase in the consumer price index for the immediately-preceding year. Application review fee adjustments equal to or greater than fifty cents (\$0.50) shall be rounded up to the next highest whole dollar. Application review fee adjustments totaling less than fifty cents (\$0.50) shall be rounded down to the next lowest whole dollar. The department shall post the application review fees on the city of Albuquerque environmental health department air quality program website.





NO. 0101355945

# MATERION

6070 Parkland Blvd. • Mayfield Heights, OH 44124

CITY OF ALBUQUERQUE - ENVIRO.  
PO BOX 25700  
ALBUQUERQUE NM 87125

Check
Document / Date 1500261828 / 01/15/2020
Check Number 0101355945

Document	Your document	Date	Deductions	Tax Included	Gross amount
Payment is made on behalf of Materion Advanced Materials					
1900008716	NTBGTV2020	01/10/2020	0.00	0.00	1,168.00
Sum total			0.00	0.00	1,168.00

Payment document	Check number	Date	Currency	Payment amount
1500261828	0101355945	01/15/2020	USD	*****1,168.00*



NO. 0101355945 <sup>56-1544</sup>/<sub>441</sub>

# MATERION

6070 Parkland Blvd. • Mayfield Heights, OH 44124

JPMorgan Chase Bank, N.A.  
Columbus, OH 43271

Check number  
0101355945

CHECK DATE	AMOUNT OF CHECK
01/15/2020	*****1,168.00*

PAY THIS AMOUNT

\*\*\* ONE THOUSAND ONE HUNDRED SIXTY EIGHT USD\*\*\*

VENDOR NUMBER: 2000022527

PAY  
TO THE  
ORDER  
OF

CITY OF ALBUQUERQUE - ENVIRO.  
PO BOX 25700  
ALBUQUERQUE NM 87125

MATERION  
Mayfield Heights, Ohio

⑈0101355945⑈ ⑆044115443⑆

652192998⑈



## 8. SUPPORTING DATA

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The following information used to determine emissions is attached:

- HAPCalc 3.01 output
- AP-42 Tables 1.4-1 and 1.4-2
- AP-42 Table 1.5-1
- AP-42 Table 3.2-3
- AP-42 Table 12.9-2
- Baldor engine manufacturer data

**GRI-HAPCalc® 3.01**  
**Engines Report**

<b>Facility ID:</b>	<b>MATERION NORTH</b>	<b>Notes:</b>
<b>Operation Type:</b>	<b>PRODUCTION</b>	
<b>Facility Name:</b>	<b>MATERION NORTH FACILITY</b>	
<b>User Name:</b>		
<b>Units of Measure:</b>	<b>U.S. STANDARD</b>	

*Note: Emissions less than 5.00E-09 tons (or tonnes) per year are considered insignificant and are treated as zero. These emissions are indicated on the report with a "0". Emissions between 5.00E-09 and 5.00E-05 tons (or tonnes) per year are represented on the report with "0.0000".*

**Engine Unit**

Unit Name: EG1

Hours of Operation: 200 Yearly  
 Rate Power: 230 hp  
 Fuel Type: NATURAL GAS  
 Engine Type: 4-Stroke, Rich Burn  
 Emission Factor Set: FIELD > EPA > LITERATURE  
 Additional EF Set: -NONE-

**Calculated Emissions (ton/yr)**

<u>Chemical Name</u>	<u>Emissions</u>	<u>Emission Factor</u>	<u>Emission Factor Set</u>
<b>HAPs</b>			
Formaldehyde	0.0050	0.09942890 g/bhp-hr	GRI Field
Methanol	0.0010	0.02000000 g/bhp-hr	GRI Field
Acetaldehyde	0.0005	0.00920800 g/bhp-hr	EPA
1,3-Butadiene	0.0001	0.00218810 g/bhp-hr	EPA
Acrolein	0.0004	0.00867990 g/bhp-hr	EPA
Benzene	0.0003	0.00521450 g/bhp-hr	EPA
Toluene	0.0001	0.00184160 g/bhp-hr	EPA
Ethylbenzene	0.0000	0.00008180 g/bhp-hr	EPA
Xylenes(m,p,o)	0.0000	0.00064360 g/bhp-hr	EPA
Styrene	0.0000	0.00003930 g/bhp-hr	EPA
Naphthalene	0.0000	0.00032050 g/bhp-hr	EPA
Ethylene Dibromide	0.0000	0.00007030 g/bhp-hr	EPA
Vinyl Chloride	0.0000	0.00002370 g/bhp-hr	EPA
Methylene Chloride	0.0000	0.00013600 g/bhp-hr	EPA
1,1-Dichloroethane	0.0000	0.00003730 g/bhp-hr	EPA
1,3-Dichloropropene	0.0000	0.00004190 g/bhp-hr	EPA
Chlorobenzene	0.0000	0.00004260 g/bhp-hr	EPA
Chloroform	0.0000	0.00004520 g/bhp-hr	EPA
1,1,2-Trichloroethane	0.0000	0.00005050 g/bhp-hr	EPA
1,1,2,2-Tetrachloroethane	0.0000	0.00008350 g/bhp-hr	EPA
Carbon Tetrachloride	0.0000	0.00005840 g/bhp-hr	EPA
<b>Total</b>	<b>0.0074</b>		

## Criteria Pollutants

PM	0.0032	0.06405970 g/bhp-hr	EPA
CO	0.7346	14.50000000 g/bhp-hr	GRI Field
NMEHC	0.0049	0.09769010 g/bhp-hr	EPA
NOx	0.9271	18.30000000 g/bhp-hr	GRI Field
SO2	0.0001	0.00194060 g/bhp-hr	EPA

## Other Pollutants

Butryaldehyde	0.0000	0.00016040 g/bhp-hr	EPA
Methane	0.0385	0.75907880 g/bhp-hr	EPA
Ethane	0.0118	0.23234410 g/bhp-hr	EPA
1,2-Dichloroethane	0.0000	0.00003730 g/bhp-hr	EPA
1,2-Dichloropropane	0.0000	0.00004290 g/bhp-hr	EPA
CO2	18.3918	363.03769350 g/bhp-hr	EPA

**GRI-HAPCalc® 3.01**  
**External Combustion Devices Report**

<b>Facility ID:</b>	<b>MATERION NORTH</b>	<b>Notes:</b>
<b>Operation Type:</b>	<b>PRODUCTION</b>	
<b>Facility Name:</b>	<b>MATERION NORTH FACILITY</b>	
<b>User Name:</b>		
<b>Units of Measure:</b>	<b>U.S. STANDARD</b>	

*Note: Emissions less than 5.00E-09 tons (or tonnes) per year are considered insignificant and are treated as zero. These emissions are indicated on the report with a "0". Emissions between 5.00E-09 and 5.00E-05 tons (or tonnes) per year are represented on the report with "0.0000".*

**External Combustion Devices**

Unit Name: A1

Hours of Operation: 8,760 Yearly  
Heat Input: 3.9 MMBtu/hr  
Fuel Type: NATURAL GAS  
Device Type: BURNER  
Emission Factor Set: EPA > FIELD > LITERATURE  
Additional EF Set: -NONE-

**Calculated Emissions (ton/yr)**

<u>Chemical Name</u>	<u>Emissions</u>	<u>Emission Factor</u>	<u>Emission Factor Set</u>
<b>HAPs</b>			
3-Methylcholanthrene	0.0000	0.0000000018 lb/MMBtu	EPA
7,12-Dimethylbenz(a)anthracene	0.0000	0.0000000157 lb/MMBtu	EPA
Formaldehyde	0.0013	0.0000735294 lb/MMBtu	EPA
Methanol	0.0074	0.0004333330 lb/MMBtu	GRI Field
Acetaldehyde	0.0050	0.0002909000 lb/MMBtu	GRI Field
1,3-Butadiene	0.0000	0.0000001830 lb/MMBtu	GRI Field
Benzene	0.0000	0.0000020588 lb/MMBtu	EPA
Toluene	0.0001	0.0000033333 lb/MMBtu	EPA
Ethylbenzene	0.0000	0.0000000720 lb/MMBtu	GRI Field
Xylenes(m,p,o)	0.0000	0.0000010610 lb/MMBtu	GRI Field
2,2,4-Trimethylpentane	0.0006	0.0000323000 lb/MMBtu	GRI Field
n-Hexane	0.0301	0.0017647059 lb/MMBtu	EPA
Phenol	0.0000	0.0000000950 lb/MMBtu	GRI Field
Naphthalene	0.0000	0.0000005980 lb/MMBtu	EPA
2-Methylnaphthalene	0.0000	0.0000000235 lb/MMBtu	EPA
Acenaphthylene	0.0000	0.0000000018 lb/MMBtu	EPA
Biphenyl	0.0000	0.0000011500 lb/MMBtu	GRI Field
Acenaphthene	0.0000	0.0000000018 lb/MMBtu	EPA
Fluorene	0.0000	0.0000000027 lb/MMBtu	EPA
Anthracene	0.0000	0.0000000024 lb/MMBtu	EPA
Phenanthrene	0.0000	0.0000000167 lb/MMBtu	EPA
Fluoranthene	0.0000	0.0000000029 lb/MMBtu	EPA
Pyrene	0.0000	0.0000000049 lb/MMBtu	EPA
Benz(a)anthracene	0.0000	0.0000000018 lb/MMBtu	EPA
Chrysene	0.0000	0.0000000018 lb/MMBtu	EPA

Benzo(a)pyrene	0.0000	0.0000000012	lb/MMBtu	EPA
Benzo(b)fluoranthene	0.0000	0.0000000018	lb/MMBtu	EPA
Benzo(k)fluoranthene	0.0000	0.0000000018	lb/MMBtu	EPA
Benzo(g,h,i)perylene	0.0000	0.0000000012	lb/MMBtu	EPA
Indeno(1,2,3-c,d)pyrene	0.0000	0.0000000018	lb/MMBtu	EPA
Dibenz(a,h)anthracene	0.0000	0.0000000012	lb/MMBtu	EPA
Lead	0.0000	0.0000004902	lb/MMBtu	EPA
<b>Total</b>	<b>0.0445</b>			

### Criteria Pollutants

VOC	0.0921	0.0053921569	lb/MMBtu	EPA
PM	0.1273	0.0074509804	lb/MMBtu	EPA
PM, Condensable	0.0955	0.0055882353	lb/MMBtu	EPA
PM, Filterable	0.0318	0.0018627451	lb/MMBtu	EPA
CO	1.4068	0.0823529410	lb/MMBtu	EPA
NMHC	0.1457	0.0085294118	lb/MMBtu	EPA
NOx	1.6747	0.0980392157	lb/MMBtu	EPA
SO2	0.0100	0.0005880000	lb/MMBtu	EPA

### Other Pollutants

Dichlorobenzene	0.0000	0.0000011765	lb/MMBtu	EPA
Methane	0.0385	0.0022549020	lb/MMBtu	EPA
Acetylene	0.0911	0.0053314000	lb/MMBtu	GRI Field
Ethylene	0.0090	0.0005264000	lb/MMBtu	GRI Field
Ethane	0.0519	0.0030392157	lb/MMBtu	EPA
Propylene	0.0159	0.0009333330	lb/MMBtu	GRI Field
Propane	0.0268	0.0015686275	lb/MMBtu	EPA
Butane	0.0352	0.0020588235	lb/MMBtu	EPA
Cyclopentane	0.0007	0.0000405000	lb/MMBtu	GRI Field
Pentane	0.0435	0.0025490196	lb/MMBtu	EPA
n-Pentane	0.0342	0.0020000000	lb/MMBtu	GRI Field
Cyclohexane	0.0008	0.0000451000	lb/MMBtu	GRI Field
Methylcyclohexane	0.0029	0.0001691000	lb/MMBtu	GRI Field
n-Octane	0.0009	0.0000506000	lb/MMBtu	GRI Field
n-Nonane	0.0001	0.0000050000	lb/MMBtu	GRI Field
CO2	2,009.6471	117.6470588235	lb/MMBtu	EPA

Unit Name: AG1

Hours of Operation: 8,760 Yearly  
Heat Input: 0.25 MMBtu/hr  
Fuel Type: NATURAL GAS  
Device Type: BURNER  
Emission Factor Set: EPA > FIELD > LITERATURE  
Additional EF Set: -NONE-

### Calculated Emissions (ton/yr)

<u>Chemical Name</u>	<u>Emissions</u>	<u>Emission Factor</u>	<u>Emission Factor Set</u>
<b>HAPs</b>			
7,12-Dimethylbenz(a)anthracene	0.0000	0.0000000157 lb/MMBtu	EPA
Formaldehyde	0.0001	0.0000735294 lb/MMBtu	EPA
Methanol	0.0005	0.0004333330 lb/MMBtu	GRI Field

Acetaldehyde	0.0003	0.0002909000	lb/MMBtu	GRI Field
1,3-Butadiene	0.0000	0.0000001830	lb/MMBtu	GRI Field
Benzene	0.0000	0.0000020588	lb/MMBtu	EPA
Toluene	0.0000	0.0000033333	lb/MMBtu	EPA
Ethylbenzene	0.0000	0.0000000720	lb/MMBtu	GRI Field
Xylenes(m,p,o)	0.0000	0.0000010610	lb/MMBtu	GRI Field
2,2,4-Trimethylpentane	0.0000	0.0000323000	lb/MMBtu	GRI Field
n-Hexane	0.0019	0.0017647059	lb/MMBtu	EPA
Phenol	0.0000	0.0000000950	lb/MMBtu	GRI Field
Naphthalene	0.0000	0.0000005980	lb/MMBtu	EPA
2-Methylnaphthalene	0.0000	0.0000000235	lb/MMBtu	EPA
Biphenyl	0.0000	0.0000011500	lb/MMBtu	GRI Field
Phenanthrene	0.0000	0.0000000167	lb/MMBtu	EPA
Pyrene	0.0000	0.0000000049	lb/MMBtu	EPA
Lead	0.0000	0.0000004902	lb/MMBtu	EPA
<b>Total</b>	<hr/>	0.0028		

### Criteria Pollutants

VOC	0.0059	0.0053921569	lb/MMBtu	EPA
PM	0.0082	0.0074509804	lb/MMBtu	EPA
PM, Condensable	0.0061	0.0055882353	lb/MMBtu	EPA
PM, Filterable	0.0020	0.0018627451	lb/MMBtu	EPA
CO	0.0902	0.0823529410	lb/MMBtu	EPA
NMHC	0.0093	0.0085294118	lb/MMBtu	EPA
NOx	0.1074	0.0980392157	lb/MMBtu	EPA
SO2	0.0006	0.0005880000	lb/MMBtu	EPA

### Other Pollutants

Dichlorobenzene	0.0000	0.0000011765	lb/MMBtu	EPA
Methane	0.0025	0.0022549020	lb/MMBtu	EPA
Acetylene	0.0058	0.0053314000	lb/MMBtu	GRI Field
Ethylene	0.0006	0.0005264000	lb/MMBtu	GRI Field
Ethane	0.0033	0.0030392157	lb/MMBtu	EPA
Propylene	0.0010	0.0009333330	lb/MMBtu	GRI Field
Propane	0.0017	0.0015686275	lb/MMBtu	EPA
Butane	0.0023	0.0020588235	lb/MMBtu	EPA
Cyclopentane	0.0000	0.0000405000	lb/MMBtu	GRI Field
Pentane	0.0028	0.0025490196	lb/MMBtu	EPA
n-Pentane	0.0022	0.0020000000	lb/MMBtu	GRI Field
Cyclohexane	0.0000	0.0000451000	lb/MMBtu	GRI Field
Methylcyclohexane	0.0002	0.0001691000	lb/MMBtu	GRI Field
n-Octane	0.0001	0.0000506000	lb/MMBtu	GRI Field
n-Nonane	0.0000	0.0000050000	lb/MMBtu	GRI Field
CO2	128.8235	117.6470588235	lb/MMBtu	EPA

Unit Name: AG2

Hours of Operation: 8,760 Yearly  
 Heat Input: 0.25 MMBtu/hr  
 Fuel Type: NATURAL GAS  
 Device Type: BURNER  
 Emission Factor Set: EPA > FIELD > LITERATURE  
 Additional EF Set: -NONE-

**Calculated Emissions (ton/yr)**

<u>Chemical Name</u>	<u>Emissions</u>	<u>Emission Factor</u>	<u>Emission Factor Set</u>
<b>HAPs</b>			
7,12-Dimethylbenz(a)anthracene	0.0000	0.0000000157 lb/MMBtu	EPA
Formaldehyde	0.0001	0.0000735294 lb/MMBtu	EPA
Methanol	0.0005	0.0004333330 lb/MMBtu	GRI Field
Acetaldehyde	0.0003	0.0002909000 lb/MMBtu	GRI Field
1,3-Butadiene	0.0000	0.0000001830 lb/MMBtu	GRI Field
Benzene	0.0000	0.0000020588 lb/MMBtu	EPA
Toluene	0.0000	0.0000033333 lb/MMBtu	EPA
Ethylbenzene	0.0000	0.0000000720 lb/MMBtu	GRI Field
Xylenes(m,p,o)	0.0000	0.0000010610 lb/MMBtu	GRI Field
2,2,4-Trimethylpentane	0.0000	0.0000323000 lb/MMBtu	GRI Field
n-Hexane	0.0019	0.0017647059 lb/MMBtu	EPA
Phenol	0.0000	0.0000000950 lb/MMBtu	GRI Field
Naphthalene	0.0000	0.0000005980 lb/MMBtu	EPA
2-Methylnaphthalene	0.0000	0.0000000235 lb/MMBtu	EPA
Biphenyl	0.0000	0.0000011500 lb/MMBtu	GRI Field
Phenanthrene	0.0000	0.0000000167 lb/MMBtu	EPA
Pyrene	0.0000	0.0000000049 lb/MMBtu	EPA
Lead	0.0000	0.0000004902 lb/MMBtu	EPA
<b>Total</b>	<b>0.0028</b>		
<b>Criteria Pollutants</b>			
VOC	0.0059	0.0053921569 lb/MMBtu	EPA
PM	0.0082	0.0074509804 lb/MMBtu	EPA
PM, Condensable	0.0061	0.0055882353 lb/MMBtu	EPA
PM, Filterable	0.0020	0.0018627451 lb/MMBtu	EPA
CO	0.0902	0.0823529410 lb/MMBtu	EPA
NMHC	0.0093	0.0085294118 lb/MMBtu	EPA
NOx	0.1074	0.0980392157 lb/MMBtu	EPA
SO2	0.0006	0.0005880000 lb/MMBtu	EPA
<b>Other Pollutants</b>			
Dichlorobenzene	0.0000	0.0000011765 lb/MMBtu	EPA
Methane	0.0025	0.0022549020 lb/MMBtu	EPA
Acetylene	0.0058	0.0053314000 lb/MMBtu	GRI Field
Ethylene	0.0006	0.0005264000 lb/MMBtu	GRI Field
Ethane	0.0033	0.0030392157 lb/MMBtu	EPA
Propylene	0.0010	0.0009333330 lb/MMBtu	GRI Field
Propane	0.0017	0.0015686275 lb/MMBtu	EPA
Butane	0.0023	0.0020588235 lb/MMBtu	EPA
Cyclopentane	0.0000	0.0000405000 lb/MMBtu	GRI Field

Pentane	0.0028	0.0025490196	lb/MMBtu	EPA
n-Pentane	0.0022	0.0020000000	lb/MMBtu	GRI Field
Cyclohexane	0.0000	0.0000451000	lb/MMBtu	GRI Field
Methylcyclohexane	0.0002	0.0001691000	lb/MMBtu	GRI Field
n-Octane	0.0001	0.0000506000	lb/MMBtu	GRI Field
n-Nonane	0.0000	0.0000050000	lb/MMBtu	GRI Field
CO2	128.8235	117.6470588235	lb/MMBtu	EPA

Unit Name: CAST-02

Hours of Operation: 8,760 Yearly  
Heat Input: 1.0 MMBtu/hr  
Fuel Type: NATURAL GAS  
Device Type: HEATER  
Emission Factor Set: FIELD > EPA > LITERATURE  
Additional EF Set: -NONE-

**Calculated Emissions (ton/yr)**

<u>Chemical Name</u>	<u>Emissions</u>	<u>Emission Factor</u>	<u>Emission Factor Set</u>
<b>HAPs</b>			
3-Methylcholanthrene	0.0000	0.0000000018 lb/MMBtu	EPA
7,12-Dimethylbenz(a)anthracene	0.0000	0.0000000157 lb/MMBtu	EPA
Formaldehyde	0.0037	0.0008440090 lb/MMBtu	GRI Field
Methanol	0.0042	0.0009636360 lb/MMBtu	GRI Field
Acetaldehyde	0.0032	0.0007375920 lb/MMBtu	GRI Field
1,3-Butadiene	0.0015	0.0003423350 lb/MMBtu	GRI Field
Benzene	0.0033	0.0007480470 lb/MMBtu	GRI Field
Toluene	0.0045	0.0010163310 lb/MMBtu	GRI Field
Ethylbenzene	0.0093	0.0021128220 lb/MMBtu	GRI Field
Xylenes(m,p,o)	0.0058	0.0013205140 lb/MMBtu	GRI Field
2,2,4-Trimethylpentane	0.0124	0.0028417580 lb/MMBtu	GRI Field
n-Hexane	0.0062	0.0014070660 lb/MMBtu	GRI Field
Phenol	0.0000	0.0000001070 lb/MMBtu	GRI Field
Styrene	0.0091	0.0020788960 lb/MMBtu	GRI Field
Naphthalene	0.0000	0.0000005100 lb/MMBtu	GRI Field
2-Methylnaphthalene	0.0000	0.0000001470 lb/MMBtu	GRI Field
Acenaphthylene	0.0000	0.0000000670 lb/MMBtu	GRI Field
Biphenyl	0.0000	0.0000004730 lb/MMBtu	GRI Field
Acenaphthene	0.0000	0.0000000900 lb/MMBtu	GRI Field
Fluorene	0.0000	0.0000000800 lb/MMBtu	GRI Field
Anthracene	0.0000	0.0000000870 lb/MMBtu	GRI Field
Phenanthrene	0.0000	0.0000000600 lb/MMBtu	GRI Field
Fluoranthene	0.0000	0.0000000900 lb/MMBtu	GRI Field
Pyrene	0.0000	0.0000000830 lb/MMBtu	GRI Field
Benz(a)anthracene	0.0000	0.0000000870 lb/MMBtu	GRI Field
Chrysene	0.0000	0.0000001170 lb/MMBtu	GRI Field
Benzo(a)pyrene	0.0000	0.0000000700 lb/MMBtu	GRI Field
Benzo(b)fluoranthene	0.0000	0.0000001500 lb/MMBtu	GRI Field
Benzo(k)fluoranthene	0.0000	0.0000007600 lb/MMBtu	GRI Field
Benzo(g,h,i)perylene	0.0000	0.0000002600 lb/MMBtu	GRI Field
Indeno(1,2,3-c,d)pyrene	0.0000	0.0000001200 lb/MMBtu	GRI Field
Dibenz(a,h)anthracene	0.0000	0.0000001030 lb/MMBtu	GRI Field

Lead	0.0000	0.0000004902	lb/MMBtu	EPA
<b>Total</b>		0.0632		
<b><u>Criteria Pollutants</u></b>				
VOC	0.0236	0.0053921569	lb/MMBtu	EPA
PM	0.0326	0.0074509804	lb/MMBtu	EPA
PM, Condensable	0.0245	0.0055882353	lb/MMBtu	EPA
PM, Filterable	0.0082	0.0018627451	lb/MMBtu	EPA
CO	0.1418	0.0323636360	lb/MMBtu	GRI Field
NMHC	0.0374	0.0085294118	lb/MMBtu	EPA
NOx	0.4249	0.0970167730	lb/MMBtu	GRI Field
SO2	0.0026	0.0005880000	lb/MMBtu	EPA

**Other Pollutants**

Dichlorobenzene	0.0000	0.0000011765	lb/MMBtu	EPA
Methane	0.0461	0.0105212610	lb/MMBtu	GRI Field
Acetylene	0.0613	0.0140000000	lb/MMBtu	GRI Field
Ethylene	0.0042	0.0009476310	lb/MMBtu	GRI Field
Ethane	0.0115	0.0026312210	lb/MMBtu	GRI Field
Propylene	0.0103	0.0023454550	lb/MMBtu	GRI Field
Propane	0.0047	0.0010686280	lb/MMBtu	GRI Field
Isobutane	0.0064	0.0014640770	lb/MMBtu	GRI Field
Butane	0.0060	0.0013766990	lb/MMBtu	GRI Field
Cyclopentane	0.0050	0.0011304940	lb/MMBtu	GRI Field
Pentane	0.0152	0.0034671850	lb/MMBtu	GRI Field
n-Pentane	0.0062	0.0014221310	lb/MMBtu	GRI Field
Cyclohexane	0.0040	0.0009183830	lb/MMBtu	GRI Field
Methylcyclohexane	0.0096	0.0022011420	lb/MMBtu	GRI Field
n-Octane	0.0125	0.0028538830	lb/MMBtu	GRI Field
1,2,3-Trimethylbenzene	0.0150	0.0034224540	lb/MMBtu	GRI Field
1,2,4-Trimethylbenzene	0.0150	0.0034224540	lb/MMBtu	GRI Field
1,3,5-Trimethylbenzene	0.0150	0.0034224540	lb/MMBtu	GRI Field
n-Nonane	0.0160	0.0036604170	lb/MMBtu	GRI Field
CO2	515.2941	117.6470588235	lb/MMBtu	EPA

Unit Name: FUM-05

Hours of Operation: 8,760 Yearly  
Heat Input: 1.0 MMBtu/hr  
Fuel Type: NATURAL GAS  
Device Type: HEATER  
Emission Factor Set: FIELD > EPA > LITERATURE  
Additional EF Set: -NONE-

**Calculated Emissions (ton/yr)**

<u>Chemical Name</u>	<u>Emissions</u>	<u>Emission Factor</u>	<u>Emission Factor Set</u>
<b><u>HAPs</u></b>			
3-Methylcholanthrene	0.0000	0.0000000018	lb/MMBtu EPA
7,12-Dimethylbenz(a)anthracene	0.0000	0.0000000157	lb/MMBtu EPA
Formaldehyde	0.0037	0.0008440090	lb/MMBtu GRI Field
Methanol	0.0042	0.0009636360	lb/MMBtu GRI Field
Acetaldehyde	0.0032	0.0007375920	lb/MMBtu GRI Field

1,3-Butadiene	0.0015	0.0003423350	lb/MMBtu	GRI Field
Benzene	0.0033	0.0007480470	lb/MMBtu	GRI Field
Toluene	0.0045	0.0010163310	lb/MMBtu	GRI Field
Ethylbenzene	0.0093	0.0021128220	lb/MMBtu	GRI Field
Xylenes(m,p,o)	0.0058	0.0013205140	lb/MMBtu	GRI Field
2,2,4-Trimethylpentane	0.0124	0.0028417580	lb/MMBtu	GRI Field
n-Hexane	0.0062	0.0014070660	lb/MMBtu	GRI Field
Phenol	0.0000	0.0000001070	lb/MMBtu	GRI Field
Styrene	0.0091	0.0020788960	lb/MMBtu	GRI Field
Naphthalene	0.0000	0.0000005100	lb/MMBtu	GRI Field
2-Methylnaphthalene	0.0000	0.0000001470	lb/MMBtu	GRI Field
Acenaphthylene	0.0000	0.0000000670	lb/MMBtu	GRI Field
Biphenyl	0.0000	0.0000004730	lb/MMBtu	GRI Field
Acenaphthene	0.0000	0.0000000900	lb/MMBtu	GRI Field
Fluorene	0.0000	0.0000000800	lb/MMBtu	GRI Field
Anthracene	0.0000	0.0000000870	lb/MMBtu	GRI Field
Phenanthrene	0.0000	0.0000000600	lb/MMBtu	GRI Field
Fluoranthene	0.0000	0.0000000900	lb/MMBtu	GRI Field
Pyrene	0.0000	0.0000000830	lb/MMBtu	GRI Field
Benz(a)anthracene	0.0000	0.0000000870	lb/MMBtu	GRI Field
Chrysene	0.0000	0.0000001170	lb/MMBtu	GRI Field
Benzo(a)pyrene	0.0000	0.0000000700	lb/MMBtu	GRI Field
Benzo(b)fluoranthene	0.0000	0.0000001500	lb/MMBtu	GRI Field
Benzo(k)fluoranthene	0.0000	0.0000007600	lb/MMBtu	GRI Field
Benzo(g,h,i)perylene	0.0000	0.0000002600	lb/MMBtu	GRI Field
Indeno(1,2,3-c,d)pyrene	0.0000	0.0000001200	lb/MMBtu	GRI Field
Dibenz(a,h)anthracene	0.0000	0.0000001030	lb/MMBtu	GRI Field
Lead	0.0000	0.0000004902	lb/MMBtu	EPA

**Total** 0.0632

### Criteria Pollutants

VOC	0.0236	0.0053921569	lb/MMBtu	EPA
PM	0.0326	0.0074509804	lb/MMBtu	EPA
PM, Condensable	0.0245	0.0055882353	lb/MMBtu	EPA
PM, Filterable	0.0082	0.0018627451	lb/MMBtu	EPA
CO	0.1418	0.0323636360	lb/MMBtu	GRI Field
NMHC	0.0374	0.0085294118	lb/MMBtu	EPA
NOx	0.4249	0.0970167730	lb/MMBtu	GRI Field
SO2	0.0026	0.0005880000	lb/MMBtu	EPA

### Other Pollutants

Dichlorobenzene	0.0000	0.0000011765	lb/MMBtu	EPA
Methane	0.0461	0.0105212610	lb/MMBtu	GRI Field
Acetylene	0.0613	0.0140000000	lb/MMBtu	GRI Field
Ethylene	0.0042	0.0009476310	lb/MMBtu	GRI Field
Ethane	0.0115	0.0026312210	lb/MMBtu	GRI Field
Propylene	0.0103	0.0023454550	lb/MMBtu	GRI Field
Propane	0.0047	0.0010686280	lb/MMBtu	GRI Field
Isobutane	0.0064	0.0014640770	lb/MMBtu	GRI Field
Butane	0.0060	0.0013766990	lb/MMBtu	GRI Field
Cyclopentane	0.0050	0.0011304940	lb/MMBtu	GRI Field
Pentane	0.0152	0.0034671850	lb/MMBtu	GRI Field
n-Pentane	0.0062	0.0014221310	lb/MMBtu	GRI Field
Cyclohexane	0.0040	0.0009183830	lb/MMBtu	GRI Field

Methylcyclohexane	0.0096	0.0022011420	lb/MMBtu	GRI Field
n-Octane	0.0125	0.0028538830	lb/MMBtu	GRI Field
1,2,3-Trimethylbenzene	0.0150	0.0034224540	lb/MMBtu	GRI Field
1,2,4-Trimethylbenzene	0.0150	0.0034224540	lb/MMBtu	GRI Field
1,3,5-Trimethylbenzene	0.0150	0.0034224540	lb/MMBtu	GRI Field
n-Nonane	0.0160	0.0036604170	lb/MMBtu	GRI Field
CO2	515.2941	117.6470588235	lb/MMBtu	EPA

Unit Name: IF1

Hours of Operation: 8,760 Yearly  
Heat Input: 1.0 MMBtu/hr  
Fuel Type: NATURAL GAS  
Device Type: BURNER  
Emission Factor Set: EPA > FIELD > LITERATURE  
Additional EF Set: -NONE-

**Calculated Emissions (ton/yr)**

<u>Chemical Name</u>	<u>Emissions</u>	<u>Emission Factor</u>	<u>Emission Factor Set</u>
<b>HAPs</b>			
3-Methylcholanthrene	0.0000	0.0000000018 lb/MMBtu	EPA
7,12-Dimethylbenz(a)anthracene	0.0000	0.0000000157 lb/MMBtu	EPA
Formaldehyde	0.0003	0.0000735294 lb/MMBtu	EPA
Methanol	0.0019	0.0004333330 lb/MMBtu	GRI Field
Acetaldehyde	0.0013	0.0002909000 lb/MMBtu	GRI Field
1,3-Butadiene	0.0000	0.0000001830 lb/MMBtu	GRI Field
Benzene	0.0000	0.0000020588 lb/MMBtu	EPA
Toluene	0.0000	0.0000033333 lb/MMBtu	EPA
Ethylbenzene	0.0000	0.0000000720 lb/MMBtu	GRI Field
Xylenes(m,p,o)	0.0000	0.0000010610 lb/MMBtu	GRI Field
2,2,4-Trimethylpentane	0.0001	0.0000323000 lb/MMBtu	GRI Field
n-Hexane	0.0077	0.0017647059 lb/MMBtu	EPA
Phenol	0.0000	0.0000000950 lb/MMBtu	GRI Field
Naphthalene	0.0000	0.0000005980 lb/MMBtu	EPA
2-Methylnaphthalene	0.0000	0.0000000235 lb/MMBtu	EPA
Acenaphthylene	0.0000	0.0000000018 lb/MMBtu	EPA
Biphenyl	0.0000	0.0000011500 lb/MMBtu	GRI Field
Acenaphthene	0.0000	0.0000000018 lb/MMBtu	EPA
Fluorene	0.0000	0.0000000027 lb/MMBtu	EPA
Anthracene	0.0000	0.0000000024 lb/MMBtu	EPA
Phenanthrene	0.0000	0.0000000167 lb/MMBtu	EPA
Fluoranthene	0.0000	0.0000000029 lb/MMBtu	EPA
Pyrene	0.0000	0.0000000049 lb/MMBtu	EPA
Benz(a)anthracene	0.0000	0.0000000018 lb/MMBtu	EPA
Chrysene	0.0000	0.0000000018 lb/MMBtu	EPA
Benzo(a)pyrene	0.0000	0.0000000012 lb/MMBtu	EPA
Benzo(b)fluoranthene	0.0000	0.0000000018 lb/MMBtu	EPA
Benzo(k)fluoranthene	0.0000	0.0000000018 lb/MMBtu	EPA
Benzo(g,h,i)perylene	0.0000	0.0000000012 lb/MMBtu	EPA
Indeno(1,2,3-c,d)pyrene	0.0000	0.0000000018 lb/MMBtu	EPA
Dibenz(a,h)anthracene	0.0000	0.0000000012 lb/MMBtu	EPA
Lead	0.0000	0.0000004902 lb/MMBtu	EPA

**Total** 0.0113

**Criteria Pollutants**

VOC	0.0236	0.0053921569 lb/MMBtu	EPA
PM	0.0326	0.0074509804 lb/MMBtu	EPA
PM, Condensable	0.0245	0.0055882353 lb/MMBtu	EPA
PM, Filterable	0.0082	0.0018627451 lb/MMBtu	EPA
CO	0.3607	0.0823529410 lb/MMBtu	EPA
NMHC	0.0374	0.0085294118 lb/MMBtu	EPA
NOx	0.4294	0.0980392157 lb/MMBtu	EPA
SO2	0.0026	0.0005880000 lb/MMBtu	EPA

**Other Pollutants**

Dichlorobenzene	0.0000	0.0000011765 lb/MMBtu	EPA
Methane	0.0099	0.0022549020 lb/MMBtu	EPA
Acetylene	0.0234	0.0053314000 lb/MMBtu	GRI Field
Ethylene	0.0023	0.0005264000 lb/MMBtu	GRI Field
Ethane	0.0133	0.0030392157 lb/MMBtu	EPA
Propylene	0.0041	0.0009333330 lb/MMBtu	GRI Field
Propane	0.0069	0.0015686275 lb/MMBtu	EPA
Butane	0.0090	0.0020588235 lb/MMBtu	EPA
Cyclopentane	0.0002	0.0000405000 lb/MMBtu	GRI Field
Pentane	0.0112	0.0025490196 lb/MMBtu	EPA
n-Pentane	0.0088	0.0020000000 lb/MMBtu	GRI Field
Cyclohexane	0.0002	0.0000451000 lb/MMBtu	GRI Field
Methylcyclohexane	0.0007	0.0001691000 lb/MMBtu	GRI Field
n-Octane	0.0002	0.0000506000 lb/MMBtu	GRI Field
n-Nonane	0.0000	0.0000050000 lb/MMBtu	GRI Field
CO2	515.2941	117.6470588235 lb/MMBtu	EPA

Unit Name: IF2

Hours of Operation: 8,760 Yearly  
 Heat Input: 1.0 MMBtu/hr  
 Fuel Type: NATURAL GAS  
 Device Type: BURNER  
 Emission Factor Set: EPA > FIELD > LITERATURE  
 Additional EF Set: -NONE-

**Calculated Emissions (ton/yr)**

<u>Chemical Name</u>	<u>Emissions</u>	<u>Emission Factor</u>	<u>Emission Factor Set</u>
<b><u>HAPs</u></b>			
3-Methylcholanthrene	0.0000	0.0000000018 lb/MMBtu	EPA
7,12-Dimethylbenz(a)anthracene	0.0000	0.0000000157 lb/MMBtu	EPA
Formaldehyde	0.0003	0.0000735294 lb/MMBtu	EPA
Methanol	0.0019	0.0004333330 lb/MMBtu	GRI Field
Acetaldehyde	0.0013	0.0002909000 lb/MMBtu	GRI Field
1,3-Butadiene	0.0000	0.0000001830 lb/MMBtu	GRI Field
Benzene	0.0000	0.0000020588 lb/MMBtu	EPA
Toluene	0.0000	0.0000033333 lb/MMBtu	EPA
Ethylbenzene	0.0000	0.0000000720 lb/MMBtu	GRI Field
Xylenes(m,p,o)	0.0000	0.0000010610 lb/MMBtu	GRI Field

2,2,4-Trimethylpentane	0.0001	0.0000323000	lb/MMBtu	GRI Field
n-Hexane	0.0077	0.0017647059	lb/MMBtu	EPA
Phenol	0.0000	0.0000000950	lb/MMBtu	GRI Field
Naphthalene	0.0000	0.0000005980	lb/MMBtu	EPA
2-Methylnaphthalene	0.0000	0.0000000235	lb/MMBtu	EPA
Acenaphthylene	0.0000	0.0000000018	lb/MMBtu	EPA
Biphenyl	0.0000	0.0000011500	lb/MMBtu	GRI Field
Acenaphthene	0.0000	0.0000000018	lb/MMBtu	EPA
Fluorene	0.0000	0.0000000027	lb/MMBtu	EPA
Anthracene	0.0000	0.0000000024	lb/MMBtu	EPA
Phenanthrene	0.0000	0.0000000167	lb/MMBtu	EPA
Fluoranthene	0.0000	0.0000000029	lb/MMBtu	EPA
Pyrene	0.0000	0.0000000049	lb/MMBtu	EPA
Benz(a)anthracene	0.0000	0.0000000018	lb/MMBtu	EPA
Chrysene	0.0000	0.0000000018	lb/MMBtu	EPA
Benzo(a)pyrene	0.0000	0.0000000012	lb/MMBtu	EPA
Benzo(b)fluoranthene	0.0000	0.0000000018	lb/MMBtu	EPA
Benzo(k)fluoranthene	0.0000	0.0000000018	lb/MMBtu	EPA
Benzo(g,h,i)perylene	0.0000	0.0000000012	lb/MMBtu	EPA
Indeno(1,2,3-c,d)pyrene	0.0000	0.0000000018	lb/MMBtu	EPA
Dibenz(a,h)anthracene	0.0000	0.0000000012	lb/MMBtu	EPA
Lead	0.0000	0.0000004902	lb/MMBtu	EPA

**Total** 0.0113

### Criteria Pollutants

VOC	0.0236	0.0053921569	lb/MMBtu	EPA
PM	0.0326	0.0074509804	lb/MMBtu	EPA
PM, Condensable	0.0245	0.0055882353	lb/MMBtu	EPA
PM, Filterable	0.0082	0.0018627451	lb/MMBtu	EPA
CO	0.3607	0.0823529410	lb/MMBtu	EPA
NMHC	0.0374	0.0085294118	lb/MMBtu	EPA
NOx	0.4294	0.0980392157	lb/MMBtu	EPA
SO2	0.0026	0.0005880000	lb/MMBtu	EPA

### Other Pollutants

Dichlorobenzene	0.0000	0.0000011765	lb/MMBtu	EPA
Methane	0.0099	0.0022549020	lb/MMBtu	EPA
Acetylene	0.0234	0.0053314000	lb/MMBtu	GRI Field
Ethylene	0.0023	0.0005264000	lb/MMBtu	GRI Field
Ethane	0.0133	0.0030392157	lb/MMBtu	EPA
Propylene	0.0041	0.0009333330	lb/MMBtu	GRI Field
Propane	0.0069	0.0015686275	lb/MMBtu	EPA
Butane	0.0090	0.0020588235	lb/MMBtu	EPA
Cyclopentane	0.0002	0.0000405000	lb/MMBtu	GRI Field
Pentane	0.0112	0.0025490196	lb/MMBtu	EPA
n-Pentane	0.0088	0.0020000000	lb/MMBtu	GRI Field
Cyclohexane	0.0002	0.0000451000	lb/MMBtu	GRI Field
Methylcyclohexane	0.0007	0.0001691000	lb/MMBtu	GRI Field
n-Octane	0.0002	0.0000506000	lb/MMBtu	GRI Field
n-Nonane	0.0000	0.0000050000	lb/MMBtu	GRI Field
CO2	515.2941	117.6470588235	lb/MMBtu	EPA

Unit Name: PS-05

Hours of Operation: 8,760 Yearly  
 Heat Input: 1.0 MMBtu/hr  
 Fuel Type: NATURAL GAS  
 Device Type: HEATER  
 Emission Factor Set: FIELD > EPA > LITERATURE  
 Additional EF Set: -NONE-

**Calculated Emissions (ton/yr)**

<u>Chemical Name</u>	<u>Emissions</u>	<u>Emission Factor</u>	<u>Emission Factor Set</u>
<b>HAPs</b>			
3-Methylcholanthrene	0.0000	0.0000000018 lb/MMBtu	EPA
7,12-Dimethylbenz(a)anthracene	0.0000	0.0000000157 lb/MMBtu	EPA
Formaldehyde	0.0037	0.0008440090 lb/MMBtu	GRI Field
Methanol	0.0042	0.0009636360 lb/MMBtu	GRI Field
Acetaldehyde	0.0032	0.0007375920 lb/MMBtu	GRI Field
1,3-Butadiene	0.0015	0.0003423350 lb/MMBtu	GRI Field
Benzene	0.0033	0.0007480470 lb/MMBtu	GRI Field
Toluene	0.0045	0.0010163310 lb/MMBtu	GRI Field
Ethylbenzene	0.0093	0.0021128220 lb/MMBtu	GRI Field
Xylenes(m,p,o)	0.0058	0.0013205140 lb/MMBtu	GRI Field
2,2,4-Trimethylpentane	0.0124	0.0028417580 lb/MMBtu	GRI Field
n-Hexane	0.0062	0.0014070660 lb/MMBtu	GRI Field
Phenol	0.0000	0.0000001070 lb/MMBtu	GRI Field
Styrene	0.0091	0.0020788960 lb/MMBtu	GRI Field
Naphthalene	0.0000	0.0000005100 lb/MMBtu	GRI Field
2-Methylnaphthalene	0.0000	0.0000001470 lb/MMBtu	GRI Field
Acenaphthylene	0.0000	0.0000000670 lb/MMBtu	GRI Field
Biphenyl	0.0000	0.0000004730 lb/MMBtu	GRI Field
Acenaphthene	0.0000	0.0000000900 lb/MMBtu	GRI Field
Fluorene	0.0000	0.0000000800 lb/MMBtu	GRI Field
Anthracene	0.0000	0.0000000870 lb/MMBtu	GRI Field
Phenanthrene	0.0000	0.0000000600 lb/MMBtu	GRI Field
Fluoranthene	0.0000	0.0000000900 lb/MMBtu	GRI Field
Pyrene	0.0000	0.0000000830 lb/MMBtu	GRI Field
Benz(a)anthracene	0.0000	0.0000000870 lb/MMBtu	GRI Field
Chrysene	0.0000	0.0000001170 lb/MMBtu	GRI Field
Benzo(a)pyrene	0.0000	0.0000000700 lb/MMBtu	GRI Field
Benzo(b)fluoranthene	0.0000	0.0000001500 lb/MMBtu	GRI Field
Benzo(k)fluoranthene	0.0000	0.0000007600 lb/MMBtu	GRI Field
Benzo(g,h,i)perylene	0.0000	0.0000002600 lb/MMBtu	GRI Field
Indeno(1,2,3-c,d)pyrene	0.0000	0.0000001200 lb/MMBtu	GRI Field
Dibenz(a,h)anthracene	0.0000	0.0000001030 lb/MMBtu	GRI Field
Lead	0.0000	0.0000004902 lb/MMBtu	EPA
<b>Total</b>	<b>0.0632</b>		
<b>Criteria Pollutants</b>			
VOC	0.0236	0.0053921569 lb/MMBtu	EPA
PM	0.0326	0.0074509804 lb/MMBtu	EPA
PM, Condensable	0.0245	0.0055882353 lb/MMBtu	EPA
PM, Filterable	0.0082	0.0018627451 lb/MMBtu	EPA
CO	0.1418	0.0323636360 lb/MMBtu	GRI Field

NMHC	0.0374	0.0085294118	lb/MMBtu	EPA
NOx	0.4249	0.0970167730	lb/MMBtu	GRI Field
SO2	0.0026	0.0005880000	lb/MMBtu	EPA

### Other Pollutants

Dichlorobenzene	0.0000	0.0000011765	lb/MMBtu	EPA
Methane	0.0461	0.0105212610	lb/MMBtu	GRI Field
Acetylene	0.0613	0.0140000000	lb/MMBtu	GRI Field
Ethylene	0.0042	0.0009476310	lb/MMBtu	GRI Field
Ethane	0.0115	0.0026312210	lb/MMBtu	GRI Field
Propylene	0.0103	0.0023454550	lb/MMBtu	GRI Field
Propane	0.0047	0.0010686280	lb/MMBtu	GRI Field
Isobutane	0.0064	0.0014640770	lb/MMBtu	GRI Field
Butane	0.0060	0.0013766990	lb/MMBtu	GRI Field
Cyclopentane	0.0050	0.0011304940	lb/MMBtu	GRI Field
Pentane	0.0152	0.0034671850	lb/MMBtu	GRI Field
n-Pentane	0.0062	0.0014221310	lb/MMBtu	GRI Field
Cyclohexane	0.0040	0.0009183830	lb/MMBtu	GRI Field
Methylcyclohexane	0.0096	0.0022011420	lb/MMBtu	GRI Field
n-Octane	0.0125	0.0028538830	lb/MMBtu	GRI Field
1,2,3-Trimethylbenzene	0.0150	0.0034224540	lb/MMBtu	GRI Field
1,2,4-Trimethylbenzene	0.0150	0.0034224540	lb/MMBtu	GRI Field
1,3,5-Trimethylbenzene	0.0150	0.0034224540	lb/MMBtu	GRI Field
n-Nonane	0.0160	0.0036604170	lb/MMBtu	GRI Field
CO2	515.2941	117.6470588235	lb/MMBtu	EPA

Table 1.4-1. EMISSION FACTORS FOR NITROGEN OXIDES (NO<sub>x</sub>) AND CARBON MONOXIDE (CO)  
FROM NATURAL GAS COMBUSTION<sup>a</sup>

Combustor Type (MMBtu/hr Heat Input) [SCC]	NO <sub>x</sub> <sup>b</sup>		CO	
	Emission Factor (lb/10 <sup>6</sup> scf)	Emission Factor Rating	Emission Factor (lb/10 <sup>6</sup> scf)	Emission Factor Rating
Large Wall-Fired Boilers (>100) [1-01-006-01, 1-02-006-01, 1-03-006-01] Uncontrolled (Pre-NSPS) <sup>c</sup> Uncontrolled (Post-NSPS) <sup>c</sup> Controlled - Low NO <sub>x</sub> burners Controlled - Flue gas recirculation	280 190 140 100	A A A D	84 84 84 84	B B B B
Small Boilers (<100) [1-01-006-02, 1-02-006-02, 1-03-006-02, 1-03-006-03] Uncontrolled	100	B	84	B
Controlled - Low NO <sub>x</sub> burners	50	D	84	B
Controlled - Low NO <sub>x</sub> burners/Flue gas recirculation	32	C	84	B
Tangential-Fired Boilers (All Sizes) [1-01-006-04] Uncontrolled	170	A	24	C
Controlled - Flue gas recirculation	76	D	98	D
Residential Furnaces (<0.3) [No SCC] Uncontrolled	94	B	40	B

<sup>a</sup> Reference 11. Units are in pounds of pollutant per million standard cubic feet of natural gas fired. To convert from lb/10<sup>6</sup> scf to kg/10<sup>6</sup> m<sup>3</sup>, multiply by 16. Emission factors are based on an average natural gas higher heating value of 1,020 Btu/scf. To convert from lb/10<sup>6</sup> scf to lb/MMBtu, divide by 1,020. The emission factors in this table may be converted to other natural gas heating values by multiplying the given emission factor by the ratio of the specified heating value to this average heating value. SCC = Source Classification Code. ND = no data. NA = not applicable.

<sup>b</sup> Expressed as NO<sub>x</sub>. For large and small wall fired boilers with SNCR control, apply a 24 percent reduction to the appropriate NO<sub>x</sub> emission factor. For tangential-fired boilers with SNCR control, apply a 13 percent reduction to the appropriate NO<sub>x</sub> emission factor.

<sup>c</sup> NSPS=New Source Performance Standard as defined in 40 CFR 60 Subparts D and Db. Post-NSPS units are boilers with greater than 250 MMBtu/hr of heat input that commenced construction modification, or reconstruction after August 17, 1971, and units with heat input capacities between 100 and 250 MMBtu/hr that commenced construction modification, or reconstruction after June 19, 1984.

TABLE 1.4-2. EMISSION FACTORS FOR CRITERIA POLLUTANTS AND GREENHOUSE GASES FROM NATURAL GAS COMBUSTION<sup>a</sup>

Pollutant	Emission Factor (lb/10 <sup>6</sup> scf)	Emission Factor Rating
CO <sub>2</sub> <sup>b</sup>	120,000	A
Lead	0.0005	D
N <sub>2</sub> O (Uncontrolled)	2.2	E
N <sub>2</sub> O (Controlled-low-NO <sub>x</sub> burner)	0.64	E
PM (Total) <sup>c</sup>	7.6	D
PM (Condensable) <sup>c</sup>	5.7	D
PM (Filterable) <sup>c</sup>	1.9	B
SO <sub>2</sub> <sup>d</sup>	0.6	A
TOC	11	B
Methane	2.3	B
VOC	5.5	C

<sup>a</sup> Reference 11. Units are in pounds of pollutant per million standard cubic feet of natural gas fired. Data are for all natural gas combustion sources. To convert from lb/10<sup>6</sup> scf to kg/10<sup>6</sup> m<sup>3</sup>, multiply by 16. To convert from lb/10<sup>6</sup> scf to lb/MMBtu, divide by 1,020. The emission factors in this table may be converted to other natural gas heating values by multiplying the given emission factor by the ratio of the specified heating value to this average heating value. TOC = Total Organic Compounds. VOC = Volatile Organic Compounds.

<sup>b</sup> Based on approximately 100% conversion of fuel carbon to CO<sub>2</sub>. CO<sub>2</sub>[lb/10<sup>6</sup> scf] = (3.67) (CON) (C)(D), where CON = fractional conversion of fuel carbon to CO<sub>2</sub>, C = carbon content of fuel by weight (0.76), and D = density of fuel, 4.2x10<sup>4</sup> lb/10<sup>6</sup> scf.

<sup>c</sup> All PM (total, condensable, and filterable) is assumed to be less than 1.0 micrometer in diameter. Therefore, the PM emission factors presented here may be used to estimate PM<sub>10</sub>, PM<sub>2.5</sub> or PM<sub>1</sub> emissions. Total PM is the sum of the filterable PM and condensable PM. Condensable PM is the particulate matter collected using EPA Method 202 (or equivalent). Filterable PM is the particulate matter collected on, or prior to, the filter of an EPA Method 5 (or equivalent) sampling train.

<sup>d</sup> Based on 100% conversion of fuel sulfur to SO<sub>2</sub>. Assumes sulfur content is natural gas of 2,000 grains/10<sup>6</sup> scf. The SO<sub>2</sub> emission factor in this table can be converted to other natural gas sulfur contents by multiplying the SO<sub>2</sub> emission factor by the ratio of the site-specific sulfur content (grains/10<sup>6</sup> scf) to 2,000 grains/10<sup>6</sup> scf.

## 1.5 Liquefied Petroleum Gas Combustion

### 1.5.1 General<sup>1</sup>

Liquefied petroleum gas (LPG or LP-gas) consists of propane, propylene, butane, and butylenes; the product used for domestic heating is composed primarily of propane. This gas, obtained mostly from gas wells (but also, to a lesser extent, as a refinery by-product) is stored as a liquid under moderate pressures. There are three grades of LPG available as heating fuels: commercial-grade propane, engine fuel-grade propane (also known as HD-5 propane), and commercial-grade butane. In addition, there are high-purity grades of LPG available for laboratory work and for use as aerosol propellants. Specifications for the various LPG grades are available from the American Society for Testing and Materials and the Gas Processors Association. A typical heating value for commercial-grade propane and HD-5 propane is 90,500 British thermal units per gallon (Btu/gal), after vaporization; for commercial-grade butane, the value is 97,400 Btu/gal.

The largest market for LPG is the domestic/commercial market, followed by the chemical industry (where it is used as a petrochemical feedstock) and the agriculture industry. Propane is also used as an engine fuel as an alternative to gasoline and as a standby fuel for facilities that have interruptible natural gas service contracts.

### 1.5.2 Firing Practices<sup>2</sup>

The combustion processes that use LPG are very similar to those that use natural gas. Use of LPG in commercial and industrial applications may require a vaporizer to provide the burner with the proper mix of air and fuel. The burner itself will usually have different fuel injector tips as well as different fuel-to-air ratio controller settings than a natural gas burner since the LPG stoichiometric requirements are different than natural gas requirements. LPG is fired as a primary and backup fuel in small commercial and industrial boilers and space heating equipment and can be used to generate heat and process steam for industrial facilities and in most domestic appliances that typically use natural gas.

### 1.5.3 Emissions<sup>1,3-5</sup>

#### 1.5.3.1 Criteria Pollutants -

LPG is considered a "clean" fuel because it does not produce visible emissions. However, gaseous pollutants such as nitrogen oxides ( $\text{NO}_x$ ), carbon monoxide (CO), and organic compounds are produced as are small amounts of sulfur dioxide ( $\text{SO}_2$ ) and particulate matter (PM). The most significant factors affecting  $\text{NO}_x$ , CO, and organic emissions are burner design, burner adjustment, boiler operating parameters, and flue gas venting. Improper design, blocking and clogging of the flue vent, and insufficient combustion air result in improper combustion and the emission of aldehydes, CO, hydrocarbons, and other organics.  $\text{NO}_x$  emissions are a function of a number of variables, including temperature, excess air, fuel and air mixing, and residence time in the combustion zone. The amount of  $\text{SO}_2$  emitted is directly proportional to the amount of sulfur in the fuel. PM emissions are very low and result from soot, aerosols formed by condensable emitted species, or boiler scale dislodged during combustion. Emission factors for LPG combustion are presented in Table 1.5-1.

Table 1.5-1 presents emission factors on a volume basis (lb/ $10^3$ gal). To convert to an energy basis (lb/MMBtu), divide by a heating value of 91.5 MMBtu/ $10^3$ gal for propane and 102 MMBtu/ $10^3$ gal for butane.

#### 1.5.3.2 Greenhouse Gases<sup>6-11</sup> -

Carbon dioxide ( $\text{CO}_2$ ), methane ( $\text{CH}_4$ ), and nitrous oxide ( $\text{N}_2\text{O}$ ) emissions are all produced during LPG combustion. Nearly all of the fuel carbon (99.5 percent) in LPG is converted to  $\text{CO}_2$  during the combustion process. This conversion is relatively independent of firing configuration. Although the formation of CO acts to reduce  $\text{CO}_2$  emissions, the amount of CO produced is insignificant compared to the amount of  $\text{CO}_2$  produced. The majority of the 0.5 percent of fuel carbon not converted to  $\text{CO}_2$  is due to incomplete combustion in the fuel stream.

Formation of N<sub>2</sub>O during the combustion process is governed by a complex series of reactions and its formation is dependent upon many factors. Formation of N<sub>2</sub>O is minimized when combustion temperatures are kept high (above 1475°F) and excess air is kept to a minimum (less than 1 percent).

Methane emissions are highest during periods of low-temperature combustion or incomplete combustion, such as the start-up or shut-down cycle for boilers. Typically, conditions that favor formation of N<sub>2</sub>O also favor emissions of CH<sub>4</sub>.

#### 1.5.4 Controls

The only controls developed for LPG combustion are to reduce NO<sub>x</sub> emissions. NO<sub>x</sub> controls have been developed for firetube and watertube boilers firing propane or butane. Vendors are now guaranteeing retrofit systems to levels as low as 30 to 40 ppm (based on 3 percent oxygen). These systems use a combination of low-NO<sub>x</sub> burners and flue gas recirculation (FGR). Some burner vendors use water or steam injection into the flame zone for NO<sub>x</sub> reduction. This is a trimming technique which may be necessary during backup fuel periods because LPG typically has a higher NO<sub>x</sub>-forming potential than natural gas; conventional natural gas emission control systems may not be sufficient to reduce LPG emissions to mandated levels. Also, LPG burners are more prone to sooting under the modified combustion conditions required for low NO<sub>x</sub> emissions. The extent of allowable combustion modifications for LPG may be more limited than for natural gas.

One NO<sub>x</sub> control system that has been demonstrated on small commercial boilers is FGR. NO<sub>x</sub> emissions from propane combustion can be reduced by as much as 50 percent by recirculating about 16 percent of the flue gas. NO<sub>x</sub> emission reductions of over 60 percent have been achieved with FGR and low-NO<sub>x</sub> burners used in combination.

#### 1.5.5 Updates Since the Fifth Edition

The Fifth Edition was released in January 1995. Revisions to this section since that date are summarized below. For further detail, consult the memoranda describing each supplement or the background report for this section.

##### Supplement A, February 1996

No changes.

##### Supplement B, October 1996

- Text was added concerning firing practices.
- The CO<sub>2</sub> emission factor was updated.
- Emission factors were added for N<sub>2</sub>O and CH<sub>4</sub>.

##### July 2008

The PM filterable, NO<sub>x</sub>, CO and TOC emissions factors were updated and the PM condensable and PM total emissions factors were added using the revised PM, NO<sub>x</sub>, CO and TOC emissions factors for natural gas combustion for small boilers (see July 1998 revisions to section 1.4, Natural Gas Combustion).

Table 1.5-1. EMISSION FACTORS FOR LPG COMBUSTION<sup>a</sup>

## EMISSION FACTOR RATING: E

Pollutant	Butane Emission Factor (lb/10 <sup>3</sup> gal)		Propane Emission Factor (lb/10 <sup>3</sup> gal)	
	Industrial Boilers <sup>b</sup> (SCC 1-02-010-01)	Commercial Boilers <sup>c</sup> (SCC 1-03-010-01)	Industrial Boilers <sup>b</sup> (SCC 1-02-010-02)	Commercial Boilers <sup>c</sup> (SCC 1-03-010-02)
PM, Filterable <sup>d</sup>	0.2	0.2	0.2	0.2
PM, Condensable	0.6	0.6	0.5	0.5
PM, Total	0.8	0.8	0.7	0.7
SO <sub>2</sub> <sup>e</sup>	0.09S	0.09S	0.10S	0.10S
NO <sub>x</sub> <sup>f</sup>	15	15	13	13
N <sub>2</sub> O <sup>g</sup>	0.9	0.9	0.9	0.9
CO <sub>2</sub> <sup>h,j</sup>	14,300	14,300	12,500	12,500
CO	8.4	8.4	7.5	7.5
TOC	1.1	1.1	1.0	1.0
CH <sub>4</sub> <sup>k</sup>	0.2	0.2	0.2	0.2

<sup>a</sup> Assumes PM, CO, and TOC emissions are the same, on a heat input basis, as for natural gas combustion. Use heat contents of 91.5 x 10<sup>6</sup> Btu/10<sup>3</sup> gallon for propane, 102 x 10<sup>6</sup> Btu/10<sup>3</sup> gallon for butane, 1020 x 10<sup>6</sup> Btu/10<sup>6</sup> scf for methane when calculating an equivalent heat input basis. For example, the equation for converting from methane's emissions factors to propane's emissions factors is as follows: lb pollutant/10<sup>3</sup> gallons of propane = (lb pollutant /10<sup>6</sup> ft<sup>3</sup> methane) \* (91.5 x 10<sup>6</sup> Btu/10<sup>3</sup> gallons of propane) / (1020 x 10<sup>6</sup> Btu/10<sup>6</sup> scf of methane). The NO<sub>x</sub> emission factors have been multiplied by a correction factor of 1.5, which is the approximate ratio of propane/butane NO<sub>x</sub> emissions to natural gas NO<sub>x</sub> emissions. To convert from lb/10<sup>3</sup> gal to kg/10<sup>3</sup> L, multiply by 0.12. SCC = Source Classification Code.

<sup>b</sup> Heat input capacities generally between 10 and 100 million Btu/hour.

<sup>c</sup> Heat input capacities generally between 0.3 and 10 million Btu/hour.

<sup>d</sup> Filterable particulate matter (PM) is that PM collected on or prior to the filter of an EPA Method 5 (or equivalent) sampling train. For natural gas, a fuel with similar combustion characteristics, all PM is less than 10 μm in aerodynamic equivalent diameter (PM-10).

<sup>e</sup> S equals the sulfur content expressed in gr/100 ft<sup>3</sup> gas vapor. For example, if the butane sulfur content is 0.18 gr/100 ft<sup>3</sup>, the emission factor would be (0.09 x 0.18) = 0.016 lb of SO<sub>2</sub>/10<sup>3</sup> gal butane burned.

<sup>f</sup> Expressed as NO<sub>2</sub>.

<sup>g</sup> Reference 12.

<sup>h</sup> Assuming 99.5% conversion of fuel carbon to CO<sub>2</sub>.

<sup>j</sup> EMISSION FACTOR RATING = C.

<sup>k</sup> Reference 13.

## References For Section 1.5

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2. Emission Factor Documentation for AP-42 Section 1.5. *Liquefied Petroleum Gas Combustion*. April 1993.
3. *Air Pollutant Emission Factors*, Final Report, Contract No. CPA-22-69-119, Resources Research, Inc., Reston, VA, Durham, NC, April 1970.
4. *Nitrous Oxide Reduction With The Weishaupt Flue Gas Recirculation System*, Weishaupt Research and Development Institute, January 1987.
5. Phone communication memorandum of conversation between B. Lusher of Acurex Environmental and D. Childress of Suburban/Petrolane, Durham, NC, May 14, 1992.
6. L. P. Nelson, *et al.*, *Global Combustion Sources Of Nitrous Oxide Emissions*, Research Project 2333-4 Interim Report, Radian Corporation, Sacramento, CA, 1991.
7. R. L. Peer, *et al.*, *Characterization Of Nitrous Oxide Emission Sources*, EPA Contract No. 68-D1-0031, Research Triangle Park, NC, 1995.
8. S. D. Piccot, *et al.*, *Emissions And Cost Estimates For Globally Significant Anthropogenic Combustion Sources Of NO<sub>x</sub>, N<sub>2</sub>O, CH<sub>4</sub>, CO, And CO<sub>2</sub>*, EPA Contract No. 68-02-4288, Research Triangle Park, NC, 1990.
9. G. Marland and R. M. Rotty, *Carbon Dioxide Emissions From Fossil Fuels: A Procedure For Estimation And Results For 1951-1981*, DOE/NBB-0036 TR-003, Carbon Dioxide Research Division, Office of Energy Research, U.S. Department of Energy, Oak Ridge, TN, 1983.
10. G. Marland and R.M. Rotty, *Carbon Dioxide Emissions From Fossil Fuels: A Procedure For Estimation And Results For 1950-1982*, *Tellus*, 36B: 232-261.
11. *Sector-Specific Issues And Reporting Methodologies Supporting The General Guidelines For The Voluntary Reporting Of Greenhouse Gases Under Section 1605(b) Of The Energy Policy Act Of 1992*, Volume 2 of 3, DOE/PO-0028, U.S. Department of Energy, 1994.
12. A. Rosland, *Greenhouse Gas Emissions In Norway: Inventories And Estimation Methods*, Ministry of Environment, Oslo, Norway, 1993.
13. *Inventory Methods Manual For Estimating Canadian Emissions Of Greenhouse Gases*, Prepared for Environment Canada by Ortech Corporation, 1994.

Table 3.2-3. UNCONTROLLED EMISSION FACTORS FOR 4-STROKE RICH-BURN  
 ENGINES<sup>a</sup>  
 (SCC 2-02-002-53)

Pollutant	Emission Factor (lb/MMBtu) <sup>b</sup> (fuel input)	Emission Factor Rating
Criteria Pollutants and Greenhouse Gases		
NO <sub>x</sub> <sup>c</sup> 90 - 105% Load	2.21 E+00	A
NO <sub>x</sub> <sup>c</sup> <90% Load	2.27 E+00	C
CO <sup>c</sup> 90 - 105% Load	3.72 E+00	A
CO <sup>c</sup> <90% Load	3.51 E+00	C
CO <sub>2</sub> <sup>d</sup>	1.10 E+02	A
SO <sub>2</sub> <sup>e</sup>	5.88 E-04	A
TOC <sup>f</sup>	3.58 E-01	C
Methane <sup>g</sup>	2.30 E-01	C
VOC <sup>h</sup>	2.96 E-02	C
PM10 (filterable) <sup>i,j</sup>	9.50 E-03	E
PM2.5 (filterable) <sup>j</sup>	9.50 E-03	E
PM Condensable <sup>k</sup>	9.91 E-03	E
Trace Organic Compounds		
1,1,2,2-Tetrachloroethane <sup>l</sup>	2.53 E-05	C
1,1,2-Trichloroethane <sup>l</sup>	<1.53 E-05	E
1,1-Dichloroethane	<1.13 E-05	E
1,2-Dichloroethane	<1.13 E-05	E
1,2-Dichloropropane	<1.30 E-05	E
1,3-Butadiene <sup>l</sup>	6.63 E-04	D
1,3-Dichloropropene <sup>l</sup>	<1.27 E-05	E
Acetaldehyde <sup>l,m</sup>	2.79 E-03	C
Acrolein <sup>l,m</sup>	2.63 E-03	C
Benzene <sup>l</sup>	1.58 E-03	B
Butyr/isobutyraldehyde	4.86 E-05	D
Carbon Tetrachloride <sup>l</sup>	<1.77 E-05	E

Table 3.2-3. UNCONTROLLED EMISSION FACTORS FOR 4-STROKE RICH-BURN ENGINES  
(Concluded)

Pollutant	Emission Factor (lb/MMBtu) <sup>b</sup> (fuel input)	Emission Factor Rating
Chlorobenzene <sup>1</sup>	<1.29 E-05	E
Chloroform <sup>1</sup>	<1.37 E-05	E
Ethane <sup>n</sup>	7.04 E-02	C
Ethylbenzene <sup>1</sup>	<2.48 E-05	E
Ethylene Dibromide <sup>1</sup>	<2.13 E-05	E
Formaldehyde <sup>1,m</sup>	2.05 E-02	A
Methanol <sup>1</sup>	3.06 E-03	D
Methylene Chloride <sup>1</sup>	4.12 E-05	C
Naphthalene <sup>1</sup>	<9.71 E-05	E
PAH <sup>1</sup>	1.41 E-04	D
Styrene <sup>1</sup>	<1.19 E-05	E
Toluene <sup>1</sup>	5.58 E-04	A
Vinyl Chloride <sup>1</sup>	<7.18 E-06	E
Xylene <sup>1</sup>	1.95 E-04	A

<sup>a</sup> Reference 7. Factors represent uncontrolled levels. For NO<sub>x</sub>, CO, and PM-10, “uncontrolled” means no combustion or add-on controls; however, the factor may include turbocharged units. For all other pollutants, “uncontrolled” means no oxidation control; the data set may include units with control techniques used for NO<sub>x</sub> control, such as PCC and SCR for lean burn engines, and PSC for rich burn engines. Factors are based on large population of engines. Factors are for engines at all loads, except as indicated. SCC = Source Classification Code. TOC = Total Organic Compounds. PM10 = Particulate Matter ≤ 10 microns (μm) aerodynamic diameter. A “<” sign in front of a factor means that the corresponding emission factor is based on one-half of the method detection limit.

<sup>b</sup> Emission factors were calculated in units of (lb/MMBtu) based on procedures in EPA Method 19. To convert from (lb/MMBtu) to (lb/10<sup>6</sup> scf), multiply by the heat content of the fuel. If the heat content is not available, use 1020 Btu/scf. To convert from (lb/MMBtu) to (lb/hp-hr) use the following equation:

$$\text{lb/hp-hr} = (\text{lb/MMBtu}) (\text{heat input, MMBtu/hr}) (1/\text{operating HP, 1/hp})$$

<sup>c</sup> Emission tests with unreported load conditions were not included in the data set.

<sup>d</sup> Based on 99.5% conversion of the fuel carbon to CO<sub>2</sub>. CO<sub>2</sub> [lb/MMBtu] = (3.67)(%CON)(C)(D)(1/h), where %CON = percent conversion of fuel carbon to CO<sub>2</sub>,

C = carbon content of fuel by weight (0.75), D = density of fuel, 4.1 E+04 lb/10<sup>6</sup> scf, and h = heating value of natural gas (assume 1020 Btu/scf at 60°F).

<sup>e</sup> Based on 100% conversion of fuel sulfur to SO<sub>2</sub>. Assumes sulfur content in natural gas of 2,000 gr/10<sup>6</sup> scf.

<sup>f</sup> Emission factor for TOC is based on measured emission levels from 6 source tests.

<sup>g</sup> Emission factor for methane is determined by subtracting the VOC and ethane emission factors from the TOC emission factor.

<sup>h</sup> VOC emission factor is based on the sum of the emission factors for all speciated organic compounds. Methane and ethane emissions were not measured for this engine category.

<sup>i</sup> No data were available for uncontrolled engines. PM10 emissions are for engines equipped with a PCC.

<sup>j</sup> Considered  $\leq 1 \mu\text{m}$  in aerodynamic diameter. Therefore, for filterable PM emissions, PM10(filterable) = PM2.5(filterable).

<sup>k</sup> No data were available for condensable emissions. The presented emission factor reflects emissions from 4SLB engines.

<sup>l</sup> Hazardous Air Pollutant as defined by Section 112(b) of the Clean Air Act.

<sup>m</sup> For rich-burn engines, no interference is suspected in quantifying aldehyde emissions. The presented emission factors are based on FTIR and CARB 430 emissions data measurements.

<sup>n</sup> Ethane emission factor is determined by subtracting the VOC emission factor from the NMHC emission factor.

Table 12.9-2 (English Units). PARTICULATE EMISSION FACTORS FOR FURNACES USED IN SECONDARY COPPER SMELTING AND ALLOYING PROCESS<sup>a</sup>

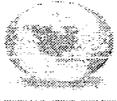
Furnace And Charge Type	Control Equipment	Total Particulate	EMISSION FACTOR RATING	PM-10 <sup>b</sup>	EMISSION FACTOR RATING	Lead <sup>c</sup>	EMISSION FACTOR RATING
<b>Cupola</b>							
Scrap iron (SCC 3-04-002-13)	None	0.003	B	ND	NA	ND	NA
Insulated copper wire (SCC 3-04-002-11)	None	230	B	211.6	E	ND	NA
	ESP <sup>d</sup>	10	B	ND	NA	ND	NA
Scrap copper and brass (SCC 3-04-002-12)	None	70	B	64.4	E	ND	NA
	ESP <sup>d</sup>	2.4		ND	NA	ND	NA
Fugitive emissions <sup>b</sup> (SCC 3-04-002-34)	None	ND	NA	2.2	E	ND	NA
<b>Reverberatory furnace</b>							
High lead alloy (58%) (SCC 3-04-002-43)	None	ND	NA	ND	NA	50	B
Red/yellow brass (SCC 3-04-002-44)	None	ND	NA	ND	NA	13.2	B
Other alloy (7%) (SCC 3-04-002-42)	None	ND	NA	ND	NA	5.0	B
Copper (SCC 3-04-002-14)	None	5.1	B	5.1	E	ND	NA
	Baghouse	0.4	B	ND	NA	ND	NA
Brass and bronze (SCC 3-04-002-15)	None	36	B	21.2	E	ND	NA
	Baghouse	2.6	B	ND	NA	ND	NA
Fugitive emissions <sup>b</sup> (SCC 3-04-002-35)	None	ND	NA	3.1	E	ND	NA
<b>Rotary furnace</b>							
Brass and bronze (SCC 3-04-002-17)	None	300	B	177.0	E	ND	NA
	ESP <sup>d</sup>	13	B	ND	NA	ND	NA
Fugitive emissions <sup>b</sup> (SCC 3-04-002-36)	None	ND	NA	2.6	E	ND	NA
<b>Crucible and pot furnace</b>							
Brass and bronze (SCC 3-04-002-19)	None	21	B	12.4	E	ND	NA
	ESP <sup>d</sup>	1	B	ND	NA	ND	NA
Fugitive emissions <sup>b</sup> (SCC 3-04-002-37)	None	ND	NA	0.29	E	ND	NA
<b>Electric arc furnace</b>							
Copper (SCC 3-04-002-20)	None	5	B	5	E	ND	NA
	Baghouse	1	B	ND	NA	ND	NA
Brass and bronze (SCC 3-04-002-21)	None	11	B	6.5	E	ND	NA
	Baghouse	6	B	ND	NA	ND	NA
<b>Electric induction furnace</b>							
Copper (SCC 3-04-002-23)	None	7	B	7	E	ND	NA
	Baghouse	0.5	B	ND	NA	ND	NA
Brass and bronze (SCC 3-04-002-24)	None	20	B	20	E	ND	NA
	Baghouse	0.7	B	ND	NA	ND	NA
Fugitive emissions <sup>b</sup> (SCC 3-04-002-38)	None	ND	NA	0.04	E	ND	NA

Table 12.9-2 (cont.).

- <sup>a</sup> Expressed as lb of pollutant/ton ore processed. The information for particulate in Table 12.9-2 was based on unpublished data furnished by the following:  
Philadelphia Air Management Services, Philadelphia, PA.  
New Jersey Department of Environmental Protection, Trenton, NJ.  
New Jersey Department of Environmental Protection, Metro Field Office, Springfield, NJ.  
New Jersey Department of Environmental Protection, Newark Field Office, Newark, NJ.  
New York State Department of Environmental Conservation, New York, NY.  
The City of New York Department of Air Resources, New York, NY.  
Cook County Department of Environmental Control, Maywood, IL.  
Wayne County Department of Health, Air Pollution Division, Detroit, MI.  
City of Cleveland Department of Public Health and Welfare, Division of Air Pollution Control, Cleveland, OH.  
State of Ohio Environmental Protection Agency, Columbus, OH.  
City of Chicago Department of Environmental Control, Chicago, IL.  
South Coast Air Quality Management District, Los Angeles, CA.
- <sup>b</sup> PM-10 and fugitive emissions are listed in *Airs Facility Subsystem Source Classification Codes and Emission Factor Listing for Criteria Air Pollutants*, U.S Environmental Protection Agency, EPA 450/4-90-003, March 1990. These estimates should be considered to have an emission factor rating of E.
- <sup>c</sup> References 1,6-7. Expressed as lb of pollutant/ton product.
- <sup>d</sup> ESP = electrostatic precipitator.

References For Section 12.9

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2. *Air Pollution Aspects Of Brass And Bronze Smelting And Refining Industry*, U. S. Department Of Health, Education And Welfare, National Air Pollution Control Administration, Raleigh, NC, Publication No. AP-58, November 1969.
3. J. A. Danielson (ed.), *Air Pollution Engineering Manual (2nd Ed.)*, AP-40, U. S. Environmental Protection Agency, Research Triangle Park, NC, 1973. Out of Print.
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FW: 10.95080-G54  
Lynda Magritz at Baldor -Generators to: giwaszek

09/11/2008 03:26 PM

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**From:** Lynda Magritz at Baldor-Generators  
**Sent:** Thursday, September 11, 2008 3:15 PM  
**To:** 'giwaszk@trinityconsultants.com'  
**Subject:** 10.95080-G54

George,

Per our phone conversation, please see the attached engine data sheet and the emissions spreadsheet. I highlighted the row that is applicable for the unit that you have.

If you have any questions, please feel free to contact me.

Regards,

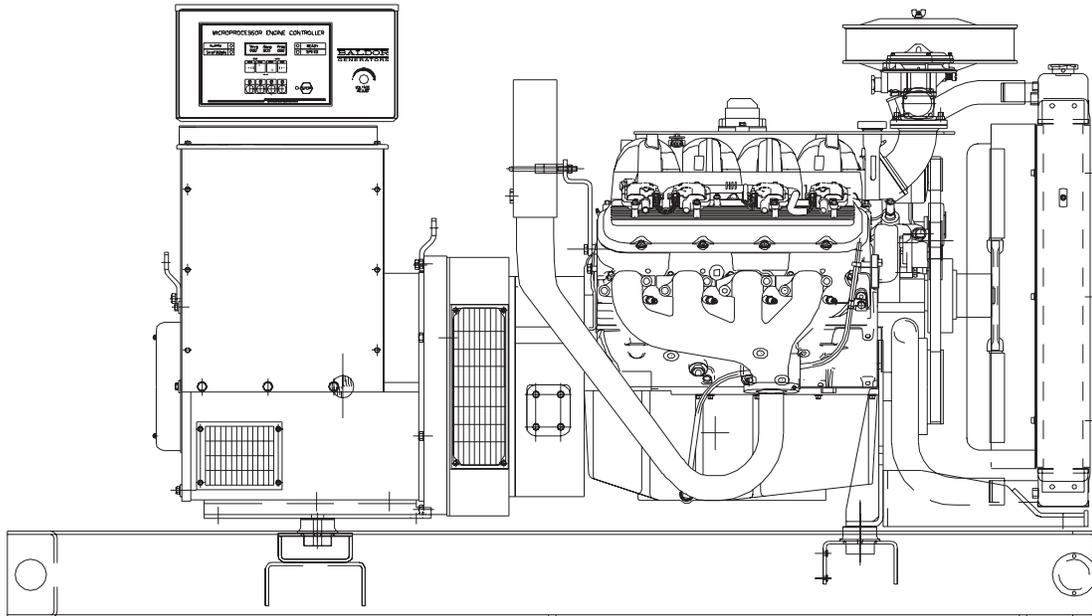
Lynda Magritz  
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8100\_brochure.pdf Nat Gas Emissions Typical.xls

Typical Open-Loop emissions data - natural gas

<u>ENGINE MODEL</u>	<u>CO grams/hour</u>	<u>HC grams/hour</u>	<u>NOX grams/hour</u>
<u>1.6L</u>	810-2700	35-54	51-140
<u>3.0L</u>	1380-4600	59-92	87-239
<u>3.0L HO</u>	1650-5500	72-110	105-286
<u>4.3L</u>	1920-6400	83-128	122-333
<u>5.0L</u>	2220-7400	96-148	141-385
<u>5.7L</u>	2940-9800	127-196	186-510
<u>5.7LT</u>	4110-13700	178-274	260-712
<u>8.1L</u>	3600-10000	156-240	228-624
<u>8.1L mod cam</u>	4680-15600	203-312	296-811
<u>8.1LT</u>	6300-21000	273-420	399-1092



## Standby or Prime Power Features

- Heavy-duty gaseous GM industrial engine
- Brushless synchronous alternators: four-pole construction, dynamically balanced
- Full featured microprocessor based controller: fully programmable for maximum flexibility
- Prototype tested and production tested
- Gen-set accepts rated load in one step
- UL2200 available – consult factory
- Optional weather-proof and sound attenuated enclosures available
- Full range of accessories and options available
- Heavy-duty construction for use in prime or standby application
- Manufactured in an ISO-9001 certified facility
- Backed by a world wide network of parts and service centers

## Gen Set Ratings

Model GLC80				Natural Gas				LP Gas			
				150°C Rise Standby Rating		105°C Rise Prime Rating		150°C Rise Standby Rating		105°C Rise Prime Rating	
Generator	Voltage	Phase	Hz	kW/kVA	Amps	kW/kVA	Amps	kW/kVA	Amps	kW/kVA	Amps
UCI274C	120/208	3	60	80/100	278	72/90	250	80/100	278	72/90	250
	127/220	3	60	80/100	262	72/90	236	80/100	262	72/90	236
	120/240	3	60	80/100	241	72/90	216	80/100	241	72/90	216
	139/240	3	60	80/100	241	72/90	216	80/100	241	72/90	216
	220/380	3	60	80/100	152	71/89	135	80/100	152	71/89	135
	277/480	3	60	80/100	120	72/90	108	80/100	120	72/90	108
UCI224G	120/240	1	60	80/80	667/333	72/72	600/300	80/80	667/333	72/72	600/300

### IMPORTANT NOTES:

- For ratings and voltages not listed above consult Factory
- Standby ratings do not have an overload capability but can be used for the duration of the utility failure per ISO-3046, DIN6271 and BS5514
- Prime (Unlimited Running Time) ratings are continuous per DIN 6271 and ISO-3046 with 10% overload capacity
- Base Load (Continuous) ratings are continuous per DIN 6271, BS5514 and ISO-8528 with no sustained overload capacity. Consult factory for Base Load ratings.
- Altitude derate is 4% for each 1000 feet over 5000
- Temperature derate is 1% for 10°F over 100°F ambient

# Controls Digital Control Module

## Controller

- Microprocessor-based circuitry
- Standard features meet requirements of NFPA110 Level 1
- Backlit LCD display
- Digital 3-phase voltage, current & frequency metering
- Up to 28 alarm/shutdown fault circuits analog/digital inputs
- EMI/RFI noise immunity per IEEE C62.41
- Certified to UL #508

## Standard Features

- Timers – Engine start, Cooldown, Oil Bypass, Cycle crank
- Control switches – Run/Auto/Load test, horn test, Lamp test, Common
- LCD Display menu – AC metering, timer, Alarm/shutdown, engine
- Diagnostic LED indicators – Watchdog (CPU running), run output energized, remote start signal initiated, common fail output energized

- Fully configurable from front panel keypad
- Password protected
- Low Oil Pressure Alarm Light
- High Coolant Temperature Alarm Light
- Overspeed Alarm Light

## Shutdowns

- Overspeed
- Over-crank
- Loss of speed signal
- High engine temperature
- Low Oil Pressure Shutdown
- Emergency stop

# Engine Technical Data

Manufacturer	General Motors
Engine Model & Type	Vortec, 4 cycle, Natural Aspiration
Cylinder Configuration	V-8
Displacement - cu. in.(Liters)	496 (8.1)
Bore and Stroke - in. - mm	4.25 x 4.37 (107.95 x 111)
Compression ratio	9.1:1
Water pump type	Centrifugal
Piston speed, M/sec. (ft./min)	6.66 (1311)
Rated rpm	1800
Max. power at rated rpm, kW (Hp)	112 (150)
Fuel type	LP Gas or Natural Gas
Governor type	Electronic
Governor make	Woodward
Frequency regulation, steady state	+/- 0.5%
Frequency regulation, no load to full load	Isochronous
Air filter type	Dry
Oil pan capacity qt (L)	5.0 (4.7)
Oil pan capacity w/filter – qt – liters	6.5 (6.2)
Oil Filter: quantity, type	1, Cartridge
Rec'd oil type - SF/CC/CD-10°F to 90°F	5W-30
<b>Battery charging alternator:</b>	
- Ground (negative/positive)	Negative
- Volts (DC)	12
- Ampere rating	70
Battery voltage	12VDC

# Gen Set Technical Data

## Alternator Technical Data

Generator Frame	274	Voltage Regulation NL - FL	+/- 1.5%
Exciter	Brushless	Underspeed Protection	Standard
Cooling Fan	Cast alloy aluminum	Overexcitation Protection	Standard
Bearing	Single, double shielded	Overvoltage Protection	Optional
Connection Type	Reconnectable	Loss of Sensing Protection	Standard
Insulation Type	Class H	Overspeed	2250 RPM
Windings	100% copper	Standards	NEMA, IEC, IEEE, CSA, BS
Pitch	2/3	Phase Sequence	A(U),B(V),C(W)
Amortisseur Winding	Full	TIF (1960 Weightings)	<50
Voltage Regulator	SX460	Excitation System	PMG - optional
SKVA output with 30% voltage dip max. 480V @ 60 Hz = 345			

## Fuel System Requirements

Fuel Type	LP Gas or Natural Gas
Fuel supply line inlet	1" NPTF
Natural gas/LpG fuel supply pressure, oz./in. <sup>2</sup> (in H <sub>2</sub> O)	1.74 – 2.74 (7.0 – 11.0)

**NOTE:** Ratings based on 60 Hz

## Exhaust System Requirements

Exhaust flow at rated kW, m <sup>3</sup> /min. (cfm)	17.5 (620)
Exhaust temperature at rated kW, dry exhaust, °C (°F)	677 (1250)
Maximum allowable back pressure, kPa (in. Hg)	10.2 (3.0)
Exhaust outlet size at engine hookup, mm (in.)	89 (3.5)

Fuel Consumption	Natural Gas, m <sup>3</sup> /hr. (cfh) at % Load		LP Gas, m <sup>3</sup> /hr. (cfh) at % Load	
	Standby Rating @ 60 Hz	Prime Rating @ 60 Hz	Standby Rating @ 60 Hz	Prime Rating @ 60 Hz
100%	28.7 (1012)	26.4 (931)	12 (425)	11.0 (391)
75%	23.5 (831)	21.6 (764)	9.8 (345)	9.0 (317)
50%	18.9 (667)	17.4 (614)	7.4 (261)	6.8 (240)
25%	12.4 (437)	11.4 (402)	5.0 (177)	4.6 (163)

## Cooling (Standard Radiator)

Ambient temperature, °C (°F)	50 (122)
Engine jacket water capacity, L (gal.)	10.0 (2.6)
Radiator system capacity, including engine, L (gal.)	20.6 (5.4)
Engine jacket water flow, Lpm (gpm)	125 (33)
Heat rejected to cooling water at rated kW, dry exhaust, kW (Btu/min.)	62 (3540)
Water pump type	Centrifugal
Fan diameter including blades, mm (in.)	599 (23.6)
Fan, kWm (Hp)	6.7 (9.0)
Max. restriction of cooling air, intake and discharge side of radiator, Kpa (in. H <sub>2</sub> O)	0.125 (.5)

## Engine Operational Values

Air Requirements	60 Hz
Radiator-cooled cooling air – m <sup>3</sup> /min. (scfm)	187 (6600)
Combustion air required – m <sup>3</sup> /min. (cfm)	5.7 (200)
Heat rejected to ambient, engine – Btu/min (kW)	2300 (40)
Heat rejected to ambient, generator – Btu/min (kW)	670 (11.8)

**NOTE:** Power corrected for ambient conditions per engine manufacturer's recommendations.

# Accessories and Options

## Control Panel

- High Coolant Temp. Pre-alarm
- Low Oil Pressure Pre-alarm
- AlarmHorn with Switch
- Remote Start-Stop
- Remote Annunciator

## PER NFPA 110

- Run Relay
- Dry Contacts

## Engine Exhaust System

- Industrial Silencer
- Residential Silencer
- Critical Silencer
- Exhaust Flex
- Rain Cap
- \_\_\_\_\_

## Generator Accessories

- Main Line Circuit Breaker
- Shunt Trip
- Alternator Heater
- Field Circuit Breaker
- PMG
- \_\_\_\_\_

## Engine Electrical System

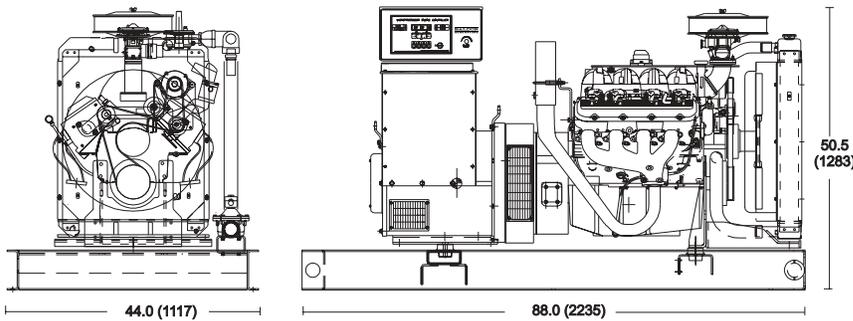
- Batteries
- Battery Rack
- Battery Cables
- Battery Charger - Automatic
- Battery Charger - Trickle
- \_\_\_\_\_

## Engine Fuel System

- Flexible Fuel Lines
- \_\_\_\_\_

## Miscellaneous

- Weather protective Enclosure
- Sound Attenuated Enclosure
- Vibration Isolators
- Coolant Heater
- \_\_\_\_\_



Dimensions – in (mm)

Weight – lbs. (Kg)  
3800 (1727)

Cubes (Approximate)  
112 ft

\*Open unit configuration,  
accessories not included

**Ratings – Standby Ratings:** Standby ratings are applicable for supplying emergency power for the duration of a utility power outage. Primary power to the installation is utility supplied. No overload capability for standby rating. Standby ratings in accordance with ISO 3046, BS55114, DIN 6271. **Continuous Power Rating:** Continuous power is the maximum power available for continuous duty. A 10% overload capacity is available for 1 hour out of 12 hours of operation. Prime Power ratings in accordance with ISO 3046, BS55114, DIN 6271. For additional information, please consult factory. Manufacture reserves the right to implement specifications or design changes without notice.

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**GENERATORS**

3815 Oregon Street • Oshkosh, WI 54902 • 1-800-872-7697 • Phone (920) 236-4200 • Fax (920) 236-4219  
909 Perkins Drive • Mukwonago, WI 53149 • Phone (262) 363-1555 • Fax (262) 363-1556

World Headquarters

Baldor Electric Company • P.O. Box 2400 • Fort Smith, AR 72902-2400 U.S.A.  
Phone (479) 646-4711 • Fax (479) 648-5792 • International Fax (479) 648-5895

www.baldor.com

## 9. MATERIAL SAFETY DATA SHEETS

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Attached are MSDSs for the following materials which may be used at the North facility:

#	Material MSDS	Process/Operation
1	Silver	Silver Strip, Targets
2	Copper	Silver Alloys
3	Nickel	Silver Alloys
4	Zinc	Silver Alloys
5	Tin	Silver Alloys
6	Palladium	Targets
7	Platinum	Targets
8	Acetylene	Oxygen/Acetylene Torch
9	Oxygen	Oxygen/Acetylene Torch
10	Argon CO <sub>2</sub> Mix	Annealing Furnace
11	Argon	Annealing Furnace
12	Hydrogen	Annealing Furnace
13	Nitrogen, Gas	CC3
14	Nitrogen, Liquid	CC3
15	Isopropyl Alcohol	Metallurgical Testing
16	Nitric Acid	Metallurgical Testing
17	Sulfuric Acid	Metallurgical Testing
18	Hydrogen Peroxide	Metallurgical Testing
19	Hydrochloric Acid	Metallurgical Testing
20	Sodium Bisulfate	Surface Treatment
21	Clay-bonded Silicon Carbide Crucibles	Induction Furnaces
22	Refractory Cement	Induction Furnaces/Crucible
23	Cast Set	Induction Furnaces
24	Silica Sand	Induction Furnaces
25	Bag House Dust	Bag House
26	Graphite	Crucible/Mold/CC3
27	Mirachem 500 Cleaner/Degreaser	Cleaner
28	Helium	

<b>MSDS No: A2</b>	<b>ISSUE DATE: 31/1/2005</b>
<b>Clay-bonded SiC/Graphite Products</b>	<b>Last revision: 4/8/2008</b>

**1. IDENTIFICATION OF THE PRODUCT AND OF THE COMPANY**

Identification of the Product: **SYNCARB, SYNCARB Z2, ISOALUSTAR, GRAFIT, SALAMANDER SUPER, INDUX, HOTROD, GRAFINOX, SIGMA, SIGMA Z2, ALPHA**

Use of the Product: **Crucibles & Foundry Products for holding, melting & general handling & treatment of metals for casting & other metal treatment processes**

Identification of the Company & Emergency telephone number:

Morganite Crucible Ltd	Carl Nolte Söhne GmbH	Morganite Crucible Inc	Morganite Crucible (India) Ltd	Morganite Brasil Ltda	Diamond Crucible Co Ltd
Woodbuy Lane	Nollinastrasse 29	22 North Plains	Works B-11, MIDC	Av do Taboão. 3265	212-C, GIDC
Norton	D-37297	Ind. Estate, Unit 1	Waluj 431 136	São Bernardo do Campo	Mehsana 384 002
Worcester	Berkatal	Wallingford	Aurangabad	São Paulo	Gujarat
WR5 2PU		CT 06492		SP 09656-000	
UNITED KINGDOM	GERMANY	USA	INDIA	BRASIL	INDIA
<b>+44 (0)1905 728200</b>	<b>+49 (0)5657 7010</b>	<b>+1 (0)203 697 0808</b>	<b>+91 (0)240 255 4405</b>	<b>+55 (0)11 4075 0400</b>	<b>+91 (0) 2762 253 132</b>

**2. COMPOSITION / INFORMATION ON INGREDIENTS**

Description: **Fired clay-bonded silicon carbide/graphite refractory articles**

Composition:

COMPONENT	% by weight	EINECS number	CAS number	Symbol	R Phrases
Carbon	25-50	231-955-3	7782-42-5	N/A	N/A
Clay	25-50	215-286-4	1318-74-7	N/A	N/A
Silicon Carbide	10-25	206-991-8	409-21-2	N/A	N/A
Iron Oxide	2.5-10	215-570-8	1332-37-2	N/A	N/A

**3. HAZARDS IDENTIFICATION**

- The components of these products are not classified as hazardous according to Directives 67/548/EEC & 1999/45/EC
- Potential hazards during use;
  - May release dust if products are abraded, broken or otherwise damaged through mishandling
  - Danger of burns through mishandling when products are in use at high temperatures
  - Risk of product spalling during heat up if product stored in damp conditions

#### 4. FIRST AID MEASURES

**Inhalation:**

Symptoms of Exposure: Dryness in throat or coughing due to exposure to respirable dust.

First Aid measures: Remove to fresh air, if symptoms persist seek medical attention.

**Skin Contact:**

Symptoms of Exposure: Mechanical irritation to skin due to exposure to dust; burn due to contact with hot product.

First Aid measures: Remove contaminated clothing. Wash area of contact thoroughly with water. Seek medical attention.

**Eye Contact:**

Symptoms of Exposure: Mechanical irritation to eyes due to exposure to dust.

First Aid measures: Wash eyes immediately with large amounts of water. Do not rub eyes. Seek medical attention.

**Ingestion:**

Symptoms of Exposure: Possible stomach problems due to ingestion of dust.

First Aid measures: Seek medical attention.

#### 5. FIRE FIGHTING MEASURES

These products are non-flammable.

Packaging and surrounding materials may be combustible.

Use extinguishing agent suitable for packaging and other materials stored nearby.

#### 6. ACCIDENTAL RELEASE MEASURES

**Personal Precautions:**

Ensure good ventilation to area. Avoid creating airborne dust. Wear personal protective equipment as detailed in section 8.

**Environmental Precautions:**

Clean up broken pieces/dust immediately. Ensure material does not enter drainage system.

**Methods for cleaning up:**

Use wet sweeping or vacuuming to clean the work area, do not use compressed air or dry sweeping. If vacuuming, the vacuum cleaner should be equipped with a high efficiency particulate filter.

#### 7. HANDLING AND STORAGE

**Handling:**

Take care to avoid damaging the product as this may create dust. Some of the larger products are very heavy and care should be taken to avoid personal injury. The use of appropriate lifting & handling equipment is recommended for this purpose.

**Storage:**

Store in dry conditions.

**Specific Use:**

For safe & efficient use of the product, working practices must comply with the recommendations described in the 'Care & Use of Crucibles' leaflet, available from the manufacturer.

MSDS No: A2  
Clay-bonded SiC/Graphite Products

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Last Revision : 4/8/2008

## 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

### Exposure Limit Values:

Industrial hygiene standards and occupational exposure limits vary between countries and local jurisdictions. Check which exposure limits apply to your facility. In the absence of exposure information, or if no regulatory dust or other standards apply, the manufacturer recommends the control of respirable dust exposures to the UK limit for nuisance dusts of 4 mg/m<sup>3</sup>/8hour time weighted average (TWA) or less.

### Exposure Controls:

Review your working practices in order to identify potential sources of dust exposure. If necessary conduct personal air monitoring. Where technically and economically feasible, use engineering controls. These may include local exhaust ventilation & equipment to remove airborne dust or materials.

### Personal Protective Equipment:

**Respiratory Protection:** Wear approved respirator when wrecking out used product if this may create dust concentrations above the exposure limit.

**Hand Protection:** Wear protective gloves.

**Eye Protection:** Wear safety glasses with side shields or other appropriate forms of eye protection.

**Skin Protection:** Wear safety shoes and appropriate work overalls when handling the product prior to use. Wear foundry grade protective garment and safety shoes when using the product.

## 9. PHYSICAL AND CHEMICAL PROPERTIES

<b>Appearance:</b>	Black Solid (may be coated fully or partly with a coloured paint)
<b>Odour:</b>	None
<b>pH:</b>	Not applicable
<b>Melting Point:</b>	600 - 1300°C (surface coating), not applicable to main body of product.
<b>Boiling Point:</b>	Not applicable
<b>Flash Point:</b>	Non-flammable
<b>Density Range:</b>	1.65 - 2.05 gcm <sup>-3</sup>
<b>Water Solubility:</b>	None

## 10. STABILITY AND REACTIVITY

<b>Chemical Stability:</b>	Stable under conditions of normal use
<b>Conditions to Avoid:</b>	Rapid heating of damp material (from damp storage conditions)
<b>Materials to Avoid:</b>	None
<b>Hazardous Decomposition Products:</b>	When using fluxes & other metallurgical treatment chemicals with the product, chemical decomposition of the product is possible. Refer to recommendations from the specific treatment chemical manufacturer.

## 11. TOXICOLOGICAL INFORMATION

<b>Inhalation:</b>	No known effect. Dust generated from damaged product may contain small amounts of crystalline silica. Crystalline silica is present as a natural impurity in some of the product components, and may be generated in small quantities within the product during extended use above 900°C. Long term exposure to respirable crystalline silica may cause lung disease, including silicosis, and an increased risk of developing lung cancer.
<b>Skin Contact:</b>	No known effect. Possible mechanical irritant effect of dust generated from damaged product.
<b>Eye Contact:</b>	No known effect. Possible mechanical irritant effect due to dust generated from damaged product.
<b>Ingestion:</b>	No known effect.

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Last Revision : 4/8/2008

## 12. ECOLOGICAL INFORMATION

These products are inert materials, which remain stable over time.  
No ecological concerns have been identified or are anticipated.

## 13. DISPOSAL CONSIDERATIONS

It is not recommended to break up the product (either before or after use) prior to disposal as this may release dust.  
Check local, regional, state or provincial regulations to identify all applicable disposal requirements.  
Contamination during use or chemical additions to the product may alter the disposal requirements.

## 14. TRANSPORT INFORMATION

Not classified as dangerous goods under IMDG (sea), ADR (road), RID (rail), or ICAO/IATA (air) regulations.  
Consult local, regional, state or provincial regulations.

## 15. REGULATORY INFORMATION

There are no known local, national or international regulations or restrictions that apply to the manufacture, use or disposal of these products. Consult local authorities if additional information is required.

## 16. OTHER INFORMATION

For best performance & recommended handling & storage practices refer to the 'Care & Use of Crucibles' leaflet, available from the manufacturer.

### **Disclaimer:**

Reasonable care has been taken in the preparation of the information contained in this Material Safety Data Sheet, and such information is given in good faith. However, no warranty or representation with respect to such information is intended or given

1/21/92

# MATERIAL SAFETY DATA SHEET

A. P. GREEN INDUSTRIES, INC.  
GREEN BOULEVARD, MEXICO, MO. 65265  
TELEPHONE NUMBER -- 314-473-3626

## SECTION I

**PRODUCT NAME:** KAST-SET  
KAST-SET Plus  
**PRODUCT TYPE:** Castable Refractory  
**CHEMICAL FAMILY:** SiO<sub>2</sub> = 39-43%  
CaO = 6-8% Al<sub>2</sub>O<sub>3</sub> = 41-45%  
Fe<sub>2</sub>O<sub>3</sub> = 3-5% **FORMULA:** Not Applicable

## SECTION II

### PRODUCT HAZARDOUS INGREDIENTS

CHEMICAL	TLV	CAS #
Cristobalite (SiO <sub>2</sub> ) (5-15%)	0.05 mg/m <sup>3</sup> Respirable Dust	11266-46-1
Quartz (SiO <sub>2</sub> ) (<2%)	0.1 mg/m <sup>3</sup> Respirable Dust	14808-60-7
Refractory Cement (15-25%)	(None) (See Section V)	65997-16-2

\*Source: American Conference of Governmental Industrial Hygienists, 1991-1992.

## SECTION III

### PHYSICAL DATA

**SOLUBILITY IN WATER:** Slight  
**SPECIFIC GRAVITY:** 2.7  
**APPEARANCE AND ODOR:** Gray, granular mixture; no odor  
**HAZILES BY VOLUME (22):** Nil  
**MELTING POINT:** Not Applicable

## SECTION IV

### FIRE AND EXPLOSION HAZARD DATA

**FLASH POINT:** None.  
**EXTINGUISHING MEDIA:** Material is non-flammable.  
**SPECIAL FIRE FIGHTING PROCEDURES:** None.  
**UNUSUAL FIRE AND EXPLOSION HAZARDS:** None.

## SECTION V

### HEALTH HAZARD DATA

**EFFECT OF OVEREXPOSURE:**  
**EYES:** ACUTE: Dust can irritate eyes. Product's cement can cause eye injury.  
CHRONIC: Unknown.  
**SKIN:** ACUTE: Product's cement can die skin irritation.  
CHRONIC: Unknown.  
**INHALATION:** ACUTE: Dust generated can cal breathing discomfort.  
CHRONIC: Long-term exposure to it may cause lung damage.

1144

# U. S. SILICA COMPANY

## MSDS - MATERIAL SAFETY DATA SHEET

### SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

#### Product Names/Trade Names:

Silica Sand sold under various names: ASTM TESTING SANDS • GLASS SAND • FLINT SILICA • DM-SERIES • F-SERIES • FOUNDRY SANDS • FJ-SERIES • FP-SERIES • H-SERIES • L-SERIES • N-SERIES • NJ-SERIES • OK-SERIES • P-SERIES • T-SERIES • HYDRAULIC FRACING SANDS • MIN-U-SIL® Ground Silica • MYSTIC WHITE® • #1 DRY • #1 SPECIAL • PENN SAND® • Q-ROK® • SIL-CO-SIL® Ground Silica • SUPERSIL® • MASON SAND • GS-SERIES • PER-SPEC

Synonyms/Common Names: Sand, Silica Sand, Quartz, Crystalline Silica, Flint, Ground Silica.

Manufacturer's Name: U. S. Silica Company  
P. O. Box 187  
Berkeley Springs, WV 25411

Emergency Telephone Number: 304-258-2500 (8:30 am to 5:00 pm eastern)  
304-258-8295 (fax)

Date Prepared: February 10, 2005

### SECTION 2 - HAZARD IDENTIFICATION

#### EMERGENCY OVERVIEW:

The U. S. Silica Company material is a white or tan sand, or ground sand. It is not flammable, combustible or explosive. It does not cause burns or severe skin or eye irritation. A single exposure will not result in serious adverse health effects. Crystalline silica (quartz) is not known to be an environmental hazard.

Crystalline silica (quartz) is incompatible with hydrofluoric acid, fluorine, chlorine trifluoride or oxygen difluoride.

#### OSHA REGULATORY STATUS

This material is considered hazardous under the OSHA Hazard Communications Standard (29 CFR 1910.1200).

#### POTENTIAL HEALTH EFFECTS:

##### Inhalation:

- a. Silicosis Respirable crystalline silica (quartz) can cause silicosis, a fibrosis (scarring) of the lungs. Silicosis may be progressive; it may lead to disability and death.
- b. Lung Cancer Crystalline silica (quartz) inhaled from occupational sources is classified as carcinogenic to humans.
- c. Tuberculosis Silicosis increases the risk of tuberculosis.
- d. Autoimmune and Chronic Kidney Diseases Some studies show excess numbers of cases of scleroderma, connective tissue disorders, lupus, rheumatoid arthritis, chronic kidney diseases and end-stage kidney disease in workers exposed to respirable crystalline silica.
- e. Non-Malignant Respiratory Diseases (other than silicosis) Some studies show an increased incidence in chronic bronchitis and emphysema in workers exposed to respirable crystalline silica.

Eye Contact: Crystalline silica (quartz) may cause abrasion of the cornea.

Skin Contact: Not applicable.

Ingestion: Not applicable.

**Chronic Effects:** The adverse health effects -- silicosis, lung cancer, autoimmune and chronic kidney diseases, tuberculosis, and non-malignant respiratory diseases-- are chronic effects.

**Signs and Symptoms of Exposure:** Generally, there are no signs or symptoms of exposure to crystalline silica (quartz).

**Medical Conditions Generally Aggravated by Exposure:** The condition of individuals with lung disease (e.g., bronchitis, emphysema, chronic obstructive pulmonary disease) can be aggravated by exposure.

See Section 11, Toxicological Information, for additional detail on potential adverse health effects.

### SECTION 3 - COMPOSITION/INFORMATION ON INGREDIENTS

**Ingredients:**

	Chemical Formula	Typical %, By Weight	CAS #
Crystalline Silica (quartz)	SiO <sub>2</sub>	99.0 - 99.9	14808-60-7
Aluminum Oxide	Al <sub>2</sub> O <sub>3</sub>	< .8	1344-28-1
Iron Oxide	Fe <sub>2</sub> O <sub>3</sub>	< .1	1309-37-1
Titanium Oxide	TiO <sub>2</sub>	< .1	13463-67-7

### SECTION 4 - FIRST AID MEASURES

**Inhalation:** No specific first-aid is necessary since the adverse health effects associated with exposure to crystalline silica (quartz) result from chronic exposures. If there is a gross inhalation of crystalline silica (quartz), remove the person immediately to fresh air, give artificial respiration as needed, seek medical attention as needed.

**Eye Contact:** Wash immediately with water. If irritation persists, seek medical attention.

**Skin Contact:** Not applicable.

**Ingestion:** Not applicable.

### SECTION 5 - FIRE FIGHTING MEASURES

Crystalline silica (quartz) is not flammable, combustible or explosive.

### SECTION 6 - ACCIDENTAL RELEASE MEASURES

**Spills:** Use dustless methods (vacuum) and place into closable container for disposal, or flush with water. Do not dry sweep. Wear protective equipment specified below.

**Waste Disposal Method:** See Section 13.

### SECTION 7 - HANDLING AND STORAGE

**Precautions During Handling and Use:** Do not breathe dust. Use adequate ventilation and dust collection. Keep airborne dust concentrations below permissible exposure limit ("PEL"). Do not rely on your sight to determine if dust is in the air. Respirable crystalline silica dust may be in the air without a visible dust cloud.

If crystalline silica dust cannot be kept below permissible limits, wear a respirator approved for silica dust when using, handling, storing or disposing of this product or bag. See Section 8 for further information on respirators. Practice good housekeeping. Do not permit dust to collect on walls, floors, sills, ledges, machinery, or equipment. Maintain, clean, and fit test respirators in accordance with OSHA regulations. Maintain and test ventilation and dust collection equipment. Wash or vacuum clothing that has become dusty.

The OSHA Hazard Communication Standard, 29 CFR Sections 1910.1200, 1915.1200, 1917.28, 1918.90, 1926.59 and 1928.21, and state and local worker or community "right-to-know" laws and regulations should be strictly followed.

**Do not use U. S. Silica Company materials for sandblasting.**

**Precautions During Storage:** Avoid breakage of bagged material or spills of bulk material. Use dustless methods (vacuum) and place into closable container for disposal, or flush with water. Do not dry sweep. See control measures in Section 8.

The OSHA Hazard Communication Standard, 29 CFR Sections 1910.1200, 1915.1200, 1917.28, 1918.90, 1926.59 and 1928.21, and state and local worker or community "right-to-know" laws and regulations should be strictly followed. **WARN YOUR EMPLOYEES (AND YOUR CUSTOMERS IN CASE OF RESALE) BY POSTING AND OTHER MEANS OF THE HAZARDS AND THE REQUIRED OSHA PRECAUTIONS. PROVIDE TRAINING FOR YOUR EMPLOYEES ABOUT THE OSHA PRECAUTIONS.**

For additional precautions, see American Society for Testing and Materials (ASTM) standard practice E 1132-99a, "Standard Practice for Health Requirements Relating to Occupational Exposure to Respirable Crystalline Silica."

**SECTION 8 - EXPOSURE CONTROLS/PERSONAL PROTECTION**

**Local Exhaust Ventilation:** Use sufficient local exhaust ventilation to reduce the level of respirable crystalline silica to below the OSHA PEL. See ACGIH "Industrial Ventilation, A Manual of Recommended Practice" (latest edition).

**Respiratory Protection:**

If it is not possible to reduce airborne exposure levels to below the OSHA PEL with ventilation, use the table below to assist you in selecting respirators that will reduce personal exposures to below the OSHA PEL. This table is part of the NIOSH Respirator Selection Logic, 2004, Chapter III, Table 1, "Particulate Respirators". The full document can be found at [www.cdc.gov/niosh/nppt/topics/respirators](http://www.cdc.gov/niosh/nppt/topics/respirators); the user of this MSDS is directed to that site for information concerning respirator selection and use.

The assigned protection factor (APF) is the minimum anticipated level of protection provided by each type of respirator worn in accordance with an adequate respiratory protection program. For example, an APF of 10 means that the respirator should reduce the airborne concentration of a particulate by a factor of 10, so that if the workplace concentration of a particulate was 150 ug/m<sup>3</sup>, then a respirator with an APF of 10 should reduce the concentration of particulate to 15 ug/m<sup>3</sup>.

Assigned protection factor <sup>1</sup>	Type of Respirator (Use only NIOSH-certified respirators)
10	Any air-purifying elastomeric half-mask respirator equipped with appropriate type of particulate filter. <sup>2</sup> Appropriate filtering facepiece respirator. <sup>2,3</sup> Any air-purifying full facepiece respirator equipped with appropriate type of particulate filter. <sup>2</sup> Any negative pressure (demand) supplied-air respirator equipped with a half-mask.
25	Any powered air-purifying respirator equipped with a hood or helmet and a high efficiency (HEPA) filter. Any continuous flow supplied-air respirator equipped with a hood or helmet.
50	Any air-purifying full facepiece respirator equipped with N-100, R-100, or P-100 filter(s). Any powered air-purifying respirator equipped with a tight-fitting facepiece (half or full facepiece) and a high-efficiency filter. Any negative pressure (demand) supplied-air respirator equipped with a full facepiece. Any continuous flow supplied-air respirator equipped with a tight-fitting facepiece (half or full facepiece). Any negative pressure (demand) self-contained respirator equipped with a full facepiece.
1,000	Any pressure-demand supplied-air respirator equipped with a half-mask.

1. The protection offered by a given respirator is contingent upon (1) the respirator user adhering to complete program requirements (such as the ones required by OSHA in 29CFR1910.134), (2) the use of NIOSH-certified respirators in their approved configuration, and (3) individual fit testing to rule out those respirators that cannot achieve a good fit on individual workers.  
 2. Appropriate means that the filter medium will provide protection against the particulate in question.  
 3. An APF of 10 can only be achieved if the respirator is qualitatively or quantitatively fit tested on individual workers.

**Exposure Guidelines:**

Component	CAS No.	Percentage (by wt.)	OSHA PEL		ACGIH TLV		NIOSH REL		Unit
			TWA	STEL	TWA	STEL	TWA	STEL	
Crystalline Silica (quartz)	14808-60-7	99.0-99.9	$\frac{10}{\% \text{ SiO}_2 + 2}$	None	.05	None	.05	None	mg/m <sup>3</sup>

If crystalline silica (quartz) is heated to more than 870°C, it can change to a form of crystalline silica known as trydimite; if crystalline silica (quartz) is heated to more than 1470°C, it can change to a form of crystalline silica known as cristobalite. The OSHA PEL for crystalline silica as trydimite or cristobalite is one-half of the OSHA PEL for crystalline silica (quartz).

**SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES**

<b>Appearance:</b>	White or tan sand; granular, crushed, or ground.		
<b>Boiling Point:</b>	4046°F/2230°C	<b>Odor:</b>	None
<b>Vapor Pressure (mm Hg.):</b>	None	<b>Specific Gravity (Water = 1):</b>	2.65
<b>Vapor Density (Air = 1):</b>	None	<b>Melting Point:</b>	2930°F/1610°C
<b>Solubility in Water:</b>	Insoluble in water	<b>Evaporation Rate (Butyl Acetate = 1):</b>	None

**SECTION 10 - STABILITY AND REACTIVITY**

**Stability:** Crystalline silica (quartz) is stable.

**Incompatibility (Materials to Avoid):** Contact with powerful oxidizing agents, such as fluorine, chlorine trifluoride and oxygen difluoride, may cause fires.

**Hazardous Decomposition or Byproducts:** Silica will dissolve in hydrofluoric acid and produce a corrosive gas - silicon tetrafluoride.

**Hazardous Polymerization:** Will not occur.

**SECTION 11 - TOXICOLOGICAL INFORMATION**

The method of exposure to crystalline silica that can lead to the adverse health effects described below is inhalation.

**A. SILICOSIS**

The major concern is silicosis, caused by the inhalation and retention of respirable crystalline silica dust. Silicosis can exist in several forms, chronic (or ordinary), accelerated, or acute.

Chronic or Ordinary Silicosis (often referred to as Simple Silicosis) is the most common form of silicosis, and can occur after many years of exposure to relatively low levels of airborne respirable crystalline silica dust. It is further defined as either simple or complicated silicosis.

Simple silicosis is characterized by lung lesions (shown as radiographic opacities) less than 1 centimeter in diameter, primarily in the upper lung zones. Often, simple silicosis is not associated with symptoms, detectable changes in lung function or disability.

Simple silicosis may be progressive and may develop into complicated silicosis or progressive massive fibrosis (PMF). Complicated silicosis or PMF is characterized by lung lesions (shown as radiographic opacities) greater than 1 centimeter in diameter. Although there may be no symptoms associated with complicated silicosis or PMF, the symptoms, if present, are shortness of breath, wheezing, cough and sputum production. Complicated silicosis or PMF may be associated with decreased lung function and may be disabling. Advanced complicated silicosis or PMF may lead to death. Advanced complicated silicosis or PMF can result in heart disease secondary to the lung disease (cor pulmonale).

Accelerated Silicosis can occur with exposure to high concentrations of respirable crystalline silica over a relatively short period; the lung lesions can appear within five (5) years of initial exposure. Progression can be rapid. Accelerated silicosis is similar to chronic or ordinary silicosis, except that lung lesions appear earlier and progression is more rapid.

Acute Silicosis can occur with exposures to very high concentrations of respirable crystalline silica over a very short time period, sometimes as short as a few months. The symptoms of acute silicosis include progressive shortness of breath, fever, cough and weight loss. Acute silicosis is fatal.

#### **B. CANCER**

IARC - The International Agency for Research on Cancer ("IARC") concluded that there was "sufficient evidence in humans for the carcinogenicity of crystalline silica in the forms of quartz or cristobalite from occupational sources", and that there is "sufficient evidence in experimental animals for the carcinogenicity of quartz and cristobalite." The overall IARC evaluation was that "crystalline silica inhaled in the form of quartz or cristobalite from occupational sources is *carcinogenic to humans (Group 1)*." The IARC evaluation noted that "carcinogenicity was not detected in all industrial circumstances studies. Carcinogenicity may be dependent on inherent characteristics of the crystalline silica or on external factors affecting its biological activity or distribution of its polymorphs." For further information on the IARC evaluation, see IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, Volume 68, "Silica, Some Silicates..." (1997).

NTP - The National Toxicology Program, in its Ninth Annual Report on Carcinogens, classified "silica, crystalline (respirable)" as a known human carcinogen.

OSHA - Crystalline silica (quartz) is not regulated by the U. S. Occupational Safety and Health Administration as a carcinogen.

#### **C. AUTOIMMUNE DISEASES**

Several studies have reported excess cases of several autoimmune disorders, -- scleroderma, systemic lupus erythematosus, rheumatoid arthritis -- among silica-exposed workers. For a review of the subject, the following may be consulted: "Occupational Exposure to Crystalline Silica and Autoimmune Disease", Environmental Health Perspectives, Volume 107, Supplement 5, pp. 793-802 (1999); "Occupational Scleroderma", Current Opinion in Rheumatology, Volume 11, pp. 490-494 (1999).

#### **D. TUBERCULOSIS**

Individuals with silicosis are at increased risk to develop pulmonary tuberculosis, if exposed to persons with tuberculosis. The following may be consulted for further information: Occupational Lung Disorders, Third Edition, Chapter 12, entitled "Silicosis and Related Diseases", Parkes, W. Raymond (1994); "Risk of pulmonary tuberculosis relative to silicosis and exposure to silica dust in South African gold miners," Occup Environ Med., Volume 55, pp.496-502 (1998).

#### **E. KIDNEY DISEASE**

Several studies have reported excess cases of kidney diseases, including end stage renal disease, among silica-exposed workers. For additional information on the subject, the following may be consulted: "Kidney Disease and Silicosis", Nephron, Volume 85, pp. 14-19 (2000).

#### **F. NON-MALIGNANT RESPIRATORY DISEASES**

The reader is referred to Section 3.5 of the NIOSH Special Hazard Review cited below, for information concerning the association between exposure to crystalline silica and chronic bronchitis, emphysema and small airways disease. There are studies that disclose an association between dusts found in various mining occupations and non-malignant respiratory diseases, particularly among smokers. It is unclear whether the observed associations exist only with underlying silicosis, only among smokers, or result from exposure to mineral dusts generally (independent of the presence or absence of crystalline silica, or the level of crystalline silica in the dust).

#### Sources of information:

The NIOSH Hazard Review - Occupational Effects of Occupational Exposure to Respirable Crystalline Silica published in April 2002 summarizes and discusses the medical and epidemiological literature on the health risks and diseases associated with occupational exposures to respirable crystalline silica. The NIOSH Hazard Review should be consulted for additional information, and citations to published studies on health risks and diseases associated with occupational exposure to respirable crystalline silica. The NIOSH Hazard Review is available from NIOSH - Publications Dissemination, 4676 Columbia Parkway, Cincinnati, OH 45226, or by calling 1-800-35-NIOSH (1-800-356-4676), or through the NIOSH web site, [www.cdc.gov/niosh/topics/silica](http://www.cdc.gov/niosh/topics/silica), then click on the link "NIOSH Hazard Review: Health Effects of Occupational Exposure to Respirable Crystalline Silica".

## **SECTION 12 - ECOLOGICAL INFORMATION**

Crystalline silica (quartz) is not known to be ecotoxic; i.e., there are no data that suggests that crystalline silica (quartz) is toxic to birds, fish, invertebrates, microorganisms or plants.

## SECTION 13 - DISPOSAL CONSIDERATIONS

**General:** The packaging and material may be landfilled; however, material should be covered to minimize generation of airborne dust.

**RCRA:** Crystalline silica (quartz) is not classified as a hazardous waste under the Resource Conservation and Recovery Act, or its regulations, 40 CFR §261 et seq.

The above applies to materials as sold by U. S. Silica Company. The material may be contaminated during use, and it is the responsibility of the user to assess the appropriate disposal of the used material.

## SECTION 14 - TRANSPORT INFORMATION

Crystalline silica (quartz) is not a hazardous material for purposes of transportation under the U. S. Department of Transportation Table of Hazardous Materials, 49 CFR §172.101.

## SECTION 15 - REGULATORY INFORMATION

### UNITED STATES (FEDERAL AND STATE)

**TSCA No.:** Crystalline silica (quartz) appears on the EPA TSCA inventory under the CAS No. 14808-60-7.

**RCRA:** Crystalline silica (quartz) is not classified as a hazardous waste under the Resource Conservation and Recovery Act, or its regulations, 40 CFR §261 et seq.

**CERCLA:** Crystalline silica (quartz) is not classified as a hazardous substance under regulations of the Comprehensive Environmental Response Compensation and Liability Act (CERCLA), 40 CFR §302.

**Emergency Planning and Community Right to Know Act (SARA Title III):** Crystalline silica (quartz) is not an extremely hazardous substance under Section 302 and is not a toxic chemical subject to the requirements of Section 313.

**Clean Air Act:** Crystalline silica (quartz) mined and processed by U.S. Silica Company is not processed with or does not contain any Class I or Class II ozone depleting substances.

**FDA:** Silica is included in the list of substances that may be included in coatings used in food contact surfaces, 21 CFR §175.300(b)(3)(xxvi).

**NTP:** Respirable crystalline silica, primarily quartz dusts occurring in industrial and occupational settings, is classified as Known to be a Human Carcinogen.

**OSHA Carcinogen:** Crystalline silica (quartz) is not listed.

**California Proposition 65:** Crystalline silica (airborne particles of respirable size) is classified as a substance known to the State of California to be a carcinogen.

**California Inhalation Reference Exposure Level (REL):** California established a chronic REL of 3 ug for silica (crystalline, respirable). A chronic REL is an airborne level of a substance at or below which no adverse health effects are anticipated in individuals indefinitely exposed to the substance at that level.

**Massachusetts Toxic Use Reduction Act:** Silica, crystalline (respirable size, <10 microns) is "toxic" for purposes of the Massachusetts Toxic Use Reduction Act.

**Pennsylvania Worker and Community Right to Know Act:** Quartz is a hazardous substance under the Act, but it is not a special hazardous substance or an environmental hazardous substance.

### CANADA

**Domestic Substances List:** U. S. Silica Company products, as naturally occurring substances, are on the Canadian DSL.

**WHMIS Classification:** D2A

**OTHER**

EINECS No.: 238-878-4

EEC Label (Risk/Safety Phrases): R 48/20, R 40/20, S22, S38

IARC: Crystalline silica (quartz) is classified in IARC Group 1.

National, state, provincial or local emergency planning, community right-to-know or other laws, regulations or ordinances may be applicable—consult applicable national, state, provincial or local laws.

**SECTION 16 - OTHER INFORMATION**

**Hazardous Material Information System (HMIS):**

Health	*
Flammability	0
Reactivity	0
Protective Equipment	E

\* For further information on health effects, see Sections 2 and 11 of this MSDS.

**National Fire Protection Association (NFPA):**

Health	0
Flammability	0
Reactivity	0

**Web Sites with Information about Effects of Crystalline Silica Exposure:**

The U. S. Silica web site will provide updated links to OSHA and NIOSH web sites addressing crystalline silica issues. [www.u-s-silica.com](http://www.u-s-silica.com), click in "Information", then click on "Health & Safety".

**U. S. SILICA COMPANY DISCLAIMER**

The information and recommendations contained herein are based upon data believed to be correct. However, no guarantee or warranty of any kind, express or implied, is made with respect to the information contained herein. We accept no responsibility and disclaim all liability for any harmful effects that may be caused by purchase, resale, use or exposure to our silica. Customers-users of silica must comply with all applicable health and safety laws, regulations, and orders, including the OSHA Hazard Communication Standard.

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## Material Safety Data Sheet

### Section 1: Chemical Product and Company Identification

Manufacturer/Supplier: Academy Corp  
 6905 Washington Ave. NE  
 Albuquerque, NM 87109  
 Phone (505) 345-1805  
 Fax. (505) 344-4638

Product Name: Baghouse Dust  
 Synonyms: None  
 Chemical Family: Metallic dust  
 Molecular Formula: NA

For 24 hour Emergency Information: Call Chemtrec at (800) 424-9300

### Section 2: Ingredients and Hazards

Component	CAS No.	TLV mg/m <sup>3</sup>	PEL mg/m <sup>3</sup>
Silver	7440-22-4	0.1	0.01
Sodium Oxide	1313-59-3	NA	NA
Sodium Borate	1330-43-4	NA	NA
Sulfur	7704-34-9	NA	NA
Iron	7439-89-6	5	10
Lead	7439-92-1	0.05	0.05
Cadmium	7440-43-9	0.01	0.005

### Section 3: Physical and Chemical Properties

Physical Form: Fine powder, dust  
 Color: Dark gray to black  
 Odor: Sulfur Odor  
 Melting Point: 1000°C  
 Vapor Pressure (@ 20C (68F): N/A  
 Vapor Density (Air = 1): N/A  
 Boiling Point: 1500°C  
 Solubility in H<sub>2</sub>O: Soluble  
 pH: > 7  
 Flash Point: N/A

### Section 4: Fire and Explosion Hazard Data

Flash point: None  
 Flammable Limits: None

Extinguishing Media: Do not attempt to extinguish molten or burning metals with water. Dry Chemical, CO<sub>2</sub>, Class D Extinguishing Agent, dry sand may be used.

Special Fire-Fighting Procedures: Firefighters should wear self-contained breathing apparatus and protective clothing to prevent contact with eyes and skin.

Unusual Fire and Explosion Hazards: Material emits toxic fumes under fire conditions. This material, like most materials in a powder form is capable of creating a dust explosion.

### **Section 5: Stability and Reactivity**

Stability: Stable      Conditions to Avoid: None Known

Incompatibility: Strong acids, Strong bases, Acetylene, ammonia, hydrogen peroxide, bromoazide, chlorine trifluoride, ethyleneimine, oxalic acid, oxygen, tartaric acid.

Hazardous Decomposition Products: Nature of decomposition products not known.

Hazardous Polymerization: Will not occur

### **Section 6: Health Hazard Data and First Aid Procedures**

Primary Routes of Exposure: Inhalation, ingestion, eye and skin.

Inhalation: Chronic exposure may cause argyria, a blue-gray discoloration of the skin, mucous membranes and eyes. Acute exposure may cause irritation of the respiratory tract or metal fume fever with symptoms of fever, chills nausea, chest tightness, or metallic taste. If inhaled, move to fresh air and seek medical attention immediately.

Ingestion: Toxic if swallowed. May cause generalized argyria and may be mildly irritating to the lining of the stomach and intestines. Never attempt to give anything by mouth to an unconscious person. Call a poison control center immediately. Seek medical attention.

Skin: Remove contaminated clothing. Wash skin with soap and water. Seek medical attention.

Eyes: Irritation may result. Rinse eyes thoroughly with water for 15 minutes. Seek medical attention immediately. Wash contaminated clothing before reuse. Destroy or thoroughly clean contaminated shoes.

Carcinogenicity?      No                      Listed in:      None known

Medical Conditions generally aggravated by exposure:      None Known

To the best of our knowledge the chemical, physical and toxicological properties have not been thoroughly investigated.

## Section 7: Precautions for Safe Handling and Use

Steps in case of spill or Leak: Evacuate area and notify spill response personnel. Shut off all sources of ignition. Wear respirator chemical safety goggles, rubber boots and gloves. Sweep up and place in a plastic bags and then place these bags in a steel drum. Avoid generating dust.

Waste Disposal: Material has reclaim value for metal content. Contact Academy Corporation for recycling options. Dispose of unsalvageable material in accordance with federal, state and local regulations.

Precautions to be taken in Handling and Storage: Keep containers tightly closed, store in a cool, dry, well ventilated area and avoid contact with incompatible materials. Observe the following precautions. Do not get in eyes. Avoid contact with skin and clothing. Avoid breathing dust. Wash thoroughly after handling. Keep out of the reach of children. Do not handle or use until safety precautions in Material Safety Data Sheet have been read and understood.

## Section 8: Exposure Controls and Personal Protection

Ventilation: Provide adequate ventilation to reduce airborne exposure below PEL and/or TLV.

Respiratory Protection: If airborne concentrations exceed exposure limits or are unknown, use a NIOSH/MSHA approved respirator for dust and or metal fume in accordance with 29 CFR 1910.134.

Other Protective Equipment: Respirator is required for handling material. Safety glasses, gloves, rubber boots and protective clothing is required to prevent excessive dust contact with skin and/or for protection from cuts abrasions when performing mechanical operations or handling sharp pieces of metal. Heat resistant gloves, clothing and face protection is required for handling molten materials. Eyewash station should be available in area of use.

Hygienic Work Practices: Avoid inhalation or ingestion. Practice good housekeeping. Avoid eating, drinking and smoking in the work area. Wash thoroughly after handling product.

## Section 9: Transport Information

Regulated as a hazardous material for transportation purposes as the pieces of metal have a diameter smaller than 100 micrometers, (0.004 in.) as per 49 CFR 172.101.

Proper shipping name as follows: "Environmentally Hazardous Substance, Solid, Class 9, N.O.S., UN 3077, P.G. III, (Baghouse dust contains silver)

**Section 10: Regulatory Information**

OSHA: Hazardous by definition of Hazard Communication Standard 29 CFR 1910.1200

TSCA Registered: Yes

RQ: 1000 lbs. (454 kg.) for pieces < 100 micrometers in diameter.

**Section 11: Supplier Notification:**

This product contains the following EPCRA Section 313 chemicals subject to the reporting requirements of Section 313 chemicals of the Emergency Planning and Community Right-To-Know Act of 1986 (40 CFR 372):

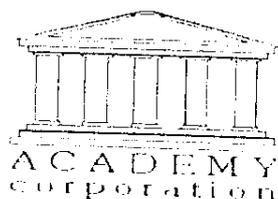
CAS No.	Chemical	Percent by Weight
7440-22-4	Silver	5.6
7439-92-1	Lead	0.08

This information should be included in all MSDS's that are copied and distributed for this material.

*The information contained herein is furnished without warranty of any kind. Users should consider these data only as a supplement to other information gathered by them and must make independent determinations of 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 and the protection of the environment. User is responsible to determine suitability of material for a specific application*

Date Prepared: 10-28-02

Date Revised: 10-28-02



## Material Safety Data Sheet

### Section 1: Chemical Product and Company Identification

Manufacturer/Supplier: Academy Corporation  
5520 Midway Park Pl NE  
Albuquerque, NM 87109  
Phone (505) 343-9440  
Fax. (505) 342-5589

Product Name: Silver  
Synonyms: Argentum, Fine silver, 0.9999 Silver, 0.999 Silver ...  
Chemical Family: Metal  
Molecular Formula: Ag

### Section 2: Ingredients and Hazards

Component	CAS No.	Weight %	TLV mg/m <sup>3</sup>	PEL mg/m <sup>3</sup>
Silver	7440-22-4	100	0.1	0.01

### Section 3: Physical and Chemical Properties

Physical Form: Bars, shot, coins, wire, sheets, Plate Anodes, Rod Anodes, Stem Anodes, Button Anodes, Ball Anodes, Snowflake Anodes, Silver Sputtering Targets, machined shapes or needle shaped crystals.  
Color: Silvery white, lustrous  
Odor: No Odor  
Specific Gravity (H<sub>2</sub>O = 1): 10.50  
Melting Point: 961.93 °C, 1763.474 °F  
Vapor Pressure (@ 20C (68F): N/A  
Vapor Density (Air = 1): N/A  
Boiling Point: 2212 °C, 4013.6 °F  
Solubility in H<sub>2</sub>O: Insoluble  
pH: N/A  
Flash Point: N/A

### Section 4: Fire and Explosion Hazard Data

Flash point: None  
Flammable Limits: None

Extinguishing Media: Do not attempt to extinguish molten or burning metals with water. Dry Chemical, CO2, Class D Extinguishing Agent, dry sand may be used.

Special Fire-Fighting Procedures: Firefighters should wear self-contained breathing apparatus and protective clothing.

### **Section 5: Stability and Reactivity**

Stability: Stable      Conditions to Avoid: None Known  
Incompatibility: Acetylene, ammonia, hydrogen peroxide, bromoazide, chlorine trifluoride, ethyleneimine, oxalic acid, tartaric acid.  
Hazardous Decomposition Products: Oxides of silver  
Hazardous Polymerization: Will not occur

### **Section 6: Health Hazard Data and First Aid Procedures**

Primary Routes of Exposure: Inhalation, eye and skin

Inhalation: Chronic exposure may cause argyria, a blue-gray discoloration of the skin, mucous membranes and eyes. Acute exposure may cause irritation of the respiratory tract or metal fume fever with symptoms of fever, chills nausea, chest tightness, or metallic taste. If inhaled, move to fresh air and seek medical attention immediately.

Ingestion: May cause generalized argyria and may be mildly irritating to the lining of the stomach and intestines. Never attempt to give anything by mouth to an unconscious person. Call a poison control center immediately. Seek medical attention.

Skin: Remove contaminated clothing. Wash skin with soap and water. Seek medical attention.

Eyes: Irritation may result. Rinse eyes thoroughly with water for 15 minutes. Seek medical attention immediately. Wash contaminated clothing before reuse. Destroy or thoroughly clean contaminated shoes.

Carcinogenicity?      No                      Listed in:      None known

Medical Conditions generally aggravated by exposure:      None Known

### **Section 7: Precautions for Safe Handling and Use**

Steps in case of spill or Leak: Notify spill response personnel in the event of a spill. Sweep up beads. Avoid generating dust and wear

appropriate personnel protective equipment. Place clean up debris in a suitable container.

**Waste Disposal:** Waste may have reclaim value. Contact Academy Corporation for recycling options. Dispose of unsalvageable material in accordance with federal, state and local regulations.

**Precautions to be taken in Handling and Storage:** Keep containers tightly closed, store in a cool, dry, well ventilated area and avoid contact with incompatible materials. When handling finely divided silver in either dust or powder form observe the following precautions. Do not get in eyes. Avoid contact with skin and clothing. Avoid breathing dust. Wash thoroughly after handling. Keep out of the reach of children. Do not handle or use until safety precautions in Material Safety Data Sheet have been read and understood.

### **Section 8: Exposure Controls and Personal Protection**

**Ventilation:** Provide adequate ventilation to reduce airborne exposure below PEL and/or TLV.

**Respiratory Protection:** If airborne concentrations exceed exposure limits or are unknown, use a NIOSH/MSHA approved respirator for dust and or metal fume in accordance with 29 CFR 1910.134.

**Other Protective Equipment:** Safety glasses are required, particularly when dust or fine particles are generated. Gloves and/or protective clothing is required to prevent excessive dust contact with skin and/or for protection from cuts abrasions when performing mechanical operations or handling sharp pieces of metal. Heat resistant gloves, clothing and face protection is required for handling molten materials. Eyewash station should be available in area of use.

**Hygienic Work Practices:** Avoid inhalation or ingestion. Practice good housekeeping. Avoid eating, drinking and smoking in the work area. Wash thoroughly after handling product.

### **Section 9: Transport Information**

Not regulated as a hazardous material for transportation purposes if the pieces of metal have a diameter larger than 100 micrometers, (0.004 in.) as per 49 CFR 172.101. For additional transportation information regarding this product, call Academy Corp. at (505) 343-9440 between 0900 and 1600 MST, Monday to Friday.

**Section 10: Regulatory Information**

OSHA: Hazardous by definition of Hazard Communication Standard 29 CFR 1910.1200  
RCRA Hazardous Waste Code: D011  
TSCA Registered: Yes  
RQ: 1000 lbs. (454 kg.) for pieces < 100 micrometers in diameter.

California Proposition 65  
No proposition 65 chemicals present.

**Section 11: Supplier Notification:**

This product contains the following EPCRA Section 313 chemicals subject to the reporting requirements of Section 313 chemicals of the Emergency Planning and Community Right-To-Know Act of 1986 (40 CFR 372):

CAS No.	Chemical	Percent by Weight
7440-22-4	Silver	100

This information should be included in all MSDS's that are copied and distributed for this material.

*The information contained herein is furnished without warranty of any kind. Users should consider these data only as a supplement to other information gathered by them and must make independent determinations of 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 and the protection of the environment. User is responsible to determine suitability of material for a specific application*

Date Prepared: 7-19-00  
Date Revised: 03-27-03  
agmsds.doc

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# MATERIAL SAFETY DATA SHEET

Prepared to U.S. OSHA, CMA, ANSI and Canadian WHMIS Standards

## PART I What is the material and what do I need to know in an emergency?

### 1. PRODUCT IDENTIFICATION

<u>TRADE NAME (AS LABELED):</u>	<b>COPPER</b>
<u>CHEMICAL NAME/CLASS:</u>	METAL ALLOY
<u>PRODUCT USE:</u>	Printing Operations
<u>MANUFACTURER'S NAME:</u>	<b>REVERE GRAPHICS WORLDWIDE</b>
<u>ADDRESS:</u>	5 Boundary Street Plymouth, MA 02360
<u>EMERGENCY PHONE:</u>	(800) 424-9300 (CHEMTREC)
<u>BUSINESS PHONE:</u>	(508) 746-1000
<u>DATE OF PREPARATION:</u>	May 24, 1995
<u>DATE OF FIRST REVISION:</u>	July 9, 1998

### 2. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS #	% w/w	EXPOSURE LIMITS IN AIR BASED ON 8 HOUR TIME-WEIGHTED AVERAGES UNLESS OTHERWISE STATED					
			ACGIH		OSHA		IDLH mg/m <sup>3</sup>	OTHER mg/m <sup>3</sup>
			TLV mg/m <sup>3</sup>	STEL mg/m <sup>3</sup>	PEL mg/m <sup>3</sup>	STEL mg/m <sup>3</sup>		
Copper (exposure limits are for copper fume, dusts, and mists)	7440-50-8	> 99.0	0.2 (fume)  1 (dusts & mists)	NE	0.1 (fume)  1 (dusts & mists)	NE	100	NIOSH REL (fume): 0.1 DFG MAK (fume): 0.1 (Respirable fraction)  NIOSH REL: (dusts & mists): 1 DFG MAK (dusts & mists): 1 (Total respirable dust fraction) Carcinogen (copper dusts & mists): EPA-D
Silver	7440-22-4	< 1	0.1	NE	0.01	NE	10	NIOSH REL: 0.01 DFG MAK: 0.01 Carcinogen: EPA-D
Other ingredients present in less than 1% concentration (or 0.1 % for carcinogens, reproductive toxins, and respiratory sensitizers)		Balance	None of these ingredients contributes has established exposure limits or contributes additional significant hazards. All pertinent hazard information has been presented in the appropriate sections of this document.					
This product has polyethylene film on one side and paint on the other. See Section 7 for handling information.			The information presented in this MSDS is not applicable to these coatings unless otherwise specified.					

NE = Not Established      C = Ceiling Limit      See Section 16 for Definitions of Terms Used  
NOTE: All WHMIS required information is included. It is located in appropriate sections based on the ANSI Z400.1-1993 format.

### 3. HAZARD IDENTIFICATION

**EMERGENCY OVERVIEW:** This product is a solid, odorless, copper alloy plate, which has polyethylene film and on one side and paint on the other. There are no immediate health hazards associated with this product. This product is not reactive. If involved in a fire, this product may generate irritating copper fumes and a variety of metal oxides. Emergency responders must wear personal protective equipment suitable for the situation to which they are responding.

**SYMPTOMS OF OVER-EXPOSURE BY ROUTE OF EXPOSURE:**

The most significant routes of over-exposure for this product are by skin or eye contact. The following paragraphs describe symptoms of exposure by route of exposure.

**INHALATION:** Inhalation is not anticipated to be a significant route of overexposure to the plates. Inhalation of large amounts of particulates generated by this product during metal processing operations may be physically irritating and cause deposits of dust in nasal passages. Inhalation of dusts and fumes of Copper (the main component of this product) can cause metal fume fever. Initial symptoms of metal fume fever can include a metallic or sweet taste in the mouth, dryness or irritation of the throat, and coughing. Later symptoms (after 4-48 hours) can include sweating, shivering, headache, fever, chills, thirstiness, muscle aches, nausea, vomiting, weakness, and tiredness. Chronic over-exposure to Copper dust may cause tiredness, stuffiness, diarrhea, and vomiting.

**CONTACT WITH SKIN or EYES:** Contact of the plate form of this product with the skin is not anticipated to be irritating. Rare cases of allergic contact dermatitis have been reported in people working with copper dust. Contact with the plate form of this product or metal dust generated during routing operations can be physically damaging and irritating to the eye (i.e., foreign object).

**SKIN ABSORPTION:** Skin absorption is not known to be a significant route of over-exposure for any component of this product.

**INGESTION:** Ingestion is not anticipated to be a likely route of occupational exposure for this product. If particulates generated during routing operations are ingested (i.e., through poor hygiene practices), nausea, vomiting, diarrhea, and abdominal cramps can occur.

**INJECTION:** Injection of this product is not anticipated to be a significant route of exposure

**TARGET ORGANS:** None under normal circumstances of use and handling. Skin, eyes, and respiratory system in situations in which fumes or dusts are generated.

**HEALTH EFFECTS OR RISKS FROM EXPOSURE:** An Explanation in **Lay Terms**. Over-exposure from this product is very unlikely when used for its designed purpose.

**ACUTE:** Inhalation of large amounts of particulates generated by this product during metal processing operations may result in irritation. Inhalation of dusts and fumes of this product can cause metal fume fever. Contact with the plate form of this product or metal dust generated during routing can be physically damaging and irritating to the eye (i.e., foreign object).

**CHRONIC:** Rare cases of allergic contact dermatitis have been reported in people working with copper dust. Chronic over-exposure to dusts of this product may cause tiredness, stuffiness, diarrhea, and vomiting. Chronic skin contact or ingestion of dusts, salts, or fumes of Silver, (a component of this product) can result in a condition known as Argyria. This condition is marked by a bluish appearance of the skin and eyes. This effect does not occur as a result of routine use of this product.

### PART II *What should I do if a hazardous situation occurs?*

#### 4. FIRST-AID MEASURES

**SKIN EXPOSURE:** In the event that skin contact leads to irritation, rinse the area thoroughly with water. The contaminated individuals must seek medical attention if any adverse effect persists.

HAZARDOUS MATERIAL INFORMATION SYSTEM			
HEALTH		(BLUE)	0
FLAMMABILITY		(RED)	0
REACTIVITY		(YELLOW)	0
PROTECTIVE EQUIPMENT			B
EYES	RESPIRATORY	HANDS	BODY
	See Section 8		See Section 8
For routine industrial applications			

**See Section 16 for Definition of Ratings**

## 4. FIRST-AID MEASURES (Continued)

**EYE EXPOSURE:** If particulates generated by this product during metal processing operations enter the eyes, open victim's eyes while under gently running water. Use sufficient force to open eyelids. Have victim "roll" eyes. Minimum flushing is for 15 minutes. Victim must seek immediate medical attention.

**INHALATION:** If particulates generated by this product during metal processing operations are inhaled, remove victim to fresh air. Seek medical attention if any adverse effect occurs after overexposure.

**INGESTION:** If particulates generated by this product during metal processing operations are swallowed, CALL PHYSICIAN OR POISON CONTROL CENTER FOR MOST CURRENT INFORMATION. If professional advice is not available, do not induce vomiting. Victim should drink milk, egg whites, or large quantities of water. Never induce vomiting or give diluents (milk or water) to someone who is unconscious, having convulsions, or unable to swallow.

Victims of chemical exposure must be taken for medical attention. Rescuers should be taken for medical attention, if necessary. Take copy of label and MSDS to health professional with victim.

## 5. FIRE-FIGHTING MEASURES

**FLASH POINT:** Not applicable.

**AUTOIGNITION TEMPERATURE:** Not applicable.

**FLAMMABLE LIMITS (in air by volume, %):** Lower: Not applicable.

Upper: Not applicable.

**FIRE EXTINGUISHING MATERIALS:** Use fire extinguishing materials appropriate for surrounding fire.

Water Spray: Yes

Foam: Yes

Halon: Yes

Carbon Dioxide: Yes

Dry Chemical: Yes

Other: Any "ABC" Class

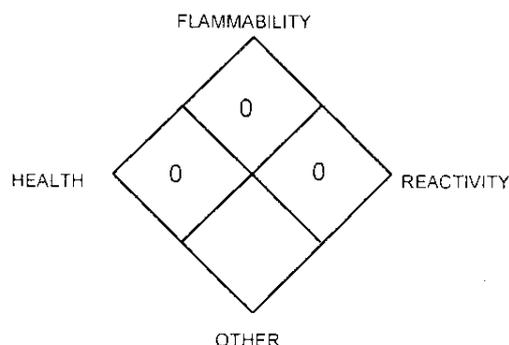
**UNUSUAL FIRE AND EXPLOSION HAZARDS:** When involved in a fire, this product may decompose and produce irritating fumes and toxic gases including copper oxides, metal fumes, carbon monoxide, and carbon dioxide (from polyethylene film and paint).

Explosion Sensitivity to Mechanical Impact: Not sensitive.

Explosion Sensitivity to Static Discharge: Not sensitive.

**SPECIAL FIRE-FIGHTING PROCEDURES:** Incipient fire responders should wear eye protection. Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment. If possible, prevent runoff water from entering storm drains, bodies of water, or other environmentally sensitive areas.

### NFPA RATING



See Section 16 for Definition of Ratings

## 6. ACCIDENTAL RELEASE MEASURES

**SPILL AND LEAK RESPONSE:** Uncontrolled releases should be responded to by appropriately trained personnel using pre-planned procedures. Proper protective equipment should be used. If necessary, clear the affected area and protect people. In the event of a non-incident release of dusts, minimum Personal Protective Equipment should be gloves, goggles, and appropriate body protection. **Level B, which includes the use of Self-Contained Breathing Apparatus, should be worn when oxygen levels are below 19.5% or are unknown.** Pick-up or sweep-up product carefully. Decontaminate the area thoroughly. Place all spill residue in a suitable container and seal if appropriate. Dispose of in accordance with U.S. Federal, State, and local hazardous waste disposal regulations, or the applicable standards of Canada and its Provinces (see Section 13, Disposal Considerations).

## PART III *How can I prevent hazardous situations from occurring?*

### 7. HANDLING and STORAGE

**WORK AND HYGIENE PRACTICES:** As with all chemicals, avoid getting this product ON YOU or IN YOU. Wash thoroughly after using this product. Do not eat, drink, smoke, or apply cosmetics while handling this product. Avoid breathing dusts of this product. If necessary, periodically wipe-down area of product use to prevent accumulation of dusts. Remove contaminated clothing immediately.

## 7. HANDLING and STORAGE (Continued)

STORAGE AND HANDLING PRACTICES: All employees who handle this product should be trained to handle it safely. Avoid breathing particulates generated by this product during metal processing or other operations. Use in a well-ventilated location. Packages of this product must be properly labeled.

No special precautions are necessary when handling these plates, except to protect the surfaces from mechanical damage. When removing the polyethylene film, dispose of the plastic properly; it is a low hazard material. If removing the paint coating, use procedures designed to prevent exposure to paint pigments and potentially hazardous components used in the removal process.

Store packages in a cool, dry location. Storage in an atmosphere that is wet, moist, or highly humid may lead to oxidation of this product. Store away from incompatible materials (see Section 10, Stability and Reactivity)

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Follow practices indicated in Section 6 (Accidental Release Measures). Make certain that application equipment is locked and tagged-out safely if necessary. Collect all rinsates and dispose of according to applicable U.S. Federal, State, or local procedures, or the applicable standards of Canada and its Provinces.

## 8. EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: Use with adequate ventilation to ensure exposure levels are maintained below the limits provided in Section 2 (Composition and Information on Ingredients). Prudent practice is to ensure eyewash/safety shower stations are available near areas where this product is used.

RESPIRATORY PROTECTION: Maintain airborne contaminant concentrations below guidelines listed in Section 2 (Composition and Information on Ingredients). If respiratory protection is needed, use only protection authorized in 29 CFR 1910.134 or applicable State regulations. Use supplied air respiration protection if oxygen levels are below 19.5% or are unknown.

EYE PROTECTION: Safety glasses.

HAND PROTECTION: Wear neoprene gloves for routine industrial use.

BODY PROTECTION: Wear body protection appropriate for task (e.g., apron, lab coat, coveralls).

## 9. PHYSICAL and CHEMICAL PROPERTIES

VAPOR DENSITY (air = 1): Not applicable.

EVAPORATION RATE (n-BuAc = 1): Not applicable.

SPECIFIC GRAVITY (water = 1): 8.9

MELTING POINT or RANGE: 1083°C (1981°F)

SOLUBILITY IN WATER: Insoluble.

BOILING POINT: Not applicable.

VAPOR PRESSURE, mm Hg @20°C: Not applicable.

pH: Not applicable.

ODOR THRESHOLD (recognition): Not applicable.

COEFFICIENT OF OIL/WATER DISTRIBUTION (PARTITION COEFFICIENT): Not applicable.

APPEARANCE AND COLOR: Flat, copper-colored, photoresist-covered, plate with a black plastic film and pigmented coating on one surface and a green paint on the other.

HOW TO DETECT THIS SUBSTANCE (warning properties): The plate shape is characteristic.

## 10. STABILITY and REACTIVITY

STABILITY: Stable.

DECOMPOSITION PRODUCTS: Copper and silver oxides, metal fumes, carbon monoxide, and carbon dioxide.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Strong acids, strong caustics, strong oxidizers, acetylene.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Fire, extremely high temperatures, contact with incompatible materials.

## 12. ECOLOGICAL INFORMATION (Continued)

### EFFECT OF CHEMICAL ON AQUATIC LIFE (continued):

**COPPER:**

LC<sub>50</sub>(fathead minnows) = 0.14 ppm in hard water  
 LC<sub>50</sub>(bluegill) = 0.02 ppm in soft water  
 LC<sub>50</sub>(brook trout) = 0.09 ppm in soft water

**SILVER:** 0.1 ppm is toxic to bacteria and aquatic life. Discharge into marine waters should not exceed /20 of 96 hour LC50, 0.25-0.025 mg/kg/day.

## 13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate U.S. Federal, State, and local regulations, or those of Canada and its Provinces. This product, if unaltered by use, may be disposed of by treatment at a permitted facility or as advised by your local solid waste regulatory authority.

EPA WASTE NUMBER: Waste of this product should be analyzed for Toxicity Characteristic Leaching Procedure chemicals, as follows: D011 (Silver), Regulated Level: 5.0 mg/L.

## 14. TRANSPORTATION INFORMATION

THIS PRODUCT IS NOT HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.

PROPER SHIPPING NAME: Not Applicable  
HAZARD CLASS NUMBER and DESCRIPTION: Not Applicable  
UN IDENTIFICATION NUMBER: Not Applicable  
PACKING GROUP: Not Applicable  
DOT LABEL(S) REQUIRED: Not Applicable  
EMERGENCY RESPONSE GUIDE NUMBER: Not Applicable

NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER, 1996: Not applicable.

MARINE POLLUTANT: No component of this product is designated as a marine pollutant by the Department of Transportation (49 CFR 172.101, Appendix B).

TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: THIS PRODUCT IS NOT CONSIDERED AS DANGEROUS GOODS.

## 15. REGULATORY INFORMATION

U.S. SARA REPORTING REQUIREMENTS: The components of this product are subject to the reporting requirements of Sections 302, 304 and 313 of Title III of the Superfund Amendments and Reauthorization Act, as follows:

CHEMICAL NAME	SARA 302 (40 CFR 355, Appendix A)	SARA 304 (40 CFR Table 302.4)	SARA 313 (40 CFR 372.65)
Copper	No	Yes	Yes
Silver	No	Yes	Yes

U.S. SARA THRESHOLD PLANNING QUANTITY: Not applicable.

U.S. CERCLA REPORTABLE QUANTITY (RQ): Copper = 5000 lb.; Silver = 1,000 lb.; (for metal particles under 100 micrometers in diameter).

U.S. TSCA INVENTORY STATUS: The components of this product are listed on the TSCA Inventory.

OTHER U.S. FEDERAL REGULATIONS: Not applicable.

## PART IV *Is there any other useful information about this material?*

### 11. TOXICOLOGICAL INFORMATION

**TOXICITY DATA:** The specific toxicology data available for components greater than 1% in concentration are as follows.

**COPPER:**

TDLo - Oral - Human: 120 ug/; Gastrointestinal - nausea or vomiting  
LD<sub>50</sub> - Intraperitoneal - mouse: 3500 ug/kg  
TDLo - Intrapleural - rat: 100 mg/kg; Tumorigenic - equivocal  
tumorigenic agent; Lungs, Thorax, or Respiration - fibrosis, focal  
(pneumoconiosis), tumors  
TDLo - Oral - rat: 152 mg/kg; female 22 week(s) pre-mating;  
fetotoxicity; Specific Developmental Abnormalities - Central  
Nervous System

**COPPER (continued):**

TDLo - Oral - rat: 1520 ug/kg; female 22 week(s) pre-mating;  
Reproductive - Specific Developmental Abnormalities -  
musculoskeletal system  
TDLo - Oral - rat: 1210 ug/kg; female 35 week(s) pre-mating;  
Reproductive - Fertility - pre-implantation mortality, post-  
implantation mortality  
TDLo - Intrauterine - rat: 250 ug/kg; female 1 day(s) pre-mating;  
Reproductive - Maternal Effects - uterus, cervix, vagina; female  
fertility index

**SUSPECTED CANCER AGENT:** Silver and Copper (components of this product) are listed as follows:

EPA-D, Not Classifiable as to Human Carcinogenicity

The other components of this product are not found on the following lists: FEDERAL, OSHA Z LIST, NTP, IARC and CAL/OSHA and therefore are neither considered to be nor suspected to be cancer-causing agents by these agencies.

**IRRITANCY OF PRODUCT:** This product's fumes or dusts may be irritating to contaminated skin, eyes and respiratory system.

**SENSITIZATION TO THE PRODUCT:** Rare cases of allergic contact dermatitis have been reported in people working with copper dust.

**REPRODUCTIVE TOXICITY INFORMATION:** Listed below is information concerning the effects of this product and their components on the human reproductive system.

**Mutagenicity:** This product is not reported to produce mutagenic effects in humans.

**Embryotoxicity:** This product is not reported to produce embryotoxic effects in humans.

**Teratogenicity:** This product is not reported to cause teratogenic effects in humans. Studies on test animals exposed to relatively high doses of Copper (a component of this product) indicate adverse teratogenic effects.

**Reproductive Toxicity:** This product is not reported to cause reproductive effects in humans. Studies on test animals exposed to relatively high doses of Copper (a component of this product) indicate adverse reproductive effects.

A *mutagen* is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generational lines. An *embryotoxin* is a chemical which causes damage to a developing embryo (i.e. within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A *teratogen* is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A *reproductive toxin* is any substance which interferes in any way with the reproductive process.

**MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE:** Skin and respiratory disorders may be aggravated by prolonged over-exposures to the particulates generated by this product during metal processing operations.

**RECOMMENDATIONS TO PHYSICIANS:** Treat symptoms and eliminate overexposure.

**BIOLOGICAL EXPOSURE INDICES:** Currently, there are no Biological Exposure Indices (BEIs) associated with the components of this product.

### 12. ECOLOGICAL INFORMATION

**ENVIRONMENTAL STABILITY:** The components of this product occur naturally in the environment and are expected to persist in the environment for an extended period of time. The components will react with water and air to form a variety of metal oxide compounds. The following environmental data are available for the components of this product.

**SILVER:** Solubility: Insoluble. Many silver salts are only slightly soluble and so silver cations will rapidly be reduced to lower levels. The Biological half-life for silver is a few days for animals and up to 50 days for humans.

**COPPER:** Solubility: Insoluble. There is no evidence of any biotransformation for copper compounds. Copper is accumulated by all plants and animals. BCF Algae = 12, plants = 1,000; invertebrate = 1,000, fish = 667 and fish = 200 (Soluble copper salts).

**EFFECT OF MATERIAL ON PLANTS or ANIMALS:** The metal components of this product occur naturally in the. This product is not expected to cause adverse effects on plant or animal life.

**EFFECT OF CHEMICAL ON AQUATIC LIFE:** Under normal circumstances, this product is not expected to cause adverse effects on aquatic life. Low chronic aquatic limits indicate a high chronic hazard, it may be concentrated to toxic levels in food chain. The following aquatic toxicity data are available for the components:

## 15. REGULATORY INFORMATION (Continued)

U.S. STATE REGULATORY INFORMATION: Components of this product are covered under specific State regulations, as denoted below:

**Alaska-Designated Toxic and Hazardous Substances:** Copper, fume, dust and mist.

**California-Permissible Exposure Limits for Chemical Contaminants:** Copper, Silver.

**Florida-Substance List:** Copper fume, dust and mist; Silver.

**Illinois-Toxic Substance List:** Copper.

**Kansas-Section 302/313 List:** Copper and compounds.

**Massachusetts-Substance List:** None.

**Michigan-Critical Materials Register:** Copper.

**Minnesota-List of Hazardous Substances:** Copper, fume; Silver.

**Missouri-Employer Information/Toxic Substance List:** Copper; Silver.

**New Jersey-Right to Know Hazardous Substance List:** Copper, Silver.

**North Dakota-List of Hazardous Chemicals, Reportable Quantities:** Copper, Silver.

**Pennsylvania-Hazardous Substance List:** Copper, Silver.

**Rhode Island-Hazardous Substance List:** Copper, fume, dust, mist; Silver.

**Texas-Hazardous Substance List:** Copper, fume.

**West Virginia-Hazardous Substance List:** Copper, fume.

**Wisconsin-Toxic and Hazardous Substances:** Copper, fume.

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): None of the components of this product are on the California Proposition 65 list.

LABELING: CAUTION! PARTICULATES GENERATED FROM THIS PRODUCT MAY CAUSE SKIN AND EYE IRRITATION. PROLONGED SKIN CONTACT WITH DUSTS MAY CAUSE ALLERGIC SKIN REACTIONS. Do not get particulates on skin or in eyes. Avoid prolonged skin contact. Avoid breathing dust or particulates generated by this product. Wear gloves and goggles, as appropriate. FIRST-AID: In case of contact, immediately flush skin or eyes with plenty of water if irritation occurs. If dusts are inhaled, remove to fresh air. If particulates are ingested, do not induce vomiting. Get medical attention if any adverse effect occurs. IN CASE OF FIRE: Use water fog, dry chemical, CO<sub>2</sub>, or "alcohol" foam, as appropriate for surrounding materials. IN CASE OF SPILL: Pick-up or sweep-up product. Place in a suitable container and seal. Consult Material Safety Data Sheet for additional information.

### ADDITIONAL CANADIAN REGULATIONS:

CANADIAN DSL/NDSL INVENTORY STATUS: The components of this product are on the DSL or NDSL Inventories

CANADIAN WHMIS SYMBOLS: Not applicable.

## 16. OTHER INFORMATION

**PREPARED BY:**

CHEMICAL SAFETY ASSOCIATES, Inc.  
9163 Chesapeake Drive, San Diego, CA 92123-1002  
619/565-0302

**DATE OF PRINTING:**

November 25, 2000

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## DEFINITIONS OF TERMS

A large number of abbreviations and acronyms appear on a MSDS. Some of these which are commonly used include the following:

**CAS #** - This is the Chemical Abstract Service Number which uniquely identifies each constituent. It is used for computer-related searching.

### EXPOSURE LIMITS IN AIR:

**ACGIH** - American Conference of Governmental Industrial Hygienists, a professional association which establishes exposure limits.

**TLV** - Threshold Limit Value - an airborne concentration of a substance which represents conditions under which it is generally believed that nearly all workers may be repeatedly exposed without adverse effect. The duration must be considered, including the 8-hour Time Weighted Average (**TWA**), the 15-minute Short Term Exposure Limit, and the instantaneous Ceiling Level (**C**). Skin absorption effects must also be considered.

**OSHA** - U.S. Occupational Safety and Health Administration.

**PEL** - Permissible Exposure Limit - This exposure value means exactly the same as a TLV, except that it is enforceable by OSHA. The OSHA Permissible Exposure Limits are based in the 1989 PELs and the June, 1993 Air Contaminants Rule (Federal Register, 58: 35338-35351 and 58: 40191). Both the current PELs and the vacated PELs are indicated. The phrase, "Vacated 1989 PEL," is placed next to the PEL which was vacated by Court Order.

**IDLH** - Immediately Dangerous to Life and Health - This level represents a concentration from which one can escape within 30-minutes without suffering escape-preventing or permanent injury. The **DFG - MAK** is the Republic of Germany's Maximum Exposure Level, similar to the U.S. PEL. **NIOSH** is the National Institute of Occupational Safety and Health, which is the research arm of the U.S. Occupational Safety and Health Administration (**OSHA**). **NIOSH** issues exposure guidelines called Recommended Exposure Levels (**RELs**). When no exposure guidelines are established, an entry of **NE** is made for reference.

### HAZARD RATINGS:

**HAZARDOUS MATERIALS IDENTIFICATION SYSTEM:** Health Hazard: 0 (minimal acute or chronic exposure hazard); 1 (slight acute or chronic exposure hazard); 2 (moderate acute or significant chronic exposure hazard); 3 (severe acute exposure hazard; onetime overexposure can result in permanent injury and may be fatal); 4 (extreme acute exposure hazard; onetime overexposure can be fatal). Flammability Hazard: 0 (minimal hazard); 1 (materials that require substantial pre-heating before burning); 2 (combustible liquid or solids; liquids with a flash point of 38-93°C [100-200°F]); 3 (Class IB and IC flammable liquids with flash points below 38°C [100°F]); 4 (Class IA flammable liquids with flash points below 23°C [73°F] and boiling points below 38°C [100°F]). Reactivity Hazard: 0 (normally stable); 1 (material that can become unstable at elevated temperatures or which can react slightly with water); 2 (materials that are unstable but do not detonate or which can react violently with water); 3 (materials that can detonate when initiated or which can react explosively with water); 4 (materials that can detonate at normal temperatures or pressures).

**NATIONAL FIRE PROTECTION ASSOCIATION:** Health Hazard: 0 (material that on exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials); 1 (materials that on exposure under fire conditions could cause irritation or minor residual injury); 2 (materials that on intense or continued exposure under fire conditions could cause temporary incapacitation or possible residual injury); 3 (materials that can on short exposure could cause serious temporary or residual injury); 4 (materials that under very short exposure could cause death or major residual injury). Flammability Hazard and Reactivity Hazard: Refer to definitions for "Hazardous Materials Identification System".

### FLAMMABILITY LIMITS IN AIR:

Much of the information related to fire and explosion is derived from the National Fire Protection Association (**NFPA**). Flash Point - Minimum temperature at which a liquid gives off sufficient vapors to form an ignitable mixture with air. Autoignition Temperature: The minimum temperature required to initiate combustion in air with no other source of ignition. LEL - the lowest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source. UEL - the highest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source.

### TOXICOLOGICAL INFORMATION:

Possible health hazards as derived from human data, animal studies, or from the results of studies with similar compounds are presented. Definitions of some terms used in this section are: **LD<sub>50</sub>** - Lethal Dose (solids & liquids) which kills 50% of the exposed animals; **LC<sub>50</sub>** - Lethal Concentration (gases) which kills 50% of the exposed animals; **ppm** concentration expressed in parts of material per million parts of air or water; **mg/m<sup>3</sup>** concentration expressed in weight of substance per volume of air; **mg/kg** quantity of material, by weight, administered to a test subject, based on their body weight in kg. Data from several sources are used to evaluate the cancer-causing potential of the material. The sources are: **IARC** - the International Agency for Research on Cancer; **NTP** - the National Toxicology Program; **RTECS** - the Registry of Toxic Effects of Chemical Substances; **OSHA** and **CAL/OSHA**. **IARC** and **NTP** rate chemicals on a scale of decreasing potential to cause human cancer with rankings from 1 to 4. Subrankings (2A, 2B, etc.) are also used. Other measures of toxicity include **TDLo**, the lowest dose to cause a symptom and **TCLo**, the lowest concentration to cause a symptom; **TDo**, **LDLo**, and **LDo**, or **TC**, **TCo**, **LCLo**, and **LCo**, the lowest dose (or concentration) to cause lethal or toxic effects. **BEI** - Biological Exposure Indices, represent the levels of determinants which are most likely to be observed in specimens collected from a healthy worker who has been exposed to chemicals to the same extent as a worker with inhalation exposure to the TLV. Ecological Information: **EC** is the effect concentration in water.

### REGULATORY INFORMATION:

**U.S. and CANADA:** This section explains the impact of various laws and regulations on the material. **EPA** is the U.S. Environmental Protection Agency. **WHMIS** is the Canadian Workplace Hazardous Materials Information System. **DOT** and **TC** are the U.S. Department of Transportation and the Transport Canada, respectively. Superfund Amendments and Reauthorization Act (**SARA**); the Canadian Domestic/Non-Domestic Substances List (**DSL/NDL**); the U.S. Toxic Substance Control Act (**TSCA**); Marine Pollutant status according to the **DOT**; the Comprehensive Environmental Response, Compensation, and Liability Act (**CERCLA** or **Superfund**); and various state regulations. This section also includes information on the precautionary warnings which appear on the material's package label.

# Material Safety Data Sheet

Printing date 08/13/2004

Reviewed on 07/26/2004

- **Product name: Nickel Metal**
- **Supplier:**  
United Nuclear Scientific Supplies, LLC.  
P.O. Box 851  
Sandia Park, NM. 87047  
  
(505) 286-2831

- **Emergency information:**  
Call Chemtrec at (800) 424-9300.

## 2 Composition/Data on components:

- **Chemical characterization:**  
Description: (CAS#)

Nickel (CAS# 7440-02-0), 100%

- **Identification number(s):**
- **EINECS Number:** 231-111-4
- **EU Number:** 028-002-00-7

## 3 Hazards identification

- **Information pertaining to particular dangers for man and environment**  
R 40 Limited evidence of a carcinogenic effect.  
R 43 May cause sensitization by skin contact.
- **Classification system**
- **HMIS ratings (scale 0-4)**

(Hazardous Materials Identification System)

Health (acute effects) = 0  
Flammability = 0  
Reactivity = 0

## 4 First aid measures

- **General information** No special measures required.
- **After inhalation** Seek medical treatment in case of complaints.
- **After skin contact** Generally the product does not irritate the skin.
- **After eye contact**  
Rinse opened eye for several minutes under running water. If

symptoms persist, consult a doctor.

- o **After swallowing** Seek immediate medical advice.

- **5 Fire fighting measures**

- o **Suitable extinguishing agents**  
Product is not flammable. Use fire fighting measures that suit the surrounding fire.
- o **Protective equipment:** No special measures required.

- **6 Accidental release measures**

- o **Person-related safety precautions:** Not required.
- o **Measures for environmental protection:**  
Do not allow material to be released to the environment without proper governmental permits.
- o **Measures for clearing/collecting:**  
Dispose contaminated material as waste according to item 13.
- o **Additional information:**  
See Section 7 for information on safe handling  
See Section 8 for information on personal protection equipment.  
See Section 13 for disposal information.

- o **7 Handling and storage**

- **Handling**
- **Information for safe handling:**  
Keep container tightly sealed.  
Store in cool, dry place in tightly closed containers.  
Ensure good ventilation at the workplace.  
Prevent formation of dust.
- **Information about protection against explosions and fires:**  
No special measures required.
- **Storage**
- **Requirements to be met by storerooms and receptacles:**  
No special requirements.
- **Information about storage in one common storage facility:**  
Not required.
- **Further information about storage conditions:** None.

- **8 Exposure controls and personal protection**

- o **Additional information about design of technical systems:**  
No further data; see item 7.

**Components with limit values that require monitoring at the workplace:**

Nickel and inorganic compounds, as Ni	mg/m <sup>3</sup>
ACGIH TLV	1.5, A5-inhalable particulate (metal)
compounds)	0.2, A1-inhalable particulate (insoluble
compounds)	0.1, A4-inhalable particulate (soluble
Austria	Carcinogen
Denmark TWA	0.5
Finland TWA	0.1 (skin) Carcinogen
France VME	1; C3-Carcinogen
Germany	Carcinogen
Hungary	0.005-STEEL; Carcinogen (insoluble
compounds)	
Japan	1; 2B-Carcinogen
Korea TLV	1.5
Netherlands MAC-TGG	1; Carcinogen
	1 (insoluble compounds)
Poland TWA	0.25
Russia	0.05-STEEL
Sweden NGV	0.5 (dust)
Switzerland MAK-W	0.5; Carcinogen
United Kingdom TWA	0.1
USA PEL	1

o **Additional information:** No data

o **Personal protective equipment**

o **General protective and hygienic measures**

The usual precautionary measures for handling chemicals should be followed.

o **Breathing equipment:** Not required.

o **Protection of hands:** Not required.

o **Eye protection:** Safety glasses

o **Body protection:** Protective work clothing.

o **9 Physical and chemical properties:**

▪ **General Information**

▪ **Form:** Thin Strips

▪ **Color:** Silver-colored

▪ **Odor:** Odorless

▪

<u>Method</u>	<u>Value/Range</u>	<u>Unit</u>
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▪ **Change in condition**

▪ **Melting point/Melting range:** 1453 ° C

▪ **Boiling point/Boiling range:** 2730 ° C

▪ **Sublimation temperature / start:** Not determined

- **Flash point:** Not applicable
- **Flammability (solid, gaseous) flammable:** Fine powder: highly flammable
- **Ignition temperature:** Not determined
- **Decomposition temperature:** Not determined
- **Danger of explosion:** Product does not present an explosion hazard.
- **Explosion limits:**
  - **Lower:** Not determined
  - **Upper:** Not determined
- **Vapor pressure:** Not determined
- **Density:** at 20 ° C 8.908 g/cm<sup>3</sup>
- **Solubility in / Miscibility with Water:** Insoluble

#### • 10 Stability and reactivity

- **Thermal decomposition / conditions to be avoided:** Decomposition will not occur if used and stored according to specifications.
- **Materials to be avoided:**
  - Acids
  - Oxidizing agents
  - Interhalogens
  - Halogens
  - Sulfur
  - Ammonia
- **Dangerous reactions** Very fine powder: spontaneously flammable in air.
- **Dangerous products of decomposition:** Metal oxide fume

#### • 11 Toxicological information

- **Acute toxicity:**
- **Primary irritant effect:**
  - **on the skin:** Powder: irritant effect
  - **on the eye:** Powder: irritant effect
- **Sensitization:** Sensitization possible through skin contact.
- **Other information (about experimental toxicology):** Tumorigenic effects have been observed on tests with laboratory animals.

- **Subacute to chronic toxicity:**

Nickel and nickel compounds may cause a form of dermatitis known as nickel itch. They may also cause intestinal disorders, convulsions and asphyxia. Airborne nickel contaminated dusts are regarded as carcinogenic to the respiratory tract.

- **Additional toxicological information:**

To the best of our knowledge the acute and chronic toxicity of this substance is not fully known.

EPA-A: human carcinogen: sufficient evidence from epidemiologic studies to support a causal association between exposure and cancer.

IARC-2B: Possibly carcinogenic to humans: limited evidence in humans in the absence of sufficient evidence in experimental animals.

NTP-2: Reasonably anticipated to be a carcinogen: limited evidence from studies in humans or sufficient evidence from studies in experimental animals.

ACGIH A5: Not suspected as a human carcinogen: Not suspected as a human carcinogen on the basis of properly conducted epidemiologic studies in humans. Studies have sufficiently long follow-up, reliable exposure histories, sufficiently high dose, and adequate statistical power to conclude that exposure to the agent does not convey a significant risk of cancer to humans. Evidence suggesting a lack of carcinogenicity in experimental animals will be considered if it is supported by other relevant data.

The Registry of Toxic Effects of Chemical Substances (RTECS) contains tumorigenic and/or carcinogenic and/or neoplastic data for components in this product.

- **12 Ecological information:**

- **General notes:**

Do not allow material to be released to the environment without proper governmental permits.

- **13 Disposal considerations**

- **Product:**

- **Recommendation**

Consult state, local or national regulations to ensure proper disposal.

- **Uncleaned packagings:**

- **Recommendation:**

Disposal must be made according to official regulations.

- **14 Transport information**

Not a hazardous material for transportation.

- DOT regulations:
- Hazard class: None
- Land transport ADR/RID (cross-border)
- ADR/RID class: None
- Maritime transport IMDG:
- IMDG Class: None
- Air transport ICAO-TI and IATA-DGR:
- ICAO/IATA Class: None
- Transport/Additional information:  
Not dangerous according to the above specifications.

- 15 Regulations

- **Product related hazard information:**
- **Hazard symbols:** Xn Harmful
- **Risk phrases:**
  - 40 Limited evidence of a carcinogenic effect.
  - 43 May cause sensitization by skin contact.
- **Safety phrases:**
  - 22 Do not breathe dust.
  - 36 Wear suitable protective clothing.
- **National regulations**

All components of this product are listed in the U.S. Environmental Protection Agency Toxic Substances Control Act Chemical substance Inventory.  
This product contains a chemical known to the state of California to cause cancer or reproductive toxicity.
- **Information about limitation of use:**

For use only by technically qualified individuals.  
This product contains nickel and is subject to the reporting requirements of section 313 of the Emergency Planning and Community Right to Know act of 1986 and 40CFR372.

- 16 Other information:

Employers should use this information only as a supplement to other information gathered by them, and should make independent judgment of suitability of this information to ensure proper use and protect the health and safety of employees. This information is furnished without warranty, and any use of the product not in conformance with this Material Safety Data Sheet, or in combination with any other product or process, is the responsibility of the user.



**MSDS** Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.  
222 Red School Lane  
Phillipsburg, NJ 08865



24 Hour Emergency Telephone: 908-858-2151  
CHEMTREC: 1-800-424-9300

National Response in Canada  
CANUTEC: 613-996-6666

Outside U.S. and Canada  
Chemtrec: 703-527-3887

**NOTE:** CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

# ZINC METAL GRANULAR

MSDS Number: Z0855 --- Effective Date: 11/02/01

## 1. Product Identification

**Synonyms:** Granular zinc; mossy zinc; CI77945; CI Pigment Black 16  
**CAS No.:** 7440-66-6  
**Molecular Weight:** 65.37  
**Chemical Formula:** Zn  
**Product Codes:** J.T. Baker: 4240, 4244, 4248, 4252, 4260, 4270, 4274  
 Mallinckrodt: 8693, 8701

## 2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Zinc	7440-66-6	99 - 100%	Yes
Lead	7439-92-1	0 - 0.1%	Yes

### 3. Hazards Identification

#### Emergency Overview

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**WARNING! HARMFUL IF SWALLOWED OR INHALED. MAY CAUSE IRRITATION TO COMBUSTIBLE DUST CONCENTRATIONS IN AIR. WATER REACTIVE. MAY AFFECT BLOOD AND REPRODUCTIVE SYSTEM (lead component).**

**J.T. Baker SAF-T-DATA<sup>(tm)</sup> Ratings** (Provided here for your convenience)

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Health Rating: 0 - None

Flammability Rating: 1 - Slight

Reactivity Rating: 2 - Moderate

Contact Rating: 0 - None

Lab Protective Equip: GOGGLES; LAB COAT

Storage Color Code: Orange (General Storage)

---

#### Potential Health Effects

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##### **Inhalation:**

No adverse effects expected but dust may cause mechanical irritation. The effects may be difficulty in breathing, sneezing, coughing. When heated, the fumes are highly toxic and may

##### **Ingestion:**

Extremely large oral dosages may produce gastrointestinal disturbances, due both to mechanical irritation and to the production of zinc chloride. Pain, stomach cramps and nausea could occur in aggravated cases.

##### **Skin Contact:**

May cause irritation.

##### **Eye Contact:**

May cause irritation.

##### **Chronic Exposure:**

No adverse health effects expected.

##### **Aggravation of Pre-existing Conditions:**

Persons with pre-existing skin disorders or impaired respiratory function may be more susceptible.

---

### 4. First Aid Measures

##### **Inhalation:**

Remove to fresh air. Get medical attention for any breathing difficulty.

##### **Ingestion:**

Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person.

##### **Skin Contact:**

Wipe off excess material from skin then immediately flush skin with plenty of water for at least 15 minutes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.

##### **Eye Contact:**

Immediately flush eyes with plenty of water for at least 15 minutes, lifting upper and lower eyelids.

---

## 5. Fire Fighting Measures

**Fire:**

Autoignition temperature: ca. 460C (ca. 860F)

The listed autoignition temperature is for Zinc powder (layer); dust cloud is ca. 680C (1250F) temperatures. Bulk dust in damp state may heat spontaneously and ignite on exposure to alkali hydroxides. Contact with strong oxidizers may cause fire.

**Explosion:**

Fine dust dispersed in air in sufficient concentrations, and in the presence of an ignition source.

**Fire Extinguishing Media:**

Smother with a suitable dry powder (sodium chloride, magnesium oxide, Met-L-X).

**Special Information:**

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus in demand or other positive pressure mode.

---

## 6. Accidental Release Measures

Remove all sources of ignition and provide mild ventilation in area of spill. Substance may require protective clothing, goggles and dust/mist respirators. Sweep or vacuum up the spill in a dry container and store in a closed container for recovery or disposal. US Regulations (CERCLA) require reporting reportable quantities. The toll free number for the US Coast Guard National Response Center is 1-800-424-6399.

---

## 7. Handling and Storage

Keep in a tightly closed container. Protect from physical damage. Store in a cool, dry, well-ventilated area. Avoid incompatibilities. Containers of this material may be hazardous when empty since they retain residues. See precautions listed for the product.

---

## 8. Exposure Controls/Personal Protection

**Airborne Exposure Limits:**

None for Zinc metal.

-OSHA Permissible Exposure Limit (PEL):

10 mg/m<sup>3</sup> (TWA), for zinc oxide fume

-ACGIH Threshold Limit Value (TLV):

5 mg/m<sup>3</sup> (TWA), 10 mg/m<sup>3</sup> (STEL) for zinc oxide fume.

**Ventilation System:**

A system of local and/or general exhaust is recommended to keep employee exposures to the lowest feasible level. Local exhaust is generally preferred because it can control the emissions of the contaminant at its source, as recommended in the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition.

**Personal Respirators (NIOSH Approved):**

If the exposure limit is exceeded and engineering controls are not feasible, a full facepiece up to 50 times the exposure limit or the maximum use concentration specified by the appropriate standard is required. If oil particles (e.g. lubricants, cutting fluids, glycerine, etc.) are present, use a NIOSH approved respirator. If exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator for oxygen-deficient atmospheres.

**Skin Protection:**

Wear protective gloves and clean body-covering clothing.

**Eye Protection:**

Use chemical safety goggles. Maintain eye wash fountain and quick-drench facilities in work area.

---

## 9. Physical and Chemical Properties

**Appearance:**

Gray-blue granular or shiny, irregular lumps.

**Odor:**

Odorless.

**Solubility:**

Insoluble in water.

**Specific Gravity:**

7.14

**pH:**

No information found.

**% Volatiles by volume @ 21C (70F):**

0

**Boiling Point:**

907C (1665F)

**Melting Point:**

419C (786F)

**Vapor Density (Air=1):**

No information found.

**Vapor Pressure (mm Hg):**

1 @ 487C (909F)

**Evaporation Rate (BuAc=1):**

No information found.

---

## 10. Stability and Reactivity

**Stability:**

Stable under ordinary conditions of use and storage. Moist zinc dust can react exothermically with oxygen.

**Hazardous Decomposition Products:**

Hydrogen in moist air, zinc oxide with oxygen at high temperature. Zinc metal, when melted, forms zinc fume.

**Hazardous Polymerization:**

Will not occur.

**Incompatibilities:**

Zinc powder can react violently with water, sulfur and halogens. Dangerous or potentially

chlorinated hydrocarbons, strong acids and alkalis.

**Conditions to Avoid:**

Heat, flames, ignition sources and incompatibles.

## 11. Toxicological Information

Zinc: Irritation skin, human: 300 ug/3D-I mild; investigated as a mutagen.

-----\Cancer Lists\-----			
Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
Zinc (7440-66-6)	No	No	None
Lead (7439-92-1)	No	No	2B

## 12. Ecological Information

**Environmental Fate:**

No information found.

**Environmental Toxicity:**

No information found.

## 13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous as contamination of this product may change the waste management options. State and local Dispose of container and unused contents in accordance with federal, state and local req

## 14. Transport Information

Not regulated.

## 15. Regulatory Information

-----\Chemical Inventory Status - Part 1\-----				
Ingredient	TSCA	EC	Japan	Australia
Zinc (7440-66-6)	Yes	Yes	No	Yes
Lead (7439-92-1)	Yes	Yes	Yes	Yes

## -----\Chemical Inventory Status - Part 2\-----

Ingredient	Korea	--Canada--		
		DSL	NDSL	Phil.
Zinc (7440-66-6)	Yes	Yes	No	Yes
Lead (7439-92-1)	Yes	Yes	No	Yes

## -----\Federal, State &amp; International Regulations - Part 1\-----

Ingredient	-SARA 302-		-SARA 313-	
	RQ	TPQ	List	Chemical Catg.
Zinc (7440-66-6)	No	No	Yes	No
Lead (7439-92-1)	No	No	Yes	No

## -----\Federal, State &amp; International Regulations - Part 2\-----

Ingredient	CERCLA	-RCRA-	-TSCA-
		261.33	8(d)
Zinc (7440-66-6)	1000	No	No
Lead (7439-92-1)	10	No	No

Chemical Weapons Convention: No      TSCA 12(b): No      CDTA: No  
 SARA 311/312: Acute: Yes      Chronic: No      Fire: Yes      Pressure: No  
 Reactivity: Yes      (Mixture / Solid)

**WARNING:**

THIS PRODUCT CONTAINS CHEMICALS KNOWN TO THE STATE OF CALIFORNIA TO CAUSE REPRODUCTIVE HARM.

**Australian Hazchem Code:** No information found.

**Poison Schedule:** S6

**WHMIS:**

This MSDS has been prepared according to the hazard criteria of the Controlled Products required by the CPR.

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## 16. Other Information

**NFPA Ratings:** Health: 1 Flammability: 1 Reactivity: 1 Other: **Water reactive**

**Label Hazard Warning:**

WARNING! HARMFUL IF SWALLOWED OR INHALED. MAY CAUSE IRRITATION TO SKIN. MAY BE COMBUSTIBLE DUST CONCENTRATIONS IN AIR. WATER REACTIVE. MAY AFFECT BLOOD AND REPRODUCTIVE SYSTEM (lead component).

**Label Precautions:**

Avoid breathing dust.  
 Avoid contact with eyes, skin and clothing.  
 Keep away from heat and flame.  
 Keep container closed.  
 Use with adequate ventilation.  
 Wash thoroughly after handling.

**Label First Aid:**

If swallowed, induce vomiting immediately as directed by medical personnel. Never give a fresh air. Get medical attention for any breathing difficulty. In case of contact, immediately medical attention if irritation develops or persists.

**Product Use:**

Laboratory Reagent.

**Revision Information:**

MSDS Section(s) changed since last revision of document include: 8.

**Disclaimer:**

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**Mallinckrodt Baker, Inc. provides the information contained herein in good faith but accuracy. This document is intended only as a guide to the appropriate precautions for this product. Individuals receiving the information must exercise their independent judgment. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE ON THIS INFORMATION.**

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**Prepared by:** Environmental Health & Safety

Phone Number: (314) 654-1600 (U.S.A.)

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The Oklahoma State University Photonics Laboratory is supported through a National Science Foundation Course Curriculum and Laboratory Improvement Award. The information on this page may be distributed freely.



# MATERIAL SAFETY DATA SHEET

## I. PRODUCT IDENTIFICATION

**Manufacturer/Supplier:**

ESPI Metals

1050 Benson Way, Ashland, OR 97520

Toll Free (800) 638-2581 \* Fax (541) 488-8313

E-Mail: sales@espimetals.com

**Trade Name:** Tin  
**Synonym:** Stannum  
**Chemical Nature:** Metallic Element  
**Formula:** Sn  
**CAS #:** 7440-31-5

## II. HAZARDOUS INGREDIENTS

**Hazardous Component:** Tin  
**%:** 0-100  
**OSHA/PEL:** 2 mg/m<sup>3</sup>  
**ACGIH/TLV:** 2 mg/m<sup>3</sup>

**HMIS Ratings (Powder): Health: 2 Flammability: 3 Reactivity: 0**  
**HMIS Protective Equipment (Powder):** F: glasses, gloves, apron, dust mask

## III. PHYSICAL DATA

**Boiling Point:** 2507 °C  
**Specific Gravity:** 7.29 g/cc  
**Melting Point:** 231.9 °C  
**Vapor Pressure:** 1 mm @ 1492 °C  
**Vapor Density:** N/A  
**% Volatiles:** 0  
**Appearance and Odor:** Silvery-white powder or grey metal, no odor.  
**Solubility in H<sub>2</sub>O:** Insoluble

## IV. FIRE AND EXPLOSION HAZARDS DATA

**Autoignition Temperature (Powder):** 630 °C (cloud), 430 °C (layer)  
**Flash Point (Method Used):** N/E or N/A  
**Flammable Limits: Upper:** N/A **Lower:** N/A  
**Flammability:** Flammable solid

**Extinguishing Media:** If involved in fire, do not use water, CO<sub>2</sub> or halogenated extinguishers. Use dry chemical extinguishing agents, graphite, sodium chloride, dry sand or dry ground dolomite.

**Special Fire Fighting Procedures:** May be flammable in fine powdered form. Use normal firefighting procedures which

include wearing NIOSH/MSHA approved self-contained breathing apparatus, flame and chemical resistant clothing; hats, boots and gloves. If without risk, remove material from fire area. Fumes from fire are hazardous. Isolate runoff to prevent environmental pollution.

**Unusual Fire & Explosion Hazard:** Combustible in the form of dust when exposed to heat or by spontaneous chemical reaction with  $\text{Br}_2$ ,  $\text{BrF}_3$ ,  $\text{Cl}_2$ ,  $\text{ClF}_3$ ,  $\text{Cu}(\text{NO}_3)_2$ ,  $\text{K}_2\text{O}_2$  and S. Powder oxidizes, especially in the presence of moisture.

## V. HEALTH HAZARD INFORMATION

### Effects of Exposure:

Tin compounds have variable toxicity. Elemental tin and inorganic tin compounds have toxicity and are poorly absorbed when ingested. Some inorganic tin salts are irritating or can liberate toxic fumes on decomposition. The latter is particularly true of tin halogens. (Sax, Dangerous Properties of Industrial Materials, eighth edition.)

### Acute Effects:

**Inhalation:** May cause irritation of the upper respiratory system, metal fume fever, thirst, metallic taste, coughing, fever, chills, muscular pain, headache, nausea, vomiting, profuse sweating, excessive urination and diarrhea.

**Ingestion:** Poor absorption makes it relatively non-toxic.

**Skin:** May cause irritation.

**Eye:** May cause irritation.

### Chronic Effects:

**Inhalation:** May cause pneumoconiosis and tin poisoning.

**Ingestion:** Repeated or high levels may cause abdominal pain, nausea, constipation or diarrhea, gastric irritation and loss of weight.

**Skin:** May cause dermatitis.

**Eye:** May cause conjunctivitis.

**Routes of Entry:** Inhalation, ingestion, skin, eyes.

**Target Organs:** May affect the respiratory system, skin and eyes.

**Medical Conditions, if any, Aggravated by the Chemical:** None known.

**Carcinogenicity:** NTP: No      IARC: No      OSHA: No      EPA: No

## EMERGENCY AND FIRST AID PROCEDURES:

**INHALATION:** Move the exposed person to fresh air at once. Keep warm and at rest. If breathing has stopped, perform artificial respiration. Seek medical attention immediately.

**INGESTION:** Vomiting may occur, but permanent injury is unlikely. If person is conscious, give large quantities of water to drink and induce vomiting. Get medical attention as soon as possible.

**SKIN:** Remove contaminated clothing from affected area. Brush material off skin, wash with mild soap and water. Seek medical attention if symptoms persist.

**EYES:** Flush eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. If irritation persists, consult a physician.

## VI. REACTIVITY DATA

**Stability:** Stable

**Conditions to Avoid:** None

**Incompatibility (Material to Avoid):** Carbon tetrachloride + water, disulfur dichloride, bromide, bromine trifluoride, chlorine trifluoride, chlorine, iodine bromide, copper (II) nitrate, fluorine, iodine heptafluoride, ammonium nitrate, potassium dioxide, sodium peroxide, sulfur, tellurium, molten tin + water. Concentrated acids, oxidants. Fires and explosions can occur

when metallic tin is in contact with turpentine.

**Hazardous Decomposition Products:** Tin oxides.

**Hazardous Polymerization:** Will not occur.

## VII. SPILL OR LEAK PROCEDURES

**Steps to be Taken in Case Material is Released or Spilled:** Wearing full protective equipment, described in section VIII, isolate spill area, provide ventilation and extinguish sources of ignition. Scoop or vacuum up spill using a high efficiency particulate absolute (HEPA) air filter and place in a closed container for proper disposal. Take care not to raise dust. Use non-sparking tools.

**Waste Disposal Method:** Dispose of in accordance with Local, State and Federal waste disposal regulations.

## VIII. SPECIAL PROTECTION INFORMATION

**Respiratory Protection (Specify Type):** NIOSH/MSHA approved high efficiency particle respirator.

**Ventilation:** Use local exhaust to maintain concentration at or below PEL, TLV. Mechanical exhaust is not recommended. When working with powders, handle in a controlled and enclosed process in an inert atmosphere.

**Protective Gloves:** Rubber gloves.

**Eye Protection:** ANSI approved safety glasses. When working with powder form do not wear contact lenses.

**Other Protective Equipment:** Chemical resistant coveralls, lab coat or apron.

## IX. SPECIAL PRECAUTIONS

**Precautions to Be Taken in Handling and Storage:** Avoid dust generation. Avoid breathing dust or fume. Keep container tightly closed. Store in a cool (-18 to 38 °C), dry, well-ventilated area. Wash thoroughly after handling.

**Other Precautions:** Tin powder oxidizes in moisture. Handle and store in a dry, controlled atmosphere.

**Work Practices:** Implement engineering and work practice controls to reduce and maintain concentration of exposure. Use good housekeeping and sanitation practices. Do not use tobacco or food in work area. Wash thoroughly before eating or smoking. Shower and change clothes at the end of work shift. Do not blow dust off clothing or skin with compressed air. Maintain eyewash capable of sustained flushing, safety drench shower and facilities for washing.

**TSCA Listed:** Yes

**DOT Regulations:**

**Solid Forms:**

**Hazard Class:** None

**Powders:**

**Hazard Class:** 4.1

**Identification Number:** UN3089

**Packing Group:** III

**Proper Shipping Name:** Metal powder, flammable, n.o.s. (tin)

The above information is believed to be correct, but does not purport to be all inclusive and shall be used only as a guide. ESPI shall not be held liable for any damage resulting from handling or from contact with the above product.

Issued by: S. Dierks

Date: December 2007

# MATERIAL SAFETY DATA SHEET

## I. PRODUCT IDENTIFICATION

**Manufacturer/Supplier:**

ESPI Metals

1050 Benson Way, Ashland, OR 97520

Toll Free (800) 638-2581 \* Fax (541) 488-8313

E-Mail: sales@espimetals.com

**Trade Name:** Palladium  
**Chemical Nature:** Metallic Element  
**Formula:** Pd  
**CAS #:** 7440-05-3

## II. HAZARDOUS INGREDIENTS

**Hazardous Component:** Palladium**%:** 100**OSHA/PEL:** N/E**ACGIH/TLV:** N/E

**HMIS Rating (0-4):** Health: 1    Flammability: 0    Reactivity: 0    **HMIS Protective Equipment:** B: glasses, gloves.

## III. PHYSICAL DATA

**Boiling Point:** 2970 - 3167 °C  
**Freezing/Melting Point:** 1552 °C  
**Vapor Pressure:** N/A  
**Solubility in H<sub>2</sub>O:** Insoluble  
**% Volatile:** N/A  
**Vapor Density:** N/A  
**Appearance and Odor:** Gray-black powder, bright metallic solid, no odor.  
**Specific Gravity (H<sub>2</sub>O = 1):** 12.02

## IV. FIRE AND EXPLOSION HAZARDS DATA

**Flash Point (Method used):** N/A**Autoignition Temperature:** N/E**Flammable Limits in Air:** Lower: N/A    Upper: N/A

**Extinguishing Media:** Flammable in powdered form. Do not use water, CO<sub>2</sub> or halogenated extinguishers. Use dry chemical extinguishing agents, dry sand or dry ground dolomite.

**Special Fire Fighting Procedures:** Firefighters must wear full face, self-contained breathing apparatus with full protective clothing to prevent contacts with skin and eyes. Fumes from fire are hazardous. Isolate runoff to prevent environmental pollution.

**Unusual Fire & Explosion Hazard:** May have an explosive reaction with hydrogen + hydrogen peroxide. May have a

reaction with formic acid or sodium tetrahydroborate, releasing flammable and explosive hydrogen gas. May have a violent reaction with isopropyl alcohol and  $OF_2S$ . Under the proper conditions it undergoes hazardous reactions with aluminum, arsenic, carbon, methanol, ozonides and sulfur. Highly flammable as a finely divided powder.

## V. HEALTH HAZARD INFORMATION

### Effects of Exposure:

To the best of our knowledge the chemical, physical and toxicological properties of palladium metal have not been thoroughly investigated and recorded.

Palladium metal may be a skin sensitizer. In the laboratory, palladium appears to bind to many cell components; blocks the action of a number of enzymes and interferes with use of energy by nerves and muscles; induces lung malfunction and produces abnormal fetuses. Lethal intravenous doses cause appetite loss, hemolysis, renal deposition and bone marrow damage.

### Acute Effects:

**Inhalation:** Powder or dust may cause abrasive irritation to the respiratory system.

**Ingestion:** Poorly absorbed by the body when ingested.

**Skin:** May cause abrasive irritation and possibly may be a skin sensitizer.

**Eye:** May cause abrasive irritation.

**Chronic Effects:** Inhalation may induce lung malfunction and produce abnormal fetuses. No other chronic health effects recorded.

**Medical Conditions, if any, Aggravated by the Chemical:** Pre-existing respiratory disorders.

**Routes of Entry:** Inhalation, ingestion, skin and eyes.

**Target Organs:** No target organs recorded.

**Carcinogenicity:** NTP: No IARC: No OSHA: No EPA: No

## EMERGENCY AND FIRST AID PROCEDURES:

**INHALATION:** Remove victim to fresh air, keep warm and quiet, give oxygen if breathing is difficult. Seek medical attention if symptoms persist.

**INGESTION:** No data available but one should obtain medical attention.

**SKIN:** Remove contaminated clothing, brush material off skin, wash affected area with mild soap and water. Seek medical attention if irritation persists.

**EYES:** Flush eyes with lukewarm water, lifting upper and lower eyelids, for at least 15 minutes. Seek medical attention if symptoms persist.

## VI. REACTIVITY DATA

**Stability:** Stable

**Conditions to Avoid:** Heat, open flame, sparks.

**Incompatibility (Material to Avoid):** Hydrogen, strong oxidizers, acids, bases, flammable gases and organic liquids.

**Hazardous Decomposition Products:** Palladium oxide, hydrogen gas.

**Hazardous Polymerization:** Will not occur.

## VII. SPILL OR LEAK PROCEDURES

**Steps to Be Taken in Case Material Is Released or Spilled:** Wear appropriate respiratory and protective equipment

specified in section VIII. Isolate spill area and provide ventilation. Vacuum up spill using a high efficiency particulate absolute (HEPA) air filter and place in a closed container for proper disposal. Take care not to raise dust.

**Waste Disposal Method:** Dispose of according to Local, State, and Federal regulations.

## VIII. SPECIAL PROTECTION INFORMATION

**Respiratory Protection (Specify Type):** NIOSH/MSHA approved dust-mist-vapor respirator.

**Ventilation:** Laboratory fume hood. General exhaust is recommended.

**Protective Gloves:** Rubber gloves.

**Eye Protection:** ANSI approved safety goggles.

## IX. SPECIAL PRECAUTIONS

**Precautions to Be Taken in Handling and Storage:** Store in a tightly sealed container, in a cool, dry, well-ventilated area. Wash thoroughly after handling.

**Work Practices:** Implement engineering and work practice controls to reduce and maintain concentration of exposure at low levels. Use good housekeeping and sanitation practices. Do not use tobacco or food in work area. Wash thoroughly before eating and smoking. Do not blow dust off clothing or skin with compressed air.

**Other Precautions:** Lab coat and apron, flame and chemical resistant coveralls, eyewash capable of sustained flushing, safety drench shower and hygienic facilities for washing.

### SARA 311 and 312 Hazard Categories:

**Immediate (Acute) Health Hazard:** Yes

**Delayed (Chronic) Health Hazard:** No

**Fire Hazard:** No

**Reactivity Hazard:** No

**Sudden Release of Pressure:** No

### DOT Regulations:

#### Rod, Wire, Sheet, Foils:

**Hazard Class:** None

#### Powders:

**Hazard Class:** 4.1

**Identification Number:** 3089

**Packing Group:** II

**Proper Shipping Name:** Metal powder, flammable, n.o.s. (palladium)

The above information is believed to be correct, but does not purport to be all inclusive and shall be used only as a guide. ESPI shall not be held liable for any damage resulting from handling or from contact with the above product.

Issued by: S. Dierks

Date: November 2005

# MATERIAL SAFETY DATA SHEET

## I. PRODUCT IDENTIFICATION

**Manufacturer/Supplier:**

ESPI Metals

1050 Benson Way, Ashland, OR 97520

Toll Free (800) 638-2581 \* Fax (541) 488-8313

E-Mail: sales@espimetals.com

**Trade Name:** Platinum  
**Synonym:** Platinum Metal Products  
**Chemical Nature:** Metallic Element  
**Formula:** Pt  
**CAS #:** 7440-06-4

## II. HAZARDOUS INGREDIENTS

**Hazardous Component:** Platinum**%:** 0-100**OSHA/PEL:** 1 mg/m<sup>3</sup>**ACGIH/TLVL:** 1 mg/m<sup>3</sup>**HMIS Rating(Powder):** Health: 1 Flammable: 3 Reactivity: 1**HMIS Rating(Solid):** Health: 0 Flammability: 0 Reactivity: 0

## III. PHYSICAL DATA

**Boiling Point:** 3827 °C**Melting Point:** 1772 °C**Specific Gravity:** 21.45 g/cm<sup>3</sup>**Vapor Density:** 0.14 at 1769 °C**% Volatiles:** N/A**Solubility in H<sub>2</sub>O:** Insoluble**Appearance and Odor:** White metal, no odor

## IV. FIRE AND EXPLOSION HAZARDS DATA

**Flash Point (Method used):** N/A**Autoignition Temperature:** N/A**Flammable Limits: Upper:** N/A **Lower:** N/A**Extinguishing Media:** Use foam, carbon dioxide, dry sand, dry ground dolomite, dry chemical extinguishing agents.**Special Firefighting Procedures:** If involved in a fire wear NIOSH/MSHA approved self-contained breathing apparatus, flame and chemical resistant protective clothing, hat, gloves and boots. If without risk move material out of fire area.**Unusual Fire & Explosion Hazard:** Can be flammable in powdered form when exposed to excessive heat.

## V. HEALTH HAZARD INFORMATION

### Effects of Exposure:

To the best of our knowledge the chemical, physical and toxicological properties of platinum have not been thoroughly investigated and recorded.

Platinum is considered to have low toxicity. Exposure to dust of pure metallic form may cause skin sensitization and irritation to the eyes. Ingestion and inhalation may have irritating effects.

### Acute Effects:

**Inhalation:** Inhalation of dust may cause irritation of the respiratory tract with coughing, wheezing and difficulty breathing.

**Ingestion:** No adverse effects expected.

**Skin:** May cause irritation and allergic reaction.

**Eye:** May cause irritation.

**Chronic Effects:** None known

**Medical Conditions Generally Aggravated by Exposure:** None known

**Carcinogenicity:** NTP: No IARC: No OSHA: No

## EMERGENCY AND FIRST AID PROCEDURES:

**INHALATION:** Remove to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth. If breathing is difficult, oxygen should be administered by qualified personnel. Call a physician.

**INGESTION:** Procedures normally not needed. If large quantities are ingested, seek medical advice.

**SKIN:** Immediately wash skin with soap and plenty of water. If irritation persists, call a physician.

**EYE:** Flush eyes with plenty of water. If irritation develops, call a physician.

## VI. REACTIVITY DATA

**Stability:** Stable

**Conditions to Avoid:** None expected

**Incompatibility (Material to Avoid):** Aqua regia, molten alkali cyanides. Attacked by halogens, by fusion with caustic alkalis, alkali nitrates, alkali peroxides, by arsenates and phosphates in presence of reducing agents. Strong oxidizers, and organic materials.

**Hazardous Decomposition Products:** Chloroplatinic acid

**Hazardous Polymerization:** Will not occur

## VII. SPILL OR LEAK PROCEDURES

**Steps to be Taken in Case Material is Released or Spilled:** Wear appropriate respiratory protection and protective clothing. Vacuum or scoop the spilled material into a container for reclamation or disposal.

**Waste Disposal Method:** Dispose of in accordance with State, Federal and Local regulations.

## VIII. SPECIAL PROTECTION INFORMATION

**Respiratory Protection (Specify Type):** A NIOSH/MSHA approved dust respirator is recommended if dust is generated.

**Ventilation:** Local exhaust ventilation as necessary to control any air contaminants to within their PEL's or TLV's during the use of this material.

**Protective Gloves:** Chemical resistant gloves should be worn.

**Eye Protection:** Safety glasses (with side shields)

**Other Protective Equipment:** Body protection as necessary to prevent skin contact.

## IX. SPECIAL PRECAUTIONS

**Precautions to Be Taken in Handling and Storage:** Store in a cool, dry location away from incompatible materials. Keep container tightly closed. Wash thoroughly after handling. Avoid contact with eyes, skin and clothing. Avoid generating or breathing dust. Use only with adequate ventilation.

**Work Practices:** Implement engineering and work practice controls to reduce and maintain concentration of exposure. Use good housekeeping and sanitation practices. Do not use tobacco or food in work area. Wash thoroughly before eating or smoking. Do not blow dust off clothing or skin with compressed air. Maintain eyewash capable of sustained flushing, safety drench shower and facilities for washing.

**TSCA Listed:** Yes

**DOT Regulations:**

**Solid Forms:**

**Hazard Class:** None

**Sponge and Powder:**

**Hazard Class:** 4.1

**Identification Number:** 3089

**Packing Group:** III

**Proper Shipping Name:** Metal powder, flammable, n.o.s. (platinum)

The above information is believed to be correct, but does not purport to be all inclusive and shall be used only as a guide. ESPI shall not be held liable for any damage resulting from handling or from contact with the above product.

**Issued by:** S. Dierks

**Date:** August 2007

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## MATERIAL SAFETY DATA SHEET

### SECTION 1 CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

MATHESON TRI-GAS, INC.  
959 ROUTE 46 EAST  
PARSIPPANY, NEW JERSEY USA  
07054-0624 OR  
530 WATSON STREET  
WHITBY, ONTARIO, CANADA  
L1N 5R9

EMERGENCY CONTACT:  
CHEMTREC 1-800-424-9300

INFORMATION CONTACT:  
(USA) 973-257-1100

(WHITBY) 905-668-3570  
(EDMONTON) 780-471-4036

**SUBSTANCE: ACETYLENE**

**TRADE NAMES/SYNONYMS:**

MTG MSDS 1; ETHYNE; WELDING GAS; ACETYLEN; ETHINE; NARCYLEN;  
VINYLENE; STCC 4905701; UN 1001; C<sub>2</sub>H<sub>2</sub>; MAT00280; RTECS AO9600000

**CHEMICAL FAMILY:** hydrocarbons, aliphatic

**CREATION DATE:** Jan 24 1989

**REVISION DATE:** Sep 18 2001

### SECTION 2 COMPOSITION, INFORMATION ON INGREDIENTS

**COMPONENT:** ACETYLENE

**CAS NUMBER:** 74-86-2

**PERCENTAGE:** 100.0

### SECTION 3 HAZARDS IDENTIFICATION

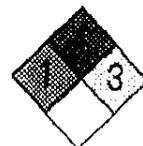
**NFPA RATINGS (SCALE 0-4):** HEALTH=1 FIRE=4 REACTIVITY=3

**EMERGENCY OVERVIEW:**

**COLOR:** colorless

**PHYSICAL FORM:** gas

**ODOR:** sweet odor



**MAJOR HEALTH HAZARDS:** central nervous system depression, difficulty breathing  
**PHYSICAL HAZARDS:** May explode when heated. Flammable gas. May cause flash fire.

**POTENTIAL HEALTH EFFECTS:**

**INHALATION:**

**SHORT TERM EXPOSURE:** nausea, vomiting, chest pain, wheezing, headache, symptoms of drunkenness, bluish skin color, suffocation, lung congestion, coma

**LONG TERM EXPOSURE:** no information on significant adverse effects

**SKIN CONTACT:**

**SHORT TERM EXPOSURE:** rash

**LONG TERM EXPOSURE:** no information is available

**EYE CONTACT:**

**SHORT TERM EXPOSURE:** no information on significant adverse effects

**LONG TERM EXPOSURE:** no information is available

**INGESTION:**

**SHORT TERM EXPOSURE:** no information on significant adverse effects

**LONG TERM EXPOSURE:** no information is available

---

**SECTION 4 FIRST AID MEASURES**

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**INHALATION:** If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. If breathing is difficult, oxygen should be administered by qualified personnel. Get immediate medical attention.

**SKIN CONTACT:** Wash exposed skin with soap and water.

**EYE CONTACT:** Flush eyes with plenty of water.

**INGESTION:** If a large amount is swallowed, get medical attention.

**NOTE TO PHYSICIAN:** For inhalation, consider oxygen.

---

**SECTION 5 FIRE FIGHTING MEASURES**

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**FIRE AND EXPLOSION HAZARDS:** Severe explosion hazard. Vapor/air mixtures are explosive. Electrostatic discharges may be generated by flow or agitation resulting in ignition or explosion.

**EXTINGUISHING MEDIA:** carbon dioxide, regular dry chemical

Large fires: Use regular foam or flood with fine water spray.

**FIRE FIGHTING:** Move container from fire area if it can be done without risk. For

fires in cargo or storage area: Cool containers with water from unmanned hose holder or monitor nozzles until well after fire is out. If this is impossible then take the following precautions: Keep unnecessary people away, isolate hazard area and deny entry. Let the fire burn. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tanks due to fire. For tank, rail car or tank truck: Stop leak if possible without personal risk. Let burn unless leak can be stopped immediately. For smaller tanks or cylinders, extinguish and isolate from other flammables. Evacuation radius: 800 meters (1/2 mile). Stop flow of gas:

**LOWER FLAMMABLE LIMIT:** 2.5%

**UPPER FLAMMABLE LIMIT:** 100%

**AUTOIGNITION:** 581 F (305 C)

---

## SECTION 6 ACCIDENTAL RELEASE MEASURES

---

### **OCCUPATIONAL RELEASE:**

Avoid heat, flames, sparks and other sources of ignition. Stop leak if possible without personal risk. Reduce vapors with water spray. Keep unnecessary people away, isolate hazard area and deny entry. Remove sources of ignition. Ventilate closed spaces before entering.

---

## SECTION 7 HANDLING AND STORAGE

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**STORAGE:** Store and handle in accordance with all current regulations and standards. Subject to storage regulations: U.S. OSHA 29 CFR 1910.102. Protect from physical damage. Store outside or in a detached building. Keep separated from incompatible substances. Store in a cool, dry place. Store in a well-ventilated area. Avoid heat, flames, sparks and other sources of ignition. Grounding and bonding required. Secure to prevent tipping. Grounding and bonding required. Keep separated from incompatible substances.

---

## SECTION 8 EXPOSURE CONTROLS, PERSONAL PROTECTION

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### **EXPOSURE LIMITS:**

#### **ACETYLENE:**

ACGIH (simple asphyxiant)

2500 ppm (2662 mg/m<sup>3</sup>) NIOSH recommended ceiling

**VENTILATION:** Provide local exhaust ventilation system. Ventilation equipment should be explosion-resistant if explosive concentrations of material are present. Ensure compliance with applicable exposure limits.

**EYE PROTECTION:** Eye protection not required, but recommended.

**CLOTHING:** Wear appropriate chemical resistant clothing.

**GLOVES:** Protective gloves are not required, but recommended.

**RESPIRATOR:** Under conditions of frequent use or heavy exposure, respiratory protection may be needed. Respiratory protection is ranked in order from minimum to maximum. Consider warning properties before use.  
Any supplied-air respirator with a full facepiece that is operated in a pressure-demand or other positive-pressure mode.

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

**For Unknown Concentrations or Immediately Dangerous to Life or Health -**

Any supplied-air respirator with full facepiece and operated in a pressure-demand or other positive-pressure mode in combination with a separate escape supply.

Any self-contained breathing apparatus with a full facepiece.

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## SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

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**PHYSICAL STATE:** gas

**COLOR:** colorless

**ODOR:** sweet odor

**MOLECULAR WEIGHT:** 26.04

**MOLECULAR FORMULA:** H-C-C-H

**BOILING POINT:** Not available

**FREEZING POINT:** Not available

**SUBLIMATION POINT:** -119 F (-84 C)

**VAPOR PRESSURE:** 760 mmHg @ -84 C

**VAPOR DENSITY (air=1):** 0.90

**SPECIFIC GRAVITY:** Not applicable

**DENSITY:** 1.1747 g/L @ 0 C

**WATER SOLUBILITY:** 0.94% @ 25 C

**PH:** Not applicable

**VOLATILITY:** Not applicable

**ODOR THRESHOLD:** Not available

**EVAPORATION RATE:** Not applicable

**VISCOSITY:** 0.010 cP @ 20 C

**COEFFICIENT OF WATER/OIL DISTRIBUTION:** Not applicable

**SOLVENT SOLUBILITY:**

Soluble: acetone, benzene, chloroform, ether

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## SECTION 10 STABILITY AND REACTIVITY

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**REACTIVITY:** May decompose violently on heating. May explode when heated.

**CONDITIONS TO AVOID:** Avoid heat, flames, sparks and other sources of ignition. Containers may rupture or explode if exposed to heat.

**INCOMPATIBILITIES:** metals, halogens, oxidizing materials, metal carbide, reducing agents, halo carbons

**HAZARDOUS DECOMPOSITION:**  
Thermal decomposition products: oxides of carbon

**POLYMERIZATION:** Polymerizes with evolution of heat. Avoid contact with curing agents, accelerators, and/or initiators.

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## SECTION 11 TOXICOLOGICAL INFORMATION

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**ACETYLENE:**

**ACUTE TOXICITY LEVEL:** Insufficient Data.

**TARGET ORGANS:** central nervous system

**ADDITIONAL DATA:** Stimulants such as epinephrine may induce ventricular fibrillation.

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## SECTION 12 ECOLOGICAL INFORMATION

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Not available

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## SECTION 13 DISPOSAL CONSIDERATIONS

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Dispose in accordance with all applicable regulations.

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## SECTION 14 TRANSPORT INFORMATION

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**U.S. DOT 49 CFR 172.101:**

**PROPER SHIPPING NAME:** Acetylene, dissolved

**ID NUMBER:** UN1001

**HAZARD CLASS OR DIVISION:** 2.1

**LABELING REQUIREMENTS:** Flammable gas

**QUANTITY LIMITATIONS:**

**PASSENGER AIRCRAFT OR RAILCAR:** Forbidden

**CARGO AIRCRAFT ONLY:** 15 kg

**CANADIAN TRANSPORTATION OF DANGEROUS GOODS:** No classification assigned.

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## SECTION 15 REGULATORY INFORMATION

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### U.S. REGULATIONS:

**CERCLA SECTIONS 102a/103 HAZARDOUS SUBSTANCES (40 CFR 302.4):** Not regulated.

**SARA TITLE III SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355.30):** Not regulated.

**SARA TITLE III SECTION 304 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355.40):** Not regulated.

**SARA TITLE III SARA SECTIONS 311/312 HAZARDOUS CATEGORIES (40 CFR 370.21):**

ACUTE: Yes

CHRONIC: No

FIRE: Yes

REACTIVE: Yes

SUDDEN RELEASE: Yes

**SARA TITLE III SECTION 313 (40 CFR 372.65):** Not regulated.

**OSHA PROCESS SAFETY (29CFR1910.119):** Not regulated.

### STATE REGULATIONS:

**California Proposition 65:** Not regulated.

### CANADIAN REGULATIONS:

**WHMIS CLASSIFICATION:** ABF

### NATIONAL INVENTORY STATUS:

**U.S. INVENTORY (TSCA):** Listed on inventory.

**TSCA 12(b) EXPORT NOTIFICATION:** Not listed.

**CANADA INVENTORY (DSL):** Not determined.

**CANADA INVENTORY (NDSL):** Not determined.

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## SECTION 16 OTHER INFORMATION

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**BIG THREE INDUSTRIES, INC.**  
 P. O. BOX 3647  
 HOUSTON, TEXAS 77253

18192

# MATERIAL SAFETY DATA SHEET

## I - GENERAL INFORMATION

PRODUCT NAME <b>Oxygen (Gas)</b>			
EMERGENCY TELEPHONE NO. <b>(713) 868-0202</b>			
MANUFACTURER'S NAME <b>Big Three Industries, Inc.</b>		TRADE NAME AND SYNONYMS <b>Oxygen</b>	
ISSUE DATE <b>APRIL 1, 1984</b>		CHEMICAL NAME AND SYNONYMS <b>Oxygen</b>	
PRODUCT ID. NO. <b>UN-1072</b>	FORMULA <b>O<sub>2</sub></b>	CHEMICAL FAMILY <b>Oxidizer</b>	CAS NUMBER <b>007 782 447</b>

## II - HAZARDOUS INGREDIENTS

HAZARDOUS MIXTURES OF LIQUIDS AND GASES	O/G	TLV
None		

## III - PHYSICAL DATA

BOILING POINT <b>- 297.3°F (- 183.0°C) @ 1 ATM</b>	SPECIFIC GRAVITY (Air = 1) <b>1.1049 at 70°F (21.1°C) and 1 ATM</b>
VAPOR PRESSURE <b>N/A</b>	PERCENT. VOLATILE BY VOLUME (O/G) <b>N/A (Gas)</b>
DENSITY <b>at 70°F (21.1°C) and 1 ATM 0.08279 LB/CU. FT.</b>	EVAPORATION RATE <b>N/A (Gas)</b>
SOLUBILITY IN WATER <b>4.89 SCC/100CC H<sub>2</sub>O at 32°F (0°C)</b>	MATERIAL AT NORMAL CONDITION <input type="checkbox"/> LIQUID <input type="checkbox"/> SOLID <input checked="" type="checkbox"/> GAS
EXPANSION RATIO (LIQUID TO GAS) <b>N/A (Gas)</b>	
APPEARANCE AND ODOR <b>Colorless, Odorless, Tasteless Gas</b>	

## IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (METHOD USED) <b>N/A</b>	FLAMMABILITY LIMITS IN AIR (% BY VOL) LOWER <b>N/A</b> UPPER <b>N/A</b>
EXTINGUISHING MEDIA <b>Shut off Oxygen gas, if possible, and use the appropriate media for the surrounding fire.</b>	
SPECIAL FIRE FIGHTING PROCEDURES <b>Though not flammable itself, oxygen vigorously accelerates combustion. Use water spray to cool fire-exposed containers. If possible, remove oxygen containers from fire area.</b>	
UNUSUAL FIRE AND EXPLOSION HAZARD <b>Materials, which do not burn in air, may burn in oxygen-enriched atmosphere where the oxygen content exceeds 21%. Oxygen may form explosive compounds when exposed to combustible materials or oil, grease, and other hydrocarbon materials.</b>	

**THIS PRODUCT SAFETY DATA SHEET IS OFFERED SOLELY FOR YOUR INFORMATION, CONSIDERATION AND INVESTIGATION. BIG THREE INDUSTRIES PROVIDES NO WARRANTIES, EITHER EXPRESS OR IMPLIED, AND ASSUMES NO LIABILITY FOR THE ACCURACY OR COMPLETENESS OF THE DATA.**

<b>None Established</b>	<b>None</b>	<b>Routes of Exposure</b> Inhalation
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**EFFECTS OF OVEREXPOSURE**  
Exposure to oxygen at high pressures for prolonged periods has been found to affect neuromuscular coordination and attentive powers.

**EMERGENCY AND FIRST AID PROCEDURES**  
Reduce oxygen pressure to 1 ATM and/or move into fresh air

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<b>VI - REACTIVITY DATA</b>	
<b>STABILITY</b> <input type="checkbox"/> UNSTABLE <input checked="" type="checkbox"/> STABLE	<b>CONDITIONS TO AVOID</b> None
<b>INCOMPATIBILITY (MATERIALS TO AVOID)</b> Oxygen reacts explosively with ethers, alcohols, and hydrocarbon materials. Keep oxygen containers free of oil and/or grease!	
<b>HAZARDOUS DECOMPOSITION PRODUCTS</b> None	
<b>HAZARDOUS POLYMERIZATION</b> <input type="checkbox"/> MAY OCCUR <input checked="" type="checkbox"/> WILL NOT OCCUR	<b>CONDITIONS TO AVOID</b> None

<b>VII - SPILL OR LEAK PROCEDURES</b>
<b>STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED</b> Shut off oxygen source if possible. Ventilate area to prevent oxygen-enriched atmosphere. Remove sources of heat or ignition.
<b>WASTE DISPOSAL METHOD</b> Secure the cylinder and blow down slowly to the atmosphere in a well-ventilated area or outdoors.

<b>VIII - SPECIAL PROTECTIVE INFORMATION</b>						
<b>RESPIRATORY PROTECTION (SPECIFY TYPE)</b> None						
<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:20%;"><b>VENTILATION</b></td> <td style="width:40%;"> <b>LOCAL EXHAUST</b> Sufficient to prevent oxygen-enriched atmospheres of over 21% oxygen.         </td> <td style="width:40%;"><b>SPECIAL</b></td> </tr> <tr> <td>           Natural or mechanical where gas is present         </td> <td> <b>MECHANICAL</b> </td> <td> <b>OTHER</b> </td> </tr> </table>	<b>VENTILATION</b>	<b>LOCAL EXHAUST</b> Sufficient to prevent oxygen-enriched atmospheres of over 21% oxygen.	<b>SPECIAL</b>	Natural or mechanical where gas is present	<b>MECHANICAL</b>	<b>OTHER</b>
<b>VENTILATION</b>	<b>LOCAL EXHAUST</b> Sufficient to prevent oxygen-enriched atmospheres of over 21% oxygen.	<b>SPECIAL</b>				
Natural or mechanical where gas is present	<b>MECHANICAL</b>	<b>OTHER</b>				
<b>PROTECTIVE GLOVES</b> N/A	<b>EYE PROTECTION</b> Safety glasses are recommended when handling high pressure cylinders.					
<b>OTHER PROTECTIVE EQUIPMENT</b> None						

<b>IX - SPECIAL PRECAUTIONS</b>		
<b>PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING</b> Store cylinders away from heat or open flame. Do not store oxygen closer than 20 feet from flammable or combustible materials. Keep cylinders free from oil and grease. Follow general safety procedures for handling compressed gas cylinders, found in CGA Pamphlet P-1.		
<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:50%;"><b>DOT LABELING</b> Yellow Oxidizer Label</td> <td style="width:50%;"><b>VALVE CONNECTION NUMBER</b> CGA 540 or CGA 870 (Pin Indexed)</td> </tr> </table>	<b>DOT LABELING</b> Yellow Oxidizer Label	<b>VALVE CONNECTION NUMBER</b> CGA 540 or CGA 870 (Pin Indexed)
<b>DOT LABELING</b> Yellow Oxidizer Label	<b>VALVE CONNECTION NUMBER</b> CGA 540 or CGA 870 (Pin Indexed)	
<b>OTHER PRECAUTIONS</b> All gauges, valves, regulators, piping and equipment to be used in oxygen service must be cleaned for oxygen service, refer to CGA Pamphlet G-4.1. Secure cylinders when in use. Keep valve protection cap in place when cylinder not in use. Oxygen is not to be used as a substitute for compressed air.		

Product: Mixtures of Argon and  
At Least 10% Carbon Dioxide

P-4715-G

Date: September 2004

## Praxair Material Safety Data Sheet

### 1. Chemical Product and Company Identification

<b>Product Name:</b> Compressed gases, n.o.s. (argon, carbon dioxide) (MSDS No. P-4715-G)	<b>Trade Name:</b> StarGold™ C10, C15, C18, C20, C25, C40, C50 Shielding Gas Mixtures. (These products are intended for electric arc welding.)
<b>Chemical Name:</b> Mixtures of argon and carbon dioxide	<b>Synonyms:</b> Not applicable
<b>Formula:</b> Mixtures of Ar & CO <sub>2</sub>	<b>Chemical Family:</b> Not applicable
<b>Telephone:</b> <b>Emergencies:</b> 1-800-645-4633* <b>CHEMTREC:</b> 1-800-424-9300* <b>Routine:</b> 1-800-PRAXAIR	<b>Company Name:</b> Praxair, Inc. 39 Old Ridgebury Road Danbury, CT 06810-5113

\* Call emergency numbers 24 hours a day only for spills, leaks, fire, exposure, or accidents involving this product. For routine information, contact your supplier, Praxair sales representative, or call 1-800-PRAXAIR (1-800-772-9247).

### 2. Composition/Information on Ingredients

This section covers materials of manufacture only. See sections 3, 8, 10, 11, 15, and 16 for information on by-products generated during use, especially use in welding and cutting. See section 16 for important information about mixtures.

INGREDIENT	CAS NUMBER	CONCENTRATION	OSHA PEL	ACGIH TLV-TWA (2004)
Carbon Dioxide	124-38-9	10-50%	5000 ppm	5000 ppm*
Argon	7440-37-1	50-90%	None currently established	Simple asphyxiant

\* See section 3.

### 3. Hazards Identification

#### EMERGENCY OVERVIEW

**CAUTION! High-pressure gas.**  
**Can cause rapid suffocation.**  
**Can increase respiration and heart rate.**  
**May cause nervous system damage.**  
**May cause dizziness and drowsiness.**  
**Self-contained breathing apparatus may be required by rescue workers.**  
**Odor: None**

**THRESHOLD LIMIT VALUE:** TLV-TWA, 5,000 ppm, carbon dioxide (ACGIH, 2004). TLV-TWA, 15 min STEL, 30,000 ppm, carbon dioxide. See section 2 for component TLVs; section 16 for more

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information on welding hazards. TLV-TWAs should be used as a guide in the control of health hazards and not as fine lines between safe and dangerous concentrations.

**EFFECTS OF A SINGLE (ACUTE) OVEREXPOSURE:**

**INHALATION**—Asphyxiant. Effects are due to lack of oxygen. The carbon dioxide component is also physiologically active, affecting circulation and breathing. Moderate concentrations may cause headache, drowsiness, dizziness, stinging of the nose and throat, excitation, rapid breathing and heart rate, excess salivation, vomiting, and unconsciousness. Lack of oxygen can kill.

**SKIN CONTACT**—No harm expected.

**SWALLOWING**—This mixture is a gas at normal temperature and pressure.

**EYE CONTACT**—No harm expected.

**EFFECTS OF REPEATED (CHRONIC) OVEREXPOSURE:** No harm expected.

**OTHER EFFECTS OF OVEREXPOSURE:** Possible damage to retinal ganglion cells and central nervous system.

**MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE:** The toxicology and the physical and chemical properties of this mixture suggest that overexposure is unlikely to aggravate existing medical conditions.

**SIGNIFICANT LABORATORY DATA WITH POSSIBLE RELEVANCE TO HUMAN HEALTH HAZARD EVALUATION:** A single study has shown an increase in heart defects in rats exposed to 6% carbon dioxide in air for 24 hours at different times during gestation. There is no evidence that carbon dioxide is teratogenic in humans.

**CARCINOGENICITY:** Neither component of this mixture is listed by NTP, OSHA, or IARC.

**4. First Aid Measures**

**INHALATION:** Immediately remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, qualified personnel may give oxygen. Call a physician.

**SKIN CONTACT:** Wash with soap and water. If irritation persists, seek medical attention.

**SWALLOWING:** This mixture is a gas at normal temperature and pressure.

**EYE CONTACT:** Flush eyes with water. Hold the eyelids open and away from the eyeballs to ensure that all surfaces are flushed thoroughly. Get medical attention if discomfort persists.

**NOTES TO PHYSICIAN:** *There is no specific antidote. Treatment of overexposure should be directed at the control of symptoms and the clinical condition of the patient.*

**5. Fire Fighting Measures**

<b>FLASH POINT (test method)</b>	Not applicable	<b>AUTOIGNITION TEMPERATURE</b>	Not applicable
<b>FLAMMABLE LIMITS IN AIR, % by volume</b>	<b>LOWER</b>	Not applicable	<b>UPPER</b> Not applicable
<b>EXTINGUISHING MEDIA:</b> This mixture cannot catch fire. Use media appropriate for surrounding fire.			

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**SPECIAL FIRE FIGHTING PROCEDURES: CAUTION! High-pressure gas.** Asphyxiant—lack of oxygen can kill. Evacuate all personnel from danger area. Immediately deluge cylinders with water from maximum distance until cool; then move them away from fire area if without risk. Self-contained breathing apparatus may be required by rescue workers. On-site fire brigades must comply with OSHA 29 CFR 1910.156.

**UNUSUAL FIRE AND EXPLOSION HAZARDS:** Heat of fire can build pressure in cylinder and cause it to rupture. No part of cylinder should be subjected to a temperature higher than 125°F (52°C). Cylinders containing this mixture are equipped with a pressure relief device. (Exceptions may exist where authorized by DOT.)

**HAZARDOUS COMBUSTION PRODUCTS:** Not applicable

## 6. Accidental Release Measures

**STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED: CAUTION! High-pressure gas.** Asphyxiant. Lack of oxygen can kill. Evacuate all personnel from danger area. Use self-contained breathing apparatus where needed. Shut off flow if you can do so without risk. Ventilate area or move cylinder to a well-ventilated area. Test for sufficient oxygen, especially in confined spaces, before allowing reentry.

**WASTE DISPOSAL METHOD:** Prevent waste from contaminating the surrounding environment. Keep personnel away. Discard any product, residue, disposable container, or liner in an environmentally acceptable manner, in full compliance with federal, state, and local regulations. If necessary, call your local supplier for assistance.

## 7. Handling and Storage

**PRECAUTIONS TO BE TAKEN IN STORAGE:** Store and use with adequate ventilation. Firmly secure cylinders upright to keep them from falling or being knocked over. Screw valve protection cap firmly in place by hand. Store only where temperature will not exceed 125°F (52°C). Store full and empty cylinders separately. Use a first-in, first-out inventory system to prevent storing full cylinders for long periods.

**PRECAUTIONS TO BE TAKEN IN HANDLING:** Protect cylinders from damage. Use a suitable hand truck to move cylinders; do not drag, roll, slide, or drop. Never attempt to lift a cylinder by its cap; the cap is intended solely to protect the valve. Never insert an object (e.g., wrench, screwdriver, pry bar) into cap openings; doing so may damage the valve and cause a leak. Use an adjustable strap wrench to remove over-tight or rusted caps. Open valve slowly. If valve is hard to open, discontinue use and contact your supplier. Never apply flame or localized heat directly to any part of the cylinder. High temperatures may damage the cylinder and could cause the pressure relief device to fail prematurely, venting the cylinder contents. For other precautions in using this mixture, see section 16.

For additional information on storage and handling, refer to Compressed Gas Association (CGA) pamphlet P-1, *Safe Handling of Compressed Gases in Containers*, available from the CGA. Refer to section 16 for the address and phone number along with a list of other available publications.

## 8. Exposure Controls/Personal Protection

### VENTILATION/ENGINEERING CONTROLS:

**LOCAL EXHAUST**—Preferred. Use a local exhaust system, if necessary, to prevent oxygen deficiency and to keep hazardous fumes and gases below applicable TLVs in the worker's breathing zone.

**MECHANICAL (general)**—General exhaust ventilation may be acceptable if it can maintain an adequate supply of air and keep hazardous fumes and gases below the applicable TLVs in the worker's breathing zone.

**SPECIAL**—None

**OTHER**—None

**RESPIRATORY PROTECTION:** Use air-purifying or air-supplied respirators, as appropriate, where local or general exhaust ventilation is inadequate. Adequate ventilation must keep worker exposure below applicable TLVs for fumes, gases, and other by-products of welding with this mixture. See sections 3, 10, 15, and 16 for details. An air-supplied respirator must be used in confined spaces. Respiratory protection must conform to OSHA rules as specified in 29 CFR 1910.134. Select per OSHA 29 CFR 1910.134 and ANSI Z88.2.

**SKIN PROTECTION:** Wear work gloves for cylinder handling; welding gloves for welding and cutting.

**EYE PROTECTION:** Wear safety glasses when handling cylinders. For welding, see section 16.

**OTHER PROTECTIVE EQUIPMENT:** Metatarsal shoes for cylinder handling. Select in accordance with OSHA 29 CFR 1910.132 and 1910.133. For welding, see section 16. Regardless of protective equipment, never touch live electrical parts.

## 9. Physical and Chemical Properties

**SPECIFIC GRAVITY** (Air = 1) at 70°F (21.1°C) and 1 atm: 1.39-1.45

**SOLUBILITY IN WATER**, vol/vol at 32°F (0°C) and 1 atm: Negligible

**PERCENT VOLATILES BY VOLUME:** 100

**APPEARANCE, ODOR, AND STATE:** Colorless, odorless gas at normal temperature and pressure

## 10. Stability and Reactivity

**STABILITY:**  Unstable  Stable

**INCOMPATIBILITY (materials to avoid):** Alkali metals, alkaline earth metals, metal acetylides, chromium, titanium above 1022°F (550°C), uranium above 1382°F (750°C), magnesium above 1427°F (775°C).

**HAZARDOUS DECOMPOSITION PRODUCTS:** The arc may form gaseous reaction products such as carbon monoxide and carbon dioxide. Ozone and nitrogen oxides may be formed by the radiation from the arc. See section 16. Other decomposition products of arc welding and cutting originate from the volatilization, reaction, or oxidation of the material being worked.

**HAZARDOUS POLYMERIZATION:**  May Occur  Will Not Occur

**CONDITIONS TO AVOID:** None known.

Product: Mixtures of Argon and  
At Least 10% Carbon Dioxide

P-4715-G

Date: September 2004

### 11. Toxicological Information

The welding process may generate hazardous fumes and gases. (See sections 3, 10, 15, and 16.)

Carbon dioxide is an asphyxiant. It initially stimulates respiration and then causes respiratory depression. High concentrations result in narcosis. Symptoms in humans are as follows:

<b>EFFECT:</b>	<b>CONCENTRATION:</b>
Breathing rate increases slightly.	1%
Breathing rate increases to 50% above normal level. Prolonged exposure can cause headache, tiredness.	2%
Breathing increases to twice normal rate and becomes labored. Weak narcotic effect. Impaired hearing, headache, increased blood pressure and pulse rate.	3%
Breathing increases to approximately four times normal rate, symptoms of intoxication become evident, and slight choking may be felt.	4 - 5%
Characteristic sharp odor noticeable. Very labored breathing, headache, visual impairment, and ringing in the ears. Judgment may be impaired, followed within minutes by loss of consciousness.	5 - 10%
Unconsciousness occurs more rapidly above 10% level. Prolonged exposure to high concentrations may eventually result in death from asphyxiation.	10 - 100%

### 12. Ecological Information

No adverse ecological effects expected. This mixture does not contain any Class I or Class II ozone-depleting chemicals. Neither component of this mixture is listed as a marine pollutant by DOT.

### 13. Disposal Considerations

**WASTE DISPOSAL METHOD:** Do not attempt to dispose of residual or unused quantities. Return cylinder to supplier.

### 14. Transport Information

**DOT/IMO SHIPPING NAME:** Compressed gases, n.o.s. (argon, carbon dioxide)

<b>HAZARD CLASS:</b> 2.2	<b>IDENTIFICATION NUMBER:</b> UN 1956	<b>PRODUCT RQ:</b> Not applicable
<b>SHIPPING LABEL(s):</b>	NONFLAMMABLE GAS	
<b>PLACARD (when required):</b>	NONFLAMMABLE GAS	

Product: Mixtures of Argon and  
At Least 10% Carbon Dioxide

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**SPECIAL SHIPPING INFORMATION:** Cylinders should be transported in a secure position, in a well-ventilated vehicle. Cylinders transported in an enclosed, nonventilated compartment of a vehicle can present serious safety hazards.

Shipment of compressed gas cylinders that have been filled without the owner's consent is a violation of federal law [49 CFR 173.301(b)].

### 15. Regulatory Information

The following selected regulatory requirements may apply to this mixture. Not all such requirements are identified. Users of this mixture are solely responsible for compliance with all applicable federal, state, and local regulations.

#### U.S. FEDERAL REGULATIONS:

##### EPA (ENVIRONMENTAL PROTECTION AGENCY)

**CERCLA:** COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT OF 1980 (40 CFR Parts 117 and 302):

**Reportable Quantity (RQ):** None

##### SARA: SUPERFUND AMENDMENT AND REAUTHORIZATION ACT:

**SECTIONS 302/304:** Require emergency planning based on Threshold Planning Quantity (TPQ) and release reporting based on Reportable Quantities (RQ) of Extremely Hazardous Substances (EHS) (40 CFR Part 355):

**TPQ:** None

**EHS RQ:** None

**SECTIONS 311/312:** Require submission of MSDSs and reporting of chemical inventories with identification of EPA hazard categories. The hazard categories for this mixture are as follows:

**IMMEDIATE:** Yes

**PRESSURE:** Yes

**DELAYED:** No

**REACTIVITY:** No

**FIRE:** No

**SECTION 313:** Requires submission of annual reports of release of toxic chemicals that appear in 40 CFR Part 372.

Neither component of this mixture requires reporting under Section 313.

**40 CFR 68: RISK MANAGEMENT PROGRAM FOR CHEMICAL ACCIDENTAL RELEASE PREVENTION:** Requires development and implementation of risk management programs at facilities that manufacture, use, store, or otherwise handle regulated substances in quantities that exceed specified thresholds.

Neither component of this mixture is listed as a regulated substance.

**TSCA: TOXIC SUBSTANCES CONTROL ACT:** Both components of this mixture are listed on the TSCA inventory.

##### OSHA: OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION:

**29 CFR 1910.119: PROCESS SAFETY MANAGEMENT OF HIGHLY HAZARDOUS CHEMICALS:** Requires facilities to develop a process safety management program based on Threshold Quantities (TQ) of highly hazardous chemicals.

Neither component of this mixture is listed in Appendix A as a highly hazardous chemical.

Product: Mixtures of Argon and  
At Least 10% Carbon Dioxide

P-4715-G

Date: September 2004

#### STATE REGULATIONS:

**CALIFORNIA:** Neither component of this mixture is listed by California under the SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986 (Proposition 65).

**WARNING:** The combustion of carbon dioxide produces carbon monoxide—a chemical known to the State of California to cause birth defects or other reproductive harm.

*(California Health and Safety Code §25249.5 et seq.)*

**PENNSYLVANIA:** Both components of this mixture are subject to the PENNSYLVANIA WORKER AND COMMUNITY RIGHT-TO-KNOW ACT (35 P.S. Sections 7301-7320).

### 16. Other Information

Be sure to read and understand all labels and instructions supplied with all containers of this mixture.

**ADDITIONAL SAFETY AND HEALTH HAZARDS:** Using this mixture in welding and cutting may create additional hazards.

Read and understand the manufacturer's instructions and the precautionary labels on the products used in welding and cutting. Ask your welding products supplier for a copy of Praxair's free safety booklet, P-52-529, *Precautions and Safe Practices for Electric Welding and Cutting*, and for other manufacturers' safety publications. For a detailed treatment, get ANSI Z49.1, *Safety in Welding, Cutting, and Allied Processes*, published by the American Welding Society (AWS), 550 N.W. Le Jeune Rd., Miami, FL 33126. <http://www.aws.org/>, or see OSHA's Web site at <http://www.osha-slc.gov/SLTC/weldingcuttingbrazing/>. Order AWS documents from Global Engineering Documents, 15 Inverness Way East, Englewood, CO 80112-5710, <http://global.ihs.com/>.

**FUMES AND GASES** can be dangerous to your health and may cause serious lung disease.

- **Keep your head out of fumes. Do not breathe fumes and gases. Use enough ventilation, local exhaust, or both to keep fumes and gases from your breathing zone and the general area. Short-term overexposure to fumes may cause dizziness; nausea; and dryness or irritation of the nose, throat, and eyes; or other similar discomfort.**

Fumes and gases cannot be classified simply. The amount and type depend on the metal being worked and the process, procedure, equipment, and supplies used. Possible dangerous materials may be found in fluxes, electrodes, and other materials. Get an MSDS for every material you use.

Contaminants in the air may add to the hazard of fumes and gases. One such contaminant, chlorinated hydrocarbon vapors from cleaning and degreasing activities, poses a special risk.

- **Do not use electric arcs in the presence of chlorinated hydrocarbon vapors—highly toxic phosgene may be produced.**

Metal coatings such as paint, plating, or galvanizing may generate harmful fumes when heated. Residues from cleaning materials may also be harmful.

- **Avoid arc operations on parts with phosphate residues (anti-rust, cleaning preparations)—highly toxic phosphine may be produced.**

To find the quantity and content of fumes and gases, you can take air samples. By analyzing these samples, you can find out what respiratory protection you need. One recommended sampling method is to take air from inside the worker's helmet or from the worker's breathing zone. See AWS F1.1, *Methods for Sampling and Analyzing Gases for Welding and Allied Processes*, available from the AWS.

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**NOTES TO PHYSICIAN:**

**Acute:** *Gases, fumes, and dusts may cause irritation to the eyes, lungs, nose, and throat. Some toxic gases associated with welding and related processes may cause pulmonary edema, asphyxiation, and death. Acute overexposure may include signs and symptoms such as watery eyes, nose and throat irritation, headache, dizziness, difficulty breathing, frequent coughing, or chest pains.*

**Chronic:** *Protracted inhalation of air contaminants may lead to their accumulation in the lungs, a condition that may be seen as dense areas on chest x-rays. The severity of change is proportional to the length of exposure. The changes seen are not necessarily associated with symptoms or signs of reduced lung function or disease. In addition, the changes on x-rays may be caused by non-work-related factors such as smoking, etc.*

**PROTECTIVE CLOTHING AND EQUIPMENT FOR WELDING OPERATIONS:**

**PROTECTIVE GLOVES:** Wear welding gloves.

**EYE PROTECTION:** Wear a helmet or use a face shield with a filter lens. Select lens per ANSI Z49.1. Provide protective screens and flash goggles if needed to protect others; select per OSHA 29 CFR 1910.133.

**OTHER PROTECTIVE EQUIPMENT:** Wear hand, head, and body protection. (See ANSI Z49.1.) Worn as needed, these help prevent injury from radiation, sparks, and electrical shock. Minimum protection includes welder's gloves and a face shield. For added protection, consider arm protectors, aprons, hats, shoulder protection, and dark, substantial clothing.

**OTHER HAZARDOUS CONDITIONS OF HANDLING, STORAGE, AND USE:** *High-pressure gas.* Use piping and equipment adequately designed to withstand pressures to be encountered. **Can cause rapid suffocation due to oxygen deficiency.** Store and use with adequate ventilation. Close cylinder valve after each use; keep closed even when empty. **Arcs and sparks can ignite combustible materials.** Prevent fires. For more information on fire prevention in welding and cutting, see NFPA 51B, *Standard for Fire Prevention During Welding, Cutting, and Other Hotwork*, published by the National Fire Protection Association. **Do not strike an arc on the cylinder.** The defect produced by an arc burn could lead to cylinder rupture. **Never work on a pressurized system.** If there is a leak, close the cylinder valve. Blow the system down in a safe and environmentally sound manner in compliance with all federal, state, and local laws; then repair the leak. **Never place a compressed gas cylinder where it may become part of an electrical circuit.** When using compressed gases in and around electric welding applications, never ground the cylinders. Grounding exposes the cylinders to damage by the electric welding arc.

**MIXTURES:** When you mix two or more gases or liquefied gases, you can create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an industrial hygienist or other trained person when you evaluate the end product. Remember, gases and liquids have properties that can cause serious injury or death.

**HAZARD RATING SYSTEMS:**

**NFPA RATINGS:**

HEALTH = 1  
FLAMMABILITY = 0  
INSTABILITY = 0  
SPECIAL = None

**HMIS RATINGS:**

HEALTH = 0  
FLAMMABILITY = 0  
PHYSICAL HAZARD = 3

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**STANDARD VALVE CONNECTIONS FOR U.S. AND CANADA:**

**THREADED:** CGA-580  
**PIN-INDEXED YOKE:** Not applicable  
**ULTRA-HIGH-INTEGRITY CONNECTION:** Not applicable

Use the proper CGA connections. **DO NOT USE ADAPTERS.** Additional limited-standard connections may apply. See CGA pamphlets V-1 and V-7 listed below.

Ask your supplier about free Praxair safety literature as referred to in this MSDS and on the label for this mixture. Further information about this mixture can be found in the following pamphlets published by the Compressed Gas Association, Inc. (CGA), 4221 Walney Road, 5<sup>th</sup> Floor, Chantilly, VA 20151-2923, Telephone (703) 788-2700, <http://www.egonet.com/Publication.asp>.

AV-1 *Safe Handling and Storage of Compressed Gases*  
G-6 *Carbon Dioxide*  
G-6.2 *Commodity Specification for Carbon Dioxide*  
P-1 *Safe Handling of Compressed Gases in Containers*  
P-9 *Inert Gases – Argon, Nitrogen, and Helium*  
SB-2 *Oxygen-Deficient Atmospheres*  
V-1 *Compressed Gas Cylinder Valve Inlet and Outlet Connections*  
V-7 *Standard Method of Determining Cylinder Valve Outlet Connections for Industrial Gas Mixtures*  
— *Handbook of Compressed Gases, Fourth Edition*

Praxair asks users of this mixture to study this MSDS and become aware of product hazards and safety information. To promote safe use of this mixture, a user should (1) notify employees, agents, and contractors of the information in this MSDS and of any other known product hazards and safety information, (2) furnish this information to each purchaser of the product, and (3) ask each purchaser to notify its employees and customers of the product hazards and safety information.

Product: Mixtures of Argon and  
At Least 10% Carbon Dioxide

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The opinions expressed herein are those of qualified experts within Praxair, Inc. We believe that the information contained herein is current as of the date of this Material Safety Data Sheet. Since the use of this information and the conditions of use of the product are not within the control of Praxair, Inc., it is the user's obligation to determine the conditions of safe use of the product.

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Praxair, Inc.  
39 Old Ridgebury Road  
Danbury, CT 06810-5113



AIR LIQUIDE

# MATERIAL SAFETY DATA SHEET

Prepared to U.S. OSHA, CMA, ANSI and Canadian WHMIS Standards

## 1. PRODUCT IDENTIFICATION

**CHEMICAL NAME; CLASS: ARGON**

SYNONYMS: Not applicable.

CHEMICAL FAMILY NAME: Inert Gas

FORMULA: Ar

<b>PRODUCT USE:</b>	Document Number: 11004 Inerting, welding and general analytical or synthetic chemical uses.
<b>SUPPLIER/MANUFACTURER'S NAME: ADDRESS:</b>	AIR LIQUIDE LARGE INDUSTRIES U.S. LP 2700 Post Oak Drive Houston, TX 77056-8229
<b>EMERGENCY PHONE:</b>	CHEMTREC: 1-800-424-9300
<b>BUSINESS PHONE:</b>	General MSDS Information 1-713/896-2896 Fax on Demand: 1-800/231-1366

## 2. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS #	mole %	EXPOSURE LIMITS IN AIR					
			ACGIH		OSHA			OTHER
			TLV ppm	STEL ppm	PEL ppm	STEL ppm	IDLH ppm	
Argon	7440-37-1	99.98%	There are no specific exposure limits for Argon. Argon is a simple asphyxiant (SA). Oxygen levels should be maintained above 19.5%.					
Maximum Impurities		<0.02	None of the trace impurities in Argon contribute significantly to the hazards associated with the product. All hazard information pertinent to Argon has been provided in this Material Safety Data Sheet, per the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200) and State equivalents standards.					

NE = Not Established

C = Ceiling Limit

See Section 16 for Definitions of Terms Used.

NOTE: all WHMIS required information is included. It is located in appropriate sections based on the ANSI Z400.1-1993 format.

### 3. HAZARD IDENTIFICATION

**EMERGENCY OVERVIEW:** Argon is a colorless, odorless gas. The main health hazard associated with releases of this gas is asphyxiation, by displacement of oxygen.

**SYMPTOMS OF OVER-EXPOSURE BY ROUTE OF EXPOSURE:** The most significant route of over-exposure for this gas is by inhalation.

**INHALATION:** High concentrations of this gas can cause an oxygen-deficient environment. Individuals breathing such an atmosphere may experience symptoms which include headaches, ringing in ears, dizziness, drowsiness, unconsciousness, nausea, vomiting, and depression of all the senses.

Under some circumstances of over-exposure, death may occur, due to the displacement of oxygen. The following effects associated with various levels of oxygen are as follows:

CONCENTRATION	SYMPTOM OF EXPOSURE
12-16% Oxygen:	Breathing and pulse rate increased, muscular coordination slightly disturbed.
10-14% Oxygen:	Emotional upset, abnormal fatigue, disturbed respiration.
6-10% Oxygen:	Nausea and vomiting, collapse or loss of consciousness.
Below 6%:	Convulsive movements, possible respiratory collapse, and death.

**HEALTH EFFECTS OR RISKS FROM EXPOSURE:** An **Explanation in Lay Terms.** Over-exposure to Argon may cause the following health effects:

**ACUTE:** The most significant hazard associated with this gas is inhalation of oxygen-deficient atmospheres. Symptoms of oxygen deficiency include respiratory difficulty, ringing in ears, headaches, shortness of breath, wheezing, headache, dizziness, indigestion, nausea, and, at high concentrations, unconsciousness or death may occur. The skin of a victim of over-exposure may have a blue color.

**CHRONIC:** There are currently no known adverse health effects associated with chronic exposure to Argon.

**TARGET ORGANS:** Respiratory system.

HAZARDOUS MATERIAL INFORMATION SYSTEM			
HEALTH		(BLUE)	0
FLAMMABILITY		(RED)	0
REACTIVITY		(YELLOW)	0
PROTECTIVE EQUIPMENT			B
EYES	RESPIRATORY	HANDS	BODY
See Section 8			
For routine industrial applications			

### 4 FIRST-AID MEASURES

**RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO ARGON WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. At a minimum, Self-Contained Breathing Apparatus should be worn.**

Remove victim(s) to fresh air, as quickly as possible. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Only trained personnel should administer supplemental oxygen.

Victim(s) must be taken for medical attention. Rescuers should be taken for medical attention, if necessary. Take copy of label and MSDS to physician or other health professional with victim(s).

### 5. FIRE-FIGHTING MEASURES

**FLASH POINT:** Not applicable.

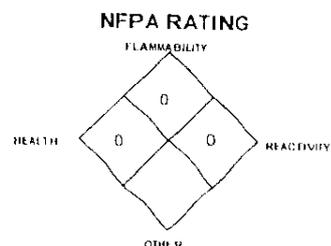
**AUTOIGNITION TEMPERATURE:** Not applicable.

**FLAMMABLE LIMITS (in air by volume, %):**

Lower (LEL): Not applicable.

Upper (UEL): Not applicable.

**FIRE EXTINGUISHING MATERIALS:** Non-flammable, inert gas. Use extinguishing media appropriate for surrounding fire.



## 5. FIRE-FIGHTING MEASURES Continued)

**UNUSUAL FIRE AND EXPLOSION HAZARDS:** Argon does not burn; however, containers, when involved in fire, may rupture or burst in the heat of the fire.

**Explosion Sensitivity to Mechanical Impact:** Not Sensitive.

**Explosion Sensitivity to Static Discharge:** Not Sensitive.

**SPECIAL FIRE-FIGHTING PROCEDURES:** Structural fire-fighters must wear Self-Contained Breathing Apparatus and full protective equipment.

## 6. ACCIDENTAL RELEASE MEASURES

**LEAK RESPONSE:** Evacuate immediate area. Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a leak, clear the affected area, protect people, and respond with trained personnel.

Minimum Personal Protective Equipment should be: **Level B: Self-Contained Breathing Apparatus.** Locate and seal the source of the leaking gas. Allow the gas, which is heavier, than air to dissipate. Monitor the surrounding area for oxygen levels. The atmosphere must have at least 19.5 percent oxygen before personnel can be allowed in the area without Self-Contained Breathing Apparatus.

If leaking incidentally from the cylinder or its valve, contact your supplier.

## 7. HANDLING and USE

**WORK PRACTICES AND HYGIENE PRACTICES:** Be aware of any signs of dizziness or fatigue; exposures to fatal concentrations of Argon could occur without any significant warning symptoms, due to oxygen deficiency.

**STORAGE AND HANDLING PRACTICES:** Cylinders should be stored upright and be firmly secured to prevent falling or being knocked-over. Cylinders can be stored in the open, but in such cases, should be protected against extremes of weather and from the dampness of the ground to prevent rusting. Cylinders should be stored in dry, well-ventilated areas away from sources of heat, ignition and direct sunlight. Keep storage area clear of materials which can burn. Do not allow area where cylinders are stored to exceed 52°C (125°F). Store containers away from heavily trafficked areas and emergency exits. Store away from process and production areas, away from elevators, building and room exits or main aisles leading to exits. Protect cylinders against physical damage.

Use a check valve or other protective device in the discharge line to prevent hazardous backflow. Never tamper with pressure relief valves and cylinders.

Keep the smallest amount necessary on-site at any one time. Full and empty cylinders should be segregated. Use a first-in, first-out inventory systems to prevent full containers from being stored for long periods of time.

**SPECIAL PRECAUTIONS FOR HANDLING GAS CYLINDERS:** Compressed gases can present significant safety hazards. The following rules are applicable to work situations in which cylinders are being used.

**Before Use:** Move cylinders with a suitable hand-truck. Do not drag, slide or roll cylinders. Do not drop cylinders or permit them to strike each other. Secure cylinders firmly. Leave the valve protection cap (where provided) in-place until cylinder is ready for use.

**During Use:** Use designated CGA fittings and other support equipment. Do not use adapters. Do not heat cylinder by any means to increase the discharge rate of the product from the cylinder. Do not use oils or grease on gas-handling fittings or equipment. Immediately contact the supplier if there are any difficulties associated with operating cylinder valve. Never insert an object (e.g wrench, screwdriver, pry bar, etc.) into valve cap openings. Doing so may damage valve, causing a leak to occur. Use an adjustable strap wrench to remove over-tight or rusted caps. Never strike an arc, on a compressed gas cylinder or make a cylinder part of an electric circuit.

**After Use:** Close main cylinder valve. Replace valve protection cap. Mark empty cylinders "EMPTY".

**NOTE:** Use only DOT or ASME code containers designed for gas storage. Close valve after each use and when empty. Cylinders must not be recharged except by or with the consent of owner. For welding and brazing operations, refer to ANSI Z-49.1 "Safety in Welding and Cutting" and OSHA safety regulations for welding, cutting, and brazing (29 CFR 1910.252). In addition, see the National Fire Protection Association (NFPA) publication 51 *Oxygen Fuel Gas Welding and Cutting*

## 7. HANDLING and USE (Continued)

**STANDARD VALVE CONNECTIONS FOR U.S. AND CANADA:** Use the proper CGA connections, DO NOT USE ADAPTERS.

<u>THREADED:</u>	0-3000 psig	CGA 580
	3001-5500 psig	CGA 680
	5501-7500 psig	CGA 677
<u>PIN-INDEXED YOKE:</u>	Not Applicable	
<u>ULTRA HIGH INTEGRITY:</u>	0-3000 psig	718

**PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT:** Follow practices indicated in Section 6 (Accidental Release Measures). Make certain application equipment is locked and tagged-out safely. Always use product in areas where adequate ventilation is provided.

## 8. EXPOSURE CONTROLS - PERSONAL PROTECTION

**VENTILATION AND ENGINEERING CONTROLS:** Use with adequate ventilation. Local exhaust ventilation is preferred, because it prevents chemical dispersion into the work place by eliminating it at its source. If appropriate, install automatic monitoring equipment to detect the level of oxygen.

**RESPIRATORY PROTECTION:** Maintain oxygen levels above 19.5% in the workplace. Use supplied air respiratory protection if oxygen levels are below 19.5% or during emergency response to a release of Argon. If respiratory protection is required, follow the requirements of the Federal OSHA Respiratory Protection Standard (29 CFR 1910.134), or equivalent State standards.

**EYE PROTECTION:** Safety glasses.

**HAND PROTECTION:** Wear glove protection appropriate to the specific operation for which Argon is used.

**BODY PROTECTION:** Use body protection appropriate for task. Safety shoes are recommended when handling cylinders.

## 9. PHYSICAL and CHEMICAL PROPERTIES

**GAS DENSITY @ 21.1°C (70°F) and 1 atm:** 0.103 lbs/cu ft (1.650 kg/m<sup>3</sup>)

**BOILING POINT @ 1 atm:** -185.9 °C (-302°F)

**FREEZING/MELTING POINT @ 10 psig:** -189.2 °C (-308.9 °F)

**SPECIFIC GRAVITY (air = 1) @ 21.1°C (70°F):** 1.38

**pH:** Not applicable.

**SOLUBILITY IN WATER vol/vol @ 0°C (32°F); and 1 atm:** 0.056 **MOLECULAR WEIGHT:** 39.95

**EVAPORATION RATE (nBuAc = 1):** Not applicable.

**EXPANSION RATIO:** Not applicable.

**ODOR THRESHOLD:** Not applicable. Odorless.

**SPECIFIC VOLUME (ft<sup>3</sup>/lb):** 9.7

**VAPOR PRESSURE @ 21.1°C (70°F) psig:** Not applicable.

**COEFFICIENT WATER/OIL DISTRIBUTION:** Not applicable.

**APPEARANCE AND COLOR:** Argon is a colorless, odorless gas.

**HOW TO DETECT THIS SUBSTANCE (warning properties):** There are no unusual warning properties associated with a release of Argon.

## 10. STABILITY and REACTIVITY

**STABILITY:** Normally stable, inert gas.

**DECOMPOSITION PRODUCTS:** None.

**MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE:** None. Argon is an inert gas.

**HAZARDOUS POLYMERIZATION:** Will not occur.

**CONDITIONS TO AVOID:** Avoid exposing cylinders to extremely high temperatures, which could cause the cylinders to rupture or burst.

## 11. TOXICOLOGICAL INFORMATION

**TOXICITY DATA:** The following data are for Argon:

Standard animal toxicity values are not available. Male rats were exposed for 6 days to 20% oxygen and 80% Argon at 1 atmosphere ambient pressure. No significant changes in blood cell counts or bone marrow were observed. Other animal studies concern the deficiency of (hypoxia) or the narcotic effects of various pressures of Argon, the effects of increased Argon pressures on the central nervous system and decompression sickness.

## 11. TOXICOLOGICAL INFORMATION (Continued)

**SUSPECTED CANCER AGENT:** Argon is not found on the following lists: FEDERAL OSHA Z LIST, NTP, CAL/OSHA, IARC, and therefore is not considered to be, nor suspected to be a cancer-causing agent by these agencies.

**IRRITANCY OF PRODUCT:** Not applicable.

**SENSITIZATION OF PRODUCT:** Argon is not a sensitizer.

**REPRODUCTIVE TOXICITY INFORMATION:** Listed below is information concerning the effects Argon on the human reproductive system.

**Mutagenicity:** Argon is not expected to cause mutagenic effects in humans.

**Embryotoxicity:** Argon is not expected to cause embryotoxic effects in humans.

**Teratogenicity:** Argon is not expected to cause teratogenic effects in humans.

**Reproductive Toxicity:** Argon is not expected to cause adverse reproductive effects in humans.

A mutagen is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generation lines. An embryotoxin is a chemical which causes damage to a developing embryo (i.e. within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A teratogen is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A reproductive toxin is any substance which interferes in any way with the reproductive process.

**MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE:** Pre-existing respiratory conditions may be aggravated by over-exposure to Argon.

**RECOMMENDATIONS TO PHYSICIANS:** Treat symptoms and reduce over-exposure.

**BIOLOGICAL EXPOSURE INDICES (BEIs):** Currently, Biological Exposure Indices (BEIs) are not applicable for Argon.

## 12. ECOLOGICAL INFORMATION

**ENVIRONMENTAL STABILITY:** Argon occurs naturally in the atmosphere. The gas will be dissipated rapidly in well-ventilated areas.

**EFFECT OF MATERIAL ON PLANTS or ANIMALS:** Any adverse effect on animals would be related to oxygen deficient environments. No adverse effect is anticipated to occur to plant-life, except for frost produced in the presence of rapidly expanding gases.

**EFFECT OF CHEMICAL ON AQUATIC LIFE:** No evidence is currently available on Argon's effects on aquatic life.

## 13. DISPOSAL CONSIDERATIONS

**PREPARING WASTES FOR DISPOSAL:** Waste disposal must be in accordance with appropriate Federal, State, and local regulations. Return cylinders with any residual product to Air Liquide. Do not dispose of locally.

For emergency disposal, secure the cylinder and slowly discharge the gas to the atmosphere in a well-ventilated area or outdoors.

## 14. TRANSPORTATION INFORMATION

**THIS MATERIAL IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.**

**PROPER SHIPPING NAME:** Argon, compressed  
**HAZARD CLASS NUMBER and DESCRIPTION:** 2.2 (Non-Flammable Gas)  
**UN IDENTIFICATION NUMBER:** UN 1006  
**PACKING GROUP:** Not applicable.  
**DOT LABEL(S) REQUIRED:** Non-Flammable Gas

**NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (1996):** 121

**MARINE POLLUTANT:** Argon is not classified by the DOT as a Marine Pollutant (as defined by 49 CFR 172.101, Appendix B).

**SPECIAL SHIPPING INFORMATION:** Cylinders should be transported in a secure position, in a well-ventilated vehicle. The transportation of compressed gas cylinders in automobiles or in closed-body vehicles present serious safety hazards and should be discouraged.

**NOTE:** Shipment of compressed gas cylinders which have not been filled with the owners consent is a violation of Federal law (49 CFR, Part 173.301 (b)).

## 14. TRANSPORTATION INFORMATION (Continued)

TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: THIS MATERIAL IS CONSIDERED AS DANGEROUS GOODS. Use the above information for the preparation of Canadian Shipments.

## 15. REGULATORY INFORMATION

**SARA REPORTING REQUIREMENTS:** Argon is not subject to the reporting requirements of Sections 302, 304 and 313 of Title III of the Superfund Amendments and Reauthorization Act.

**SARA Threshold Planning Quantity:** Not applicable.

**TSCA INVENTORY STATUS:** Argon is listed on the TSCA Inventory.

**CERCLA REPORTABLE QUANTITIES (RQ):** Not applicable.

**CALIFORNIA PROPOSITION 65:** Argon is not on the California Proposition 65 lists.

**STATE REGULATORY INFORMATION:** Argon is covered under the following specific State regulations:

Alaska - Designated Toxic and Hazardous Substances: Argon.	Minnesota - List of Hazardous Substances: Argon.	Pennsylvania - Hazardous Substance List: Argon.
California - Permissible Exposure Limits for Chemical Contaminants: Argon.	Missouri - Employer Information/Toxic Substance List: Argon.	Rhode Island - Hazardous Substance List: Argon.
Florida - Substance List: Argon.	New Jersey - Right to Know Hazardous Substance List: Argon.	Texas - Hazardous Substance List: No.
Illinois - Toxic Substance List: Argon.	North Dakota - List of Hazardous Chemicals. Reportable Quantities: No.	West Virginia - Hazardous Substance List: No.
Kansas - Section 302/313 List: No.		Wisconsin - Toxic and Hazardous Substances: No.
Massachusetts - Substance List: Argon.		

### OTHER FEDERAL REGULATIONS:

- Argon does not contain any Class I or Class II ozone depleting chemicals (40 CFR part 82).
- Argon is not listed as a Regulated Substance, per 40 CFR, Part 68, of the Risk Management for Chemical Accidental Release.
- Argon is not subject to the reporting requirements of Section 112(r) of the Clean Air Act.
- Argon is not listed in Appendix A as a highly hazardous chemical, per 29 CFR 1910.119: Process Safety Management of Highly Hazardous Chemicals.

**OTHER CANADIAN REGULATIONS:** Argon is categorized as a Controlled Product, Hazard Class A, as per the Controlled Product Regulations.

## 16. OTHER INFORMATION

**MIXTURES:** When two or more gases or liquefied gases are mixed, their hazardous properties may combine to create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an Industrial Hygienist or other trained person when you make your safety evaluation of the end product. Remember, gases and liquids have properties which can cause serious injury or death.

Further information about Argon can be found in the following pamphlets published by: Compressed Gas Association Inc. (CGA), 4221 Walney Road 5<sup>th</sup> floor, Chantilly, VA 20151-2923. Telephone: (703) 788-2700.

G-11.1	"Commodity Specification for Argon"
P-1	"Safe Handling of Compressed Gases in Containers"
P-9	"Inert Gases--Argon, Nitrogen, and Helium"
P-14	"Accident Prevention in Oxygen-Rich, Oxygen-Deficient Atmospheres"
SB-2	"Oxygen Deficient Atmospheres"
AV-1	"Safe Handling and Storage of Compressed Gases"
	"Handbook of Compressed Gases"

PREPARED BY:

CHEMICAL SAFETY ASSOCIATES, Inc.  
9163 Chesapeake Drive, San Diego, CA 92123-1002  
619/565-0302  
Fax on Demand: 1-800/231-1366



AIR LIQUIDE

This Material Safety Data Sheet is offered pursuant to OSHA's Hazard Communication Standard, 29 CFR, 1910.1200. Other government regulations must be reviewed for applicability to Argon. To the best of Air Liquide America's knowledge, the information contained herein is reliable and accurate as of this date, however, accuracy, suitability or completeness are not guaranteed and no warranties of any type, either express or implied, are provided. The information contained herein relates only to this specific product. If Argon is combined with other materials, all component properties must be considered. Data may be changed from time to time. Be sure to consult the latest edition.



# Material Safety Data Sheet for Hydrogen (H<sub>2</sub>)

**Reference:** Voltaix, Inc. MSDS Document Number -H000 (revision dated 03 Sept 96)

**IN AN EMERGENCY, CALL CHEMTREC at 800-424-9360 (US toll free) or 703-527-3887**

## Contents:

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## Section 1: *Chemical Product and Company Identification*

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**Material Name:** Hydrogen.

**Chemical Formula:** H<sub>2</sub>

**Synonyms:** Protium.

*Note:* This Material Safety Data Sheet addresses the compressed, gaseous form of this substance, not the refrigerated liquid.

**Manufacturer:** Voltaix, Inc.:

Post Office Box 5357, North Branch, New Jersey 08876-5357,  
USA

Voice: 908-231-9060 or 800-VOLTAIX, Facsimile: 908-231-9063

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## Section 2: *Composition/Information on Ingredients*

(return to contents)

Component	CAS Registry Number	Molar (volume) concentration	Exposure Guidelines
Hydrogen	1333-74-0	100%	Simple Asphyxiant

## Section 3: *Hazards Identification*

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### Emergency Overview

Hydrogen is a colorless gas with no odor. It is not toxic; the immediate health hazard is that it may cause thermal burns. It is flammable and may form mixtures with air that are flammable or explosive. Hydrogen may react violently if combined with oxidizers, such as air, oxygen, and halogens. Hydrogen is an asphyxiant and may displace oxygen in a workplace atmosphere. The concentrations at which flammable or explosive mixtures form are much lower than the concentration at which asphyxiation risk is significant.

### NFPA 704 Rating (determined by Voltaix, Inc.):

Health	<b>0</b>
Flammability	<b>4</b>
Reactivity	<b>0</b>
Special	None

### Potential Health Effects

**Routes of Exposure:** Hydrogen is not toxic by any route. Asphyxia may result if the oxygen concentration is reduced to below 18% by displacement.

**Lengths of Exposure:** None of the available data indicate toxicity for exposures of any duration.

**Severity of Effect:** No effect identified.

**Target Organs:** None identified.

**Type of Effect:** No effect identified.

**Signs and Symptoms of Exposure:** None identified.

**Medical Conditions that may be Aggravated by Exposure:** None identified.

**Reported Carcinogenic and Reproductive Effects:** None known to Voltaix, Inc.

## Section 4: *First Aid Measures*

(return to contents)

### Asphyxiation

This is the primary health risk.

1. Remove the affected person from the gas source or contaminated area. Note: Personal Protective Equipment (PPE), including positive pressure, self contained breathing apparatus, may be required to assure the safety of the rescuer. The concentration required for asphyxiation is above the upper flammable limit. A boundary region, in the flammable range, may exist between contaminated and uncontaminated areas. Take appropriate precaution against ignition of the atmosphere in this region.
2. If the affected person is not breathing spontaneously, administer rescue breathing.
3. If the affected person does not have a pulse, administer CPR.
4. If medical oxygen and appropriately trained personnel are available, administer 100% oxygen to the affected person.
5. Summon an emergency ambulance. If an ambulance is not available, contact a physician, hospital, or poison control center for instruction.
6. Keep the affected person warm, comfortable, and at rest while awaiting professional medical care. *Monitor the breathing and pulse continuously.* Administer rescue breathing or CPR if necessary.

### Skin Contact

No detrimental effect of skin contact has been reported. Treat thermal burns by assuring that affected area is cool by flushing with cool water, then apply dry sterile dressings. If the patient is burned on the face, neck, head, or chest, assume that the airway may also have been burned and obtain professional medical assistance immediately.

### Eye Contact

No detrimental effect of eye contact has been reported.

### Ingestion

Ingestion is not an observed route of exposure to gaseous hazardous materials.

### Chronic Effects

None is known to Voltaix, Inc.

**Note to Physicians:**

The combustion product of hydrogen and air is water.

**Section 5: *Fire Fighting Measures***

(return to contents)

**Flammability and Explosivity**

**Flash Point:** Not applicable. this material is a gas.

**Flammability Limits in Air:** 4.0% to 75.0%.

**Autoignition Temperature:** 500 deg. C (932 deg. F).

**Flammability Classification (per 29 CFR 1910.1200):** Flammable gas.

**Known or Anticipated Hazardous Products of Combustion:** None.

**Properties that may Initiate or Intensify Fire:** Heating cylinder to the point of activation of the pressure relief device.

**Reactions that Release Flammable Gases:** None known to Voltaix, Inc.

**Extinguishing Media**

None

**Fire Fighting Instructions**

The only safe way to extinguish a flammable gas fire is to stop the flow of gas. If the flow cannot be stopped, allow the entire contents of the cylinder to burn. Cool the cylinder and surroundings with water from a suitable distance. Extinguishing the fire without stopping the flow of gas may permit the formation of ignitable or explosive mixtures with air. These mixtures may propagate to a source of ignition.

Excessive pressure may develop in gas cylinders exposed to fire, which may result in explosion, regardless of the cylinder's content. Cylinders with pressure relief devices (PRD's) may release their contents through such devices if the cylinder is exposed to fire. Cylinders without PRD's have no provision for controlled release and are therefore more likely to explode if exposed to fire.

Positive pressure, self-contained breathing apparatus is required for all fire fighting involving hazardous materials. Full structural fire fighting (bunker) gear is the *minimum* acceptable attire. The need for proximity, entry, and flashover protection and special protective clothing should be determined for each incident by a competent fire fighting safety professional.

**Section 6: *Accidental Release Measures***

(return to contents)

### **Containment**

As hydrogen is a gas at atmospheric conditions, the only means of containment is the enclosure of the space into which it is released. Containment is described in Section 7.

### **Clean Up**

Clean up consists of passing the entire gas volume of the enclosure through appropriate exhaust gas treatment equipment (EGTE). Purge the enclosure with a non-reactive gas, such as nitrogen, through the EGTE until an acceptably low level of contamination remains. The primary consideration is flammability.

### **Evacuation**

If the release is not contained in an appropriate device or system, all personnel not appropriately protected (see Section 8) must evacuate the contaminated spaces. Consider evacuation of additional areas, as a precaution against the spread of the release or subsequent explosion or fire.

### **Special Instructions**

None.

## **Section 7: Handling and Storage**

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### **Handling**

Handle this material only in sealed, purged systems. The design of handling systems for hazardous materials is beyond the scope of this MSDS, and should be performed by a competent, experienced professional. Consider the use of doubly-contained piping; diaphragm or bellows sealed, soft seat valves; backflow prevention devices; flash arrestors; and flow monitoring or limiting devices. Gas cabinets, with appropriate exhaust treatment, are recommended, as is automatic monitoring of the secondary enclosures and work areas for release.

Handle sealed gas cylinders in accordance with CGA P-1, *Safe Handling of Compressed Gases in Containers*.

Some material may have accumulated behind the outlet plug. Face the outlet away from you and wear appropriate protective equipment when removing the plug to connect the cylinder to your system.

Never introduce any substance into a gas cylinder. If you believe your cylinder may have been contaminated, notify Voltaix, Inc. immediately. Provide as much information as possible on the nature and quantity of contamination.

### **Storage**

Store cylinders in accordance with CGA P-1, *Safe Handling of Compressed Gases in Containers*, local building and fire codes and other relevant regulations. Materials should be segregated by the hazards they comprise for storage.

Protect the cylinders from direct sunlight, precipitation, mechanical damage, and temperatures above 55°C (130°F).

Ship and store cylinders with the outlet plug and valve protective cap in place.

## **Section 8: Exposure Control/Personal Protection**

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### **Engineering Controls**

Local exhaust is required. Secondary containment, with appropriate exhaust gas treatment, is strongly encouraged and is required in some jurisdictions.

Monitor the work area and the secondary containment continuously for release of the material. Automatic alerting of personnel and automatic shutdown of flow are appropriate in most applications and are required in some jurisdictions.

Purge all primary containment systems with a nonreactive gas, such as nitrogen, before introducing hydrogen.

### **Personal Protective Equipment (PPE)**

**Respiratory Protection:** Positive pressure, full face, air supplied breathing apparatus should be used for work within the secondary containment equipment if a leak is suspected or the primary containment is to be opened, *e.g.*, for a cylinder change. Air supplied breathing apparatus is required for response to demonstrated or suspected releases from the primary containment.

**Eye/Face Protection:** When using respiratory protection as described above, use a face mask that provides splash and impact protection for the face and eyes. Otherwise, wear safety glasses.

**Skin Protection:** Wear appropriate gloves when handling sealed cylinders. Use gloves and other skin protection, as assigned by a competent safety professional, when working within the secondary enclosure with the primary enclosure compromised, *e.g.*, cylinder changing, to protect both from exposure to the material and from fire that may result from its release to the air.

**Other Protection:** Wear appropriate protective footwear when moving cylinders.

### **Exposure Guidelines**

As hydrogen is a simple asphyxiant, no TLV (ACGIH), PEL (OSHA), or REL (NIOSH) has been established. Workplace concentrations should be controlled to be below the lower flammable limit.

## Section 9: *Physical and Chemical Properties*

(return to contents)

Notes: 1) "N/A" means not applicable.

2) Unless otherwise specified, properties are reported at 0°C (32°F) and 1 atmosphere (1.0 bar, 14.7 psia).

Property	Hydrogen
Appearance	colorless
Odor	none
Physical state	gas
PH	N/A
Vapor Pressure	N/A
Vapor Density	0.082 g/L
Boiling point	-252.9 deg. C (-423 deg. F)
Melting point	N/A
Solubility in water (v/v, at 20 deg C)	0.0182
Specific gravity (liquid)	N/A
Molecular weight	2.02

## Section 10: *Stability and Reactivity*

(return to contents)Contents

**Chemical Stability:** Hydrogen is stable.

**Conditions to Avoid:** Sources of ignition, exposure to air.

**Incompatibility with Other Materials:** Oxidizers, including air, oxygen and halogens.

**Hazardous Decomposition, Reaction and Oxidation (other than burning) Products:** None.

**Hazardous Polymerization:** Has not been observed.

## Section 11: *Toxicological Information*

(return to contents)Contents

**Acute Data (by route):** None, hydrogen is a simple asphyxiant.

**Chronic and Subchronic Data:** Hydrogen is listed in RTECS, but no information on its carcinogenicity or other effects is included.

**Special Studies:** None known.

## **Section 12: *Ecological Information***

(return to contents)

**Ecotoxicity:** None known to Voltaix, Inc.

**Environmental Fate:** None known to Voltaix, Inc.

## **Section 13: *Disposal Considerations***

(return to contents)

**Classification under RCRA, 40 CFR 261:** This material is not listed.

**US EPA waste number and descriptions:** D001 (ignitability).

**Special Instructions and Limitations:** Treat process and other exhaust streams appropriately before release to the atmosphere.

**Notice:** The information above is derived from Voltaix, Inc.'s interpretation of the US federal laws, regulations and policies concerning the material, as shipped by Voltaix, Inc., at the time this MSDS was prepared. Federal controls are subject to change and state and local controls may also apply. Proper waste disposal is the responsibility of the owner of the waste. The user is encouraged to consult with appropriate experts in developing a disposal plan.

## **Section 14: *Transport Information***

(return to contents)

**Basic Description:** Hydrogen, Compressed, Division 2.1 (Flammable Gas), UN 1049.

**Additional Information for shipment by water:** IMDG Page Number 2148.

**Additional Information for shipment by air:** Transportation by air is permitted in Cargo Aircraft Only.

## Section 15: Regulatory Information

(return to contents)

**TSCA Status:** This material is listed on the Inventory of Chemical Substances.

**CERCLA Reportable Quantity (40CFR302.40):** This material is not listed. The Reportable Quantity (RQ) for "Unlisted Hazardous Wastes Characteristic of Ignitability" (D001) of 45.4 kg (100 lbs.) therefore applies.

**SARA Title III Status (Section 302 (40CFR355), Section 311/312, Section 313 (40CFR372)):** No Threshold Planning Quantities (TPQ's) or Reportable Quantities (RQ's) are listed for these substances. The default federal MSDS submission and inventory requirement filing threshold of 4,540 kg (10,000 lbs ) therefore applies.

*Note:* State and local requirements may be more stringent.

## Section 16: Other Information

(return to contents)

### References

*Book of SEMI Standards, Facilities Standards and Safety Guidelines.* Mountain View, CA: Semiconductor Equipment and Materials International, 1993.

Borak, Jonathan, M.D., Michael Callan and William Abbott, *Hazardous Materials Exposure: Emergency Response and Patient Care.* Englewood Cliffs, NJ: Prentice-Hall, Inc., 1991.

Braker, William and Allen L. Mossman, *Matheson Gas Data Book (Sixth Edition).* Lyndhurst, NJ: Matheson, 1980.

*Documentation of TLV's and BEI's.* Cincinnati, Ohio: American Conference of Government Industrial Hygienists, 1992.

*Fire Protection Guide on Hazardous Materials.* Quincy, MA: National Fire Protection Association, 1993.

*Material Safety Data Sheet: Hydrogen.* Irvington, NJ: Spectra Gases, Inc., 1992.

*Safe Handling of Compressed Gases in Containers (Pamphlet P-1).* Arlington, VA: Compressed Gas Association, Inc., 1991.

### Revision Indication

International telephone number for Chemtrec revised.

### **Disclaimer**

Voltaix, Inc. cannot guarantee that these are the only hazards that exist. Users are solely responsible for the safe storage, handling, use and disposal of this material, and for compliance with the applicable laws, regulations and accepted practices.

Voltaix, Inc. makes no representations or warranties, either expressed or implied, of merchantability, fitness for a particular purpose, or any other nature.

### **IMPORTANT NOTICE**

**The information contained in this Material Safety Data Sheet is based upon technical information Voltaix, Inc. believes to be reliable as of the date indicated at the top of this document. It is subject to revision as additional knowledge and experience are gained. These Data Sheets are provided for information purposes only. Users are cautioned not to rely on this Sheet as there may be additional important information contained in the Voltaix, Inc. current Material Safety Data Sheet which may be obtained from the Company upon request.**

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TRI-GAS, INC.

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MATERIAL SAFETY DATA SHEET

TRI-GAS, INC.  
4545 FULLER DRIVE  
SUITE 200  
IRVING, TX 75038  
(214) 650-1700

EMERGENCY CONTACT:  
CHEMTREC 1-800-424-9300

SUBSTANCE IDENTIFICATION

SUBSTANCE: NITROGEN, COMPRESSED GAS

CAS-NUMBER 7727-37-9

TRADE NAMES/SYNONMS:

DIATOMIC NITROGEN; DINITROGEN; NITROGEN; NITROGEN-14; NITROGEN GAS;  
STCC 4904565; UN 1066; N2

CHEMICAL FAMILY:  
INORGANIC GAS

MOLECULAR FORMULA: N2

MOLECULAR WEIGHT: 28.0134

CERCLA RATINGS (SCALE 0-3): HEALTH=U FIRE=0 REACTIVITY=0 PERSISTENCE=0  
NFPA RATINGS (SCALE 0-4): HEALTH=U FIRE=0 REACTIVITY=0

COMPONENTS AND CONTAMINANTS

COMPONENT: NITROGEN

CAS# 7727-37-9

PERCENT: 100.0

OTHER CONTAMINANTS: NONE

EXPOSURE LIMITS:

NO OCCUPATIONAL EXPOSURE LIMITS ESTABLISHED BY OSHA, ACGIH, OR NIOSH.

PHYSICAL DATA

DESCRIPTION: ODORLESS, TASTELESS, COLORLESS, INERT GAS.

BOILING POINT: -321 F (-196 C) MELTING POINT: -346 F (-210 C)

SPECIFIC GRAVITY: 1.2506 G/L VOLATILITY: 100%

VAPOR PRESSURE: 760 MMHG @ -196 C SOLUBILITY IN WATER: 1.6% @ 20 C

VAPOR DENSITY: 0.967

SOLVENT SOLUBILITY: SOLUBLE IN LIQUID AMMONIA; SLIGHTLY SOLUBLE IN ALCOHOL

VISCOSITY: 0.01787 CPS @ 27 C

May 6 '96 11:02 P.02

TRI-GAS, INC. IRVING, TEXAS FAX: 505-828-1191

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FIRE AND EXPLOSION DATA

FIRE AND EXPLOSION HAZARD:  
NEGLIGIBLE FIRE HAZARD WHEN EXPOSED TO HEAT OR FLAME.  
CYLINDER MAY EXPLODE IN HEAT OF FIRE.

FIREFIGHTING MEDIA:

DRY CHEMICAL OR CARBON DIOXIDE  
(1990 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.5).

FOR LARGER FIRES, USE WATER SPRAY, FOG OR STANDARD FOAM  
(1990 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.5).

FIREFIGHTING:

MOVE CONTAINER FROM FIRE AREA IF POSSIBLE. STAY AWAY FROM STORAGE TANK ENDS.  
COOL FIRE-EXPOSED CONTAINERS WITH WATER FROM THE SIDE UNTIL WELL AFTER THE  
FIRE IS OUT. WITHDRAW IMMEDIATELY IF RISING SOUND FROM VENTING SAFETY DEVICE  
OR ANY DISCOLORATION OF STORAGE TANKS DUE TO FIRE (1990 EMERGENCY RESPONSE  
GUIDEBOOK, DOT P 5800.5 GUIDE PAGE 12).

EXTINGUISH USING AGENT SUITABLE FOR TYPE OF SURROUNDING FIRE. COOL CONTAINERS  
WITH FLOODING QUANTITIES OF WATER FROM AS FAR A DISTANCE AS POSSIBLE.

---

TRANSPORTATION DATA

DEPARTMENT OF TRANSPORTATION HAZARD CLASSIFICATION 49 CFR 172.101:  
NONFLAMMABLE GAS

DEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS 49 CFR 172.101 AND  
SUBPART H:  
NONFLAMMABLE GAS

DEPARTMENT OF TRANSPORTATION PACKAGING REQUIREMENTS: 49 CFR 173.304 AND  
49 CFR 173.314  
EXCEPTIONS: 49 CFR 173.306

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TOXICITY

NITROGEN:  
CARCINOGEN STATUS: NONE.  
ACUTE TOXICITY LEVEL: NO DATA AVAILABLE.  
TARGET EFFECTS: SIMPLE ASPHYXIAN.

HEALTH EFFECTS AND FIRST AID

INHALATION:

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NITROGEN:

SEE INFORMATION ON SIMPLE ASPHYXIANTS. NITROGEN INHALED UNDER INCREASED ATMOSPHERIC PRESSURE, (>1.5 ATMOSPHERES), MAY DISSOLVE IN THE FAT-CONTAINING BRAIN CELLS, AND ACT AS AN ANESTHETIC, CAUSING NARCOSIS. PERSONS WHO HAVE BEEN EXPOSED TO INCREASED PRESSURE FOR A TIME AND WHO ARE SUDDENLY RELEASED FROM THE PRESSURE MAY DEVELOP DECOMPRESSION SICKNESS. REPEATED EXPOSURE, WITHOUT COMPLETE DECOMPRESSION, MAY RESULT IN DECOMPRESSION SICKNESS.

SIMPLE ASPHYXIANTS:

ACUTE EXPOSURE- THE SYMPTOMS OF ASPHYXIA DEPEND ON THE RAPIDITY WITH WHICH THE OXYGEN DEFICIENCY DEVELOPS AND HOW LONG IT CONTINUES. IN SUDDEN ACUTE ASPHYXIA, UNCONSCIOUSNESS MAY BE IMMEDIATE. WITH SLOW DEVELOPMENT THERE MAY BE RAPID RESPIRATION AND PULSE, AIR HUNGER, DIZZINESS, REDUCED AWARENESS, TIGHTNESS IN THE HEAD, TINGLING SENSATIONS, INCOORDINATION, FAULTY JUDGEMENT, EMOTIONAL INSTABILITY, AND RAPID FATIGUE. AS THE ASPHYXIA PROGRESSES, NAUSEA, VOMITING, COLLAPSE, UNCONSCIOUSNESS, CONVULSIONS, DEEP COMA AND DEATH ARE POSSIBLE.  
CHRONIC EXPOSURE- NO DATA AVAILABLE.

FIRST AID- REMOVE FROM EXPOSURE AREA TO FRESH AIR IMMEDIATELY. IF BREATHING HAS STOPPED, GIVE ARTIFICIAL RESPIRATION. MAINTAIN AIRWAY AND BLOOD PRESSURE AND ADMINISTER OXYGEN IF AVAILABLE. KEEP AFFECTED PERSON WARM AND AT REST. TREAT SYMPTOMATICALLY AND SUPPORTIVELY. ADMINISTRATION OF OXYGEN SHOULD BE PERFORMED BY QUALIFIED PERSONNEL. GET MEDICAL ATTENTION IMMEDIATELY.

SKIN CONTACT:

NITROGEN:

ACUTE EXPOSURE- NO ADVERSE EFFECTS HAVE BEEN REPORTED FROM THE GAS. DUE TO THE RAPID EVAPORATION, THE LIQUID MAY CAUSE FROSTBITE WITH REDNESS, TINGLING, AND PAIN OR NUMBNESS. IN MORE SEVERE CASES, THE SKIN MAY BECOME HARD AND WHITE AND DEVELOP BLISTERS.  
CHRONIC EXPOSURE- NO ADVERSE EFFECTS HAVE BEEN REPORTED.

FIRST AID- IT IS UNLIKELY THAT EMERGENCY TREATMENT WILL BE REQUIRED. IF ADVERSE EFFECTS OCCUR, GET MEDICAL ATTENTION.  
IN CASE OF FROSTBITE, WARM AFFECTED SKIN IN WARM WATER AT A TEMPERATURE OF 107 F. IF WARM WATER IS NOT AVAILABLE OR IMPRACTICAL TO USE, GENTLY WRAP AFFECTED PART IN BLANKETS. ENCOURAGE VICTIM TO EXERCISE AFFECTED PART WHILE IT IS BEING WARMED. ALLOW CIRCULATION TO RETURN NATURALLY. GET MEDICAL ATTENTION IMMEDIATELY.

EYE CONTACT:

NITROGEN:

ACUTE EXPOSURE- MAY CAUSE IRRITATION IF SPRAYED DIRECTLY INTO THE EYES.  
DUE TO RAPID EVAPORATION, THE LIQUID MAY CAUSE FROSTBITE WITH REDNESS,  
PAIN AND BLURRED VISION.

CHRONIC EXPOSURE- NO ADVERSE EFFECTS HAVE BEEN REPORTED.

FIRST AID- IMMEDIATELY WASH THE EYES WITH LARGE AMOUNTS OF WATER,  
OCCASIONALLY LIFTING UPPER AND LOWER LIDS, UNTIL NO EVIDENCE OF CHEMICAL  
REMAINS (APPROXIMATELY 15-20 MINUTES). IF FROSTBITE IS PRESENT, WARM WATER

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MAY BE PREFERRED. GET MEDICAL ATTENTION IMMEDIATELY.

INGESTION:

NITROGEN:

ACUTE EXPOSURE- INGESTION OF A GAS IS UNLIKELY. IF THE LIQUID IS SWALLOWED,  
FROSTBITE DAMAGE OF THE LIPS, MOUTH AND MUCOUS MEMBRANES MAY OCCUR.

CHRONIC EXPOSURE- NO DATA AVAILABLE.

FIRST AID- IT IS UNLIKELY THAT EMERGENCY TREATMENT WILL BE REQUIRED.  
IF ADVERSE EFFECTS OCCUR, TREAT SYMPTOMATICALLY AND SUPPORTIVELY AND  
GET MEDICAL ATTENTION.

ANTIDOTE:

NO SPECIFIC ANTIDOTE. TREAT SYMPTOMATICALLY AND SUPPORTIVELY.

-----  
REACTIVITY

REACTIVITY:

STABLE UNDER NORMAL TEMPERATURES AND PRESSURES.

INCOMPATIBILITIES:

NITROGEN:

LITHIUM: MAY IGNITE IN THE GAS.

MAGNESIUM: VIOLENT REACTION WITH THE LIQUID ON IGNITION.

NEODYMIUM: VIGOROUS REACTION.

OZONE: MIXTURES OF THE GASES MAY BE EXPLOSIVE.

TITANIUM: WILL BURN IN NITROGEN ATMOSPHERE.

DECOMPOSITION:

THERMAL DECOMPOSITION PRODUCTS MAY INCLUDE TOXIC OXIDES OF NITROGEN.

POLYMERIZATION:

HAZARDOUS POLYMERIZATION HAS NOT BEEN REPORTED TO OCCUR UNDER NORMAL  
TEMPERATURES AND PRESSURES.

STORAGE AND DISPOSAL

OBSERVE ALL FEDERAL, STATE AND LOCAL REGULATIONS WHEN STORING OR DISPOSING OF THIS SUBSTANCE. FOR ASSISTANCE, CONTACT THE DISTRICT DIRECTOR OF THE ENVIRONMENTAL PROTECTION AGENCY.

\*\*STORAGE\*\*

STORE IN ACCORDANCE WITH 29 CFR 1910.101.

STORE AWAY FROM INCOMPATIBLE SUBSTANCES.

-----  
CONDITIONS TO AVOID

DO NOT PERMIT PHYSICAL DAMAGE OR OVERHEATING OF CONTAINERS. CONTENTS ARE UNDER PRESSURE; CONTAINERS MAY VIOLENTLY RUPTURE AND TRAVEL A CONSIDERABLE

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DISTANCE.

-----  
SPILL AND LEAK PROCEDURES

OCCUPATIONAL SPILL:

STOP LEAK IF YOU CAN DO IT WITHOUT RISK. KEEP UNNECESSARY PEOPLE AWAY; ISOLATE HAZARD AREA AND DENY ENTRY.

-----  
PROTECTIVE EQUIPMENT

VENTILATION:

PROVIDE GENERAL DILUTION VENTILATION.

RESPIRATOR:

THE FOLLOWING RESPIRATORS ARE RECOMMENDED BASED ON INFORMATION FOUND IN THE PHYSICAL DATA, TOXICITY AND HEALTH EFFECTS SECTIONS. THEY ARE RANKED IN ORDER FROM MINIMUM TO MAXIMUM RESPIRATORY PROTECTION. THE SPECIFIC RESPIRATOR SELECTED MUST BE BASED ON CONTAMINATION LEVELS FOUND IN THE WORK PLACE, MUST NOT EXCEED THE WORKING LIMITS OF THE RESPIRATOR AND BE JOINTLY APPROVED BY THE NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH AND THE MINE SAFETY AND HEALTH ADMINISTRATION (NIOSH-MSHA).

ANY SUPPLIED-AIR RESPIRATOR OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

ANY SELF-CONTAINED BREATHING APPARATUS.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS:

May 9 11:04 P.06

NIOSH: HAZARDOUS WASTE FAX: 505-828-1191

SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

SUPPLIED-AIR RESPIRATOR WITH FULL FACEPIECE AND OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE IN COMBINATION WITH AN AUXILIARY SELF-CONTAINED BREATHING APPARATUS OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

CLOTHING:

FOR THE GAS FORM, PROTECTIVE CLOTHING NOT REQUIRED.  
IF CONTACT WITH THE LIQUID FORM IS POSSIBLE. EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE CLOTHING AND EQUIPMENT TO PREVENT SKIN FROM FREEZING.

GLOVES:

WEAR FULL PROTECTIVE, COLD INSULATING GLOVES.

EYE PROTECTION:

FOR THE GAS FORM EYE PROTECTION IS NOT REQUIRED BUT RECOMMENDED.  
WHERE THERE IS ANY POSSIBILITY OF CONTACT WITH THE LIQUID FORM, EMPLOYEES MUST WEAR SPLASH-PROOF SAFETY GOGGLES AND A FACESHIELD TO PREVENT CONTACT WITH THIS SUBSTANCE. CONTACT LENSES SHOULD NOT BE WORN.

EMERGENCY WASH FACILITIES:

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WHERE THERE IS ANY POSSIBILITY THAT AN EMPLOYEE'S EYES AND/OR SKIN MAY BE EXPOSED TO THE LIQUID FORM OF THIS SUBSTANCE, THE EMPLOYER SHOULD PROVIDE AN EYE WASH FOUNTAIN AND QUICK DRENCH SHOWER WITHIN THE IMMEDIATE WORK AREA FOR EMERGENCY USE.

AUTHORIZED: TRI-GAS, INC.  
DATE: 4/15/93

NO DISTRIBUTION EXCEPT AS REQUIRED BY LAW.  
REVISION DATE: 4/15/93

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# Liquid Nitrogen

## MATERIAL SAFETY DATA SHEET

### SECTION 1. PRODUCT IDENTIFICATION

**PRODUCT NAME:** Nitrogen, refrigerated liquid

**CHEMICAL NAME:** Nitrogen **FORMULA:** N<sub>2</sub>

**SYNONYMS:** Liquid Nitrogen, LIN, Cryogenic Liquid Nitrogen, Nitrogen

**MANUFACTURER:** Air Products and Chemicals, Inc.

- 7201 Hamilton Boulevard
- Allentown, PA 18195-1501

**PRODUCT INFORMATION:** 1-800-752-1597

**MSDS NUMBER:** 1041 **REVISION:** 5

**REVISION DATE:** July 1995\*\*

### SECTION 2. COMPOSITION/INFORMATION ON INGREDIENTS

Nitrogen is sold as pure product > 99%.

**CAS NUMBER:** 7727-37-9

**EXPOSURE LIMITS:**

**OSHA:** Not established **ACGIH:** Simple asphyxiant

### SECTION 3. HAZARD IDENTIFICATION

#### EMERGENCY OVERVIEW

Liquid nitrogen is a colorless, odorless, extremely cold liquid and gas under pressure. It can cause rapid suffocation when concentrations are sufficient to reduce oxygen levels below 19.5%. Self Contained Breathing Apparatus (SCBA) may be required. Contact with liquid or cold vapors can cause severe frostbite. Cold vapors in the air will appear as a white fog due to condensation of moisture. While this may indicate the presence of the gas it should not be used to determine its concentration in the atmosphere. Oxygen concentrations must be monitored in the release area. All cryogenic liquids produce large volumes of gas when they vaporize. One volume of liquid nitrogen will expand to produce 696.5 equivalent volumes of gas.

**EMERGENCY TELEPHONE NUMBERS:**

800-523-9374 Continental U.S., Canada and Puerto Rico

610-481-7711 other locations

**POTENTIAL HEALTH EFFECTS INFORMATION:**

**INHALATION:** Simple asphyxiant.

**EYE CONTACT:** Tissue freezing and severe cryogenic burns if contacted into eyes.

**SKIN CONTACT:** Tissue freezing and severe cryogenic burn of skin.

**CHRONIC EFFECTS:** None established.

**EXPOSURE INFORMATION:**

**ROUTE OF ENTRY:** Inhalation

**TARGET ORGANS:** None

**EFFECT:** Asphyxiation (suffocation)

- **SYMPTOMS:** Exposure to an oxygen deficient atmosphere (<19.5%) may cause dizziness, drowsiness, nausea, vomiting, excess salivation, diminished mental alertness, loss of consciousness and death. Exposure to atmospheres containing 8-10% or less oxygen will quickly bring about unconsciousness without warning, leaving individuals unable to help or protect themselves. Lack of sufficient oxygen can cause serious injury or death.

Skin contact with liquid nitrogen can cause tissue freezing, resulting in severe burns. The burns are caused by the extremely low temperature of the cryogenic liquid and not the result of chemical action. Skin may appear red with the formation of blisters. In cases that involve prolonged or severe exposure, tissue may freeze and have a waxy or yellow appearance.

**MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE:** None

**CARCINOGENIC POTENTIAL:** Nitrogen is not listed by NTP, OSHA or IARC as a carcinogen or suspected carcinogen.

**SECTION 4. FIRST AID**

**INHALATION:** Persons suffering from lack of oxygen should be moved to fresh air. If victim is not breathing, administer artificial respiration. If breathing is difficult, administer oxygen. Obtain prompt medical attention.

**SKIN CONTACT:** Remove any clothing that may restrict circulation to frozen area. Do not rub frozen parts as tissue damage may result. As soon as practical place the affected area in a warm water bath which has a temperature not to exceed 105°F (40°C). Never use dry heat. Call a physician as soon as possible.

Frozen tissue is painless and appears waxy with a possible yellow color. It will become swollen, painful, and prone to infection when thawed. If the frozen part of the body has been thawed, cover the area with dry sterile dressing with a large bulky protective covering, pending medical care. In case of massive exposure, remove clothing while showering with warm water. Call a physician.

**EYE CONTACT:** For exposure to liquid, immediately warm frostbite area with warm water (not to exceed 105°F).

**SECTION 5. FIRE AND EXPLOSION**

**FLASH POINT: AUTO IGNITION: FLAMMABLE LIMIT:**

Not Applicable Nonflammable Nonflammable

**EXTINGUISHING MEDIA:** Nitrogen is nonflammable and does not support combustion. Use extinguishing media appropriate for the surrounding fire.

**HAZARDOUS COMBUSTION PRODUCTS:** None

**SPECIAL FIRE FIGHTING INSTRUCTIONS:** Nitrogen is a simple asphyxiant. If possible, remove nitrogen containers from fire area or cool with water. Do not direct water spray at the container vent. Self contained breathing apparatus may be required for rescue workers. Evacuate the area.

**UNUSUAL FIRE AND EXPLOSION HAZARDS:** Liquid nitrogen when spilled will vaporize rapidly forming an oxygen deficient vapor cloud. Evacuate this area. Pressure in a container can build up due to heat and it may rupture if pressure relief devices should fail to function. Contact with cold liquid or gaseous oxygen may cause frostbite. Visibility may be obscured in its vapor cloud.

## SECTION 6. ACCIDENTAL RELEASE MEASURES

Evacuate all personnel from affected area. Increase ventilation to release area and monitor oxygen level. Use appropriate protective equipment (SCBA). To increase rate of vaporization spray large amounts of water on to the spill from an upwind position. If leak is from container or it's valve, call the Air Products emergency telephone number. Do NOT spray water directly at leak. If leak is in user's system close cylinder valve and vent pressure before attempting repairs.

## SECTION 7. HANDLING AND STORAGE

**STORAGE:** Store and use with adequate ventilation. Do not store in a confined space. Cryogenic containers are equipped with pressure relief devices to control internal pressure. Under normal conditions these containers will periodically vent product. Do not plug, remove, or tamper with pressure relief device.

**HANDLING:** Never allow any unprotected part of the body to touch uninsulated pipes or vessels which contain cryogenic fluids. The extremely cold metal will cause the flesh to stick fast and tear when one attempts to withdraw from it.

Use a suitable hand truck for container movement. Containers shall be handled and stored in an upright position. Do not drop, tip, or roll containers on their sides. Do not remove or interchange connections. If user experiences any difficulty operating container valve or with container connections discontinue use and contact supplier. Use the proper connection. DO NOT USE ADAPTERS.

Use piping and equipment adequately designed to withstand pressures to be encountered. Use a check valve or other protective apparatus in any line or piping from the cylinder to prevent reverse flow. To prevent cryogenic liquids or cold gas from being trapped in piping between valves the piping shall be equipped with pressure relief devices. Only transfer lines designed for cryogenic liquids shall be used. Some metals such as carbon steel may become brittle at low temperatures, will easily fracture and should not be used with cryogenic liquids. It is recommended that all vents be piped to the exterior of the building.

**SPECIAL PRECAUTIONS:** Some metals, such as carbon steel, may become brittle and fracture at low temperatures.

For additional information concerning storage and handling refer to Compressed Gas Association pamphlet P-12 *Safe Handling of Cryogenic Liquids* available from the Compressed Gas Association, Inc., 1725 Jefferson Davis Highway, Arlington, VA 22202-4102 Telephone (703) 412-0900.

## SECTION 8. PERSONAL PROTECTION / EXPOSURE CONTROL

**ENGINEERING CONTROLS:** Natural or mechanical ventilation to prevent oxygen deficient atmospheres under

19.5% oxygen.

**RESPIRATORY PROTECTION:**

**General Use:** None required.

- **Emergency Use:** Self contained breathing apparatus (SCBA) or positive pressure airline with mask and escape pack are to be used in oxygen deficient atmosphere. Respirators will not function.

**PROTECTIVE GLOVES:** Loose fitting thermal insulated or leather gloves.

**EYE PROTECTION:** Full face shield and safety glasses are recommended.

**OTHER PROTECTIVE EQUIPMENT:** Safety shoes when handling containers. Long sleeve shirts and trousers without cuffs.

**SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES**

**APPEARANCE:** Colorless, cryogenic liquid

**ODOR:** Odorless

**MOLECULAR WEIGHT:** 28.01

**BOILING POINT** (1 atm): -320.4 ° F (-195.8 ° C)

**SPECIFIC GRAVITY (Air = 1):** 0.967

**FREEZING POINT/MELTING POINT:** -345.8 ° F (-209.9 ° C)

**VAPOR PRESSURE** (AT 20 ° C): Not applicable

**GAS DENSITY** (At 70 ° F (21.1 ° C) and 1 Atm): 0.072 lb/ft<sup>3</sup> (1.153 kg/m<sup>3</sup>)

**SOLUBILITY IN WATER** (Vol/Vol at 32 ° F (0 ° C)): 0.023

**EXPANSION RATIO:** (For liquid to gas) at 70 ° F (21.1 ° C): 1 to 696.5

**SECTION 10. REACTIVITY / STABILITY**

**CHEMICAL STABILITY:** Stable

**CONDITIONS TO AVOID:** None

**INCOMPATIBILITY:** None

**HAZARDOUS DECOMPOSITION PRODUCTS:** None

**HAZARDOUS POLYMERIZATION:** Will not occur.

## SECTION 11. TOXICOLOGICAL INFORMATION

Nitrogen is a simple asphyxiant.

## SECTION 12. ECOLOGICAL INFORMATION

The atmosphere contains approximately 78% nitrogen. No adverse ecological effects are expected. Nitrogen does not contain any Class I or Class II ozone depleting chemicals. Nitrogen is not listed as a marine pollutant by DOT 49 CFR.

## SECTION 13. DISPOSAL

**UNUSED PRODUCT/EMPTY CONTAINER:** Return container and unused product to supplier. Do not attempt to dispose of unused product.

**DISPOSAL:** For emergency disposal, discharge slowly to the atmosphere in a well ventilated area or outdoors.

## SECTION 14. TRANSPORTATION

**DOT HAZARD CLASS:** 2.2

**DOT SHIPPING LABEL:** Nonflammable Gas

**DOT SHIPPING NAME:** Nitrogen, Refrigerated Liquid

**IDENTIFICATION NUMBER:** UN1977

**REPORTABLE QUANTITY (RQ):** None

**SPECIAL SHIPPING INFORMATION:** Containers should be transported in a secure upright position in a well ventilated truck. Never transport in passenger compartment of a vehicle.

## SECTION 15. REGULATORY INFORMATION

### U.S. FEDERAL REGULATIONS:

**CERCLA:** Comprehensive Environmental Response, Compensation, and Liability Act of 1980 requires notification to the National Response Center of a release of quantities of hazardous substances equal to or greater than the reportable quantities (RQ) in 40 CFR 302.4.

**CERCLA REPORTABLE QUANTITY:** None

### SARA TITLE III: SUPERFUND AMENDMENT AND REAUTHORIZATION ACT OF 1986

- **SECTION 302:** Requires emergency planning based on threshold planning quantities (TPQ) and release reporting based on reportable quantities (RQ) of EPA's extremely hazardous substances (40 CFR 355).

Nitrogen is not listed as an Extremely Hazardous Substance.

- **SECTIONS 311/312:** Require submission of material safety data sheets (MSDSs) and chemical inventory reporting with identification of EPA defined hazard classes. The hazard classes for this product are:

**IMMEDIATE HEALTH:** Yes **PRESSURE:** Yes

DELAYED HEALTH: No REACTIVITY: No

FIRE: No

- **SECTION 313:** Requires submission of annual reports of release of toxic chemicals that appear in 40 CFR 372. This information should be included in all MSDSs that are copied and distributed for this material.

Nitrogen is not listed as a toxic chemical.

**TOXIC SUBSTANCE CONTROL ACT (TSCA):** Nitrogen is listed on the TSCA inventory.

**Environmental Protection Agency (EPA)**

- **40 CFR Part 68:** Risk Management for Chemical Accident Release Prevention.

Nitrogen is not listed as a regulated substance.

**OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA)**

- **29 CFR 1910.119:** Process Safety Management of Highly Hazardous Chemicals. Requires facilities to develop a process safety management program based on Threshold Quantities (TQ) of highly hazardous chemicals.

Nitrogen is not listed as a Highly Hazardous Chemical.

**STATE REGULATIONS:**

**CALIFORNIA:**

- Proposition 65: This product does NOT contain any listed substances which the State of California requires warning under this statute.

SCAQMD Rule: VOC = Not applicable

**SECTION 16. SUPPLEMENTAL INFORMATION**

**NFPA RATINGS: HMIS RATINGS:**

HEALTH: 3 HEALTH: 3

FLAMMABILITY: 0 FLAMMABILITY: 0

REACTIVITY: 0 REACTIVITY: 0

SPECIAL: SA\*

\*Compressed Gas Association recommendation to designate simple asphyxiant.

\*\* Documents with effective dates of July 1995 and July 1998 are identical in content and either may be used.

**MSDS: ISOPROPYL ALCOHOL, (IPA, 2-PROPANOL)**  
**Reagent ACS**

**SECTION 1 CHEMICAL PRODUCT AND COMPANY IDENTIFICATION**

**TELECHEM INTERNATIONAL, INC**  
**524 E. WEDDELL**  
**Sunnyvale, CA 94089**  
**1-408-744-1331**  
**www.arrayit.com**

**EMERGENCY TELEPHONE NUMBER: 1-800-424-9300 (NORTH AMERICA)**

Date MSDS Prepared: December 28, 2001

Safety Data Review Date: February 7, 2002

MSDS Preparer's Name: R. Schena

CHEMICAL FAMILY: alcohols, aliphatic

**SECTION 2 COMPOSITION, INFORMATION ON INGREDIENTS**

COMPONENT: ISOPROPYL ALCOHOL  
CAS NUMBER: 67-63-0  
EC NUMBER (EINECS): 200-661-7  
EC INDEX NUMBER: 603-117-00-0  
PERCENTAGE: 100.00

**SECTION 3 HAZARDS IDENTIFICATION**

NFPA RATINGS (SCALE 0-4): HEALTH=1 FIRE=3 REACTIVITY=0

**EMERGENCY OVERVIEW:**

PHYSICAL FORM: soluble concentrate

MAJOR HEALTH HAZARDS: respiratory tract irritation, eye irritation, central nervous system depression

PHYSICAL HAZARDS: Flash back hazard.

**POTENTIAL HEALTH EFFECTS:**

**INHALATION:**

SHORT TERM EXPOSURE: same as effects reported in short term ingestion, irritation, hallucinations

LONG TERM EXPOSURE: no information on significant adverse effects

**SKIN CONTACT:**

SHORT TERM EXPOSURE: same as effects reported in short term ingestion, irritation

LONG TERM EXPOSURE: irritation

**EYE CONTACT:**

SHORT TERM EXPOSURE: irritation (possibly severe). eye damage

LONG TERM EXPOSURE: irritation

INGESTION:

SHORT TERM EXPOSURE: changes in blood pressure, nausea, vomiting, stomach pain, difficulty breathing, irregular heartbeat, headache, drowsiness, dizziness, disorientation, loss of coordination, lung congestion, internal bleeding, kidney damage, coma

LONG TERM EXPOSURE: no information on significant adverse effects

CARCINOGEN STATUS:

OSHA: No

NTP: No

IARC: No

SECTION 4 FIRST AID MEASURES
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INHALATION: If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. Get immediate medical attention.

SKIN CONTACT: Wash skin with soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention, if needed. Thoroughly clean and dry contaminated clothing and shoes before reuse.

EYE CONTACT: Flush eyes with plenty of water for at least 15 minutes. Then get immediate medical attention.

INGESTION: Contact local poison control center or physician immediately. Never make an unconscious person vomit or drink fluids. When vomiting occurs, keep head lower than hips to help prevent aspiration. If person is unconscious, turn head to side. Get medical attention immediately.

NOTE TO PHYSICIAN: For ingestion, consider gastric lavage and activated charcoal slurry. Consider oxygen.

SECTION 5 FIRE FIGHTING MEASURES
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FIRE AND EXPLOSION HAZARDS: Severe fire hazard. The vapor is heavier than air. Vapors or gases may ignite at distant ignition sources and flash back. Vapor/air mixtures are explosive.

EXTINGUISHING MEDIA: alcohol resistant foam, carbon dioxide, regular dry chemical, water

Large fires: Use alcohol-resistant foam or flood with fine water spray.

FIRE FIGHTING: Move container from fire area if it can be done without risk.

Cool containers with water spray until well after the fire is out. Stay away from the ends of tanks. For fires in cargo or storage area: Cool containers with water from unmanned hose holder or monitor nozzles until well after fire is out. If this is impossible then take the following precautions: Keep unnecessary people away, isolate hazard area and deny entry. Let the fire burn. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tanks due to fire. For tank, rail car or tank truck: Evacuation radius: 800 meters (1/2 mile). Do not attempt to extinguish fire unless flow of material can be stopped first. Flood with fine water spray. Do not scatter spilled material with high-pressure water streams. Cool containers with water spray until well after the fire is out. Apply water from a protected location or from a safe distance. Avoid inhalation of material or combustion by-products. Stay upwind and keep out of low areas.

FLASH POINT: 53.0F, 11.7C

#### SECTION 6 ACCIDENTAL RELEASE MEASURES

##### OCCUPATIONAL RELEASE:

Avoid heat, flames, sparks and other sources of ignition. Remove sources of ignition. Stop leak if possible without personal risk. Reduce vapors with water spray. Small spills: Absorb with sand or other non-combustible material. Collect spilled material in appropriate container for disposal. Large spills: Dike for later disposal. Keep unnecessary people away, isolate hazard area and deny entry. Stay upwind and keep out of low areas.

#### SECTION 7 HANDLING AND STORAGE

STORAGE: Store and handle in accordance with all current regulations and standards. Keep separated from incompatible substances.

#### SECTION 8 EXPOSURE CONTROLS, PERSONAL PROTECTION

##### EXPOSURE LIMITS:

##### ISOPROPYL ALCOHOL:

##### ISOPROPYL ALCOHOL (ISOPROPANOL; 2-PROPANOL):

400 ppm (980 mg/m<sup>3</sup>) OSHA TWA

500 ppm (1230 mg/m<sup>3</sup>) OSHA STEL (vacated by 58 FR 35338, June 30, 1993)

400 ppm ACGIH TWA

500 ppm ACGIH STEL

400 ppm (980 mg/m<sup>3</sup>) NIOSH recommended TWA 10 hour(s)

500 ppm (1225 mg/m<sup>3</sup>) NIOSH recommended STEL

500 mg/m<sup>3</sup> (200 ml/m<sup>3</sup>) DFG MAK (peak limitation category-II, 1)

400 ppm (999 mg/m<sup>3</sup>) UK OES TWA

500 ppm (1250 mg/m<sup>3</sup>) UK OES STEL

MEASUREMENT METHOD: Charcoal tube; 2-Butanol/Carbon disulfide: Gas chromatography with flame ionization detection; NIOSH IV # 1400. Alcohols  
VENTILATION: Ventilation equipment should be explosion-resistant if explosive concentrations of material are present. Ensure compliance with applicable exposure limits.

EYE PROTECTION: Wear splash resistant safety goggles. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.

CLOTHING: Wear appropriate chemical resistant clothing.

GLOVES: Wear appropriate chemical resistant gloves.

RESPIRATOR: The following respirators and maximum use concentrations are drawn from NIOSH and/or OSHA.

2000 ppm

Any supplied-air respirator operated in a continuous-flow mode.

Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s).

Any air-purifying respirator with a full facepiece and an organic vapor canister.

Any powered, air-purifying respirator with organic vapor cartridge(s).

Any self-contained breathing apparatus with a full facepiece.

Any supplied-air respirator with a full facepiece.

Escape -

Any air-purifying respirator with a full facepiece and an organic vapor canister.

Any appropriate escape-type, self-contained breathing apparatus.

For Unknown Concentrations or Immediately Dangerous to Life or Health -

Any supplied-air respirator with full facepiece and operated in a pressure-demand or other positive-pressure mode in combination with a separate escape supply.

Any self-contained breathing apparatus with a full facepiece.

## SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Appearance and Odor: COLORLESS LIQUID; CHARACTERISTIC ODOR

Boiling Point: 180F,82C

Melting Point: -127F,-88C

Vapor Pressure (MM Hg/70 F): 33 MMHG

Vapor Density (Air=1): 2.07

Specific Gravity: 0.7864

Decomposition Temperature: UNKNOWN

Evaporation Rate And Ref: 2.88 (N-BUTYL ACETATE=1)

Solubility In Water: COMPLETE

Percent Volatiles By Volume: 100  
Corrosion Rate (IPY): UNKNOWN

SECTION 10 STABILITY AND REACTIVITY
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REACTIVITY: Stable at normal temperatures and pressure. Stable at normal temperatures and pressure.

INCOMPATIBILITIES: acids, metals, oxidizing materials, combustible materials, halogens, peroxides, bases, metal salts

ISOPROPYL ALCOHOL:

ACIDS: Incompatible.

ACIDS ANHYDRIDES: Incompatible.

ALUMINUM: Dissolution is exothermic.

BARIUM PERCHLORATE: Formation of explosive compound.

2-BUTANONE (METHYL ETHYL KETONE): Accelerates the peroxidation of the alcohol.

CHROMIUM TRIOXIDE (GRANULAR): Ignition.

COATINGS: May be attacked.

DIOXYGENYL TETRAFLUOROBORATE: Ignition at ambient temperatures.

HALOGENS: Incompatible.

HYDROGEN + PALLADIUM (PARTICLES): Ignition on exposure to air.

HYDROGEN PEROXIDE: Formation of explosive compound.

KETONES: Markedly increases the possibility of peroxidation.

NITROFORM (TRINITROMETHANE): Dissolves liberating heat and possibly exploding.

OLEUM: Temperature and pressure increase in closed container.

OXIDIZERS (STRONG): Fire and explosion hazard.

OXYGEN (GAS): Autoxidation, on exposure to light, results in formation of ketones and potentially explosive hydrogen peroxide.

PHOSGENE: In the presence of iron salts, may explode.

PLASTICS: May be attacked.

POTASSIUM TERT-BUTOXIDE: Ignition.

RUBBER: May be attacked.

SODIUM DICHROMATE + SULFURIC ACID: Exothermic reaction with possible incandescence.

See also ALCOHOLS.

ALCOHOLS:

ACETALDEHYDE: Violent condensation reaction.

BARIUM PERCHLORATE: Formation of highly explosive perchloric ester on refluxing.

CHLORINE: Formation of highly explosive alkyl hypochlorites.

DIETHYL ALUMINUM BROMIDE: Spontaneous ignition.

ETHYLENE OXIDE: Possible explosion

HEXAMETHYLENE DIISOCYANATE: Possible explosion in absence of solvent.

HYDROGEN PEROXIDE + SULFURIC ACID: Possible explosion.  
HYPOCHLOROUS ACID: Formation of highly explosive alkyl hypochlorites.  
ISOCYANATES: Possible explosion in absence of solvent.  
LITHIUM ALUMINUM HYDRIDE: Vigorous reaction.  
NITROGEN TETROXIDE: Possible explosion.  
PERCHLORIC ACID (HOT): Dangerous interaction.  
PERMONOSULFURIC ACID: Possible explosion on contact with primary or secondary alcohols.  
TRI-ISO-BUTYL ALUMINUM: Violent reaction.

**HAZARDOUS DECOMPOSITION:**

Thermal decomposition products: oxides of carbon

POLYMERIZATION: Will not polymerize.

SECTION 11 TOXICOLOGICAL INFORMATION
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**ISOPROPYL ALCOHOL:**

**IRRITATION DATA:**

500 mg skin-rabbit mild; 100 mg eyes-rabbit severe; 10 mg eyes-rabbit moderate; 100 mg/24 hour(s) eyes-rabbit moderate

**TOXICITY DATA:**

14432 mg/kg oral-man TDLo; 223 mg/kg oral-human TDLo; 5272 mg/kg oral-man LDLo; 3570 mg/kg oral-human LDLo; 13 gm/kg oral-infant TDLo; 2 ml/kg unreported-human LDLo; 2770 mg/kg unreported-man LDLo; 1375 mg/kg unreported-infant TDLo; 5045 mg/kg oral-rat LD50; 16000 ppm/8 hour(s) inhalation-rat LC50; 2735 mg/kg intraperitoneal-rat LD50; 1088 mg/kg intravenous-rat LD50; 3600 mg/kg oral-mouse LD50; 12800 ppm/3 hour(s) inhalation-mouse LCLo; 4477 mg/kg intraperitoneal-mouse LD50; 6 gm/kg subcutaneous-mouse LDLo; 1509 mg/kg intravenous-mouse LD50; 1537 mg/kg oral-dog LDLo; 1024 mg/kg intravenous-dog LDLo; 6 ml/kg oral-cat LDLo; 1963 mg/kg intravenous-cat LDLo; 6410 mg/kg oral-rabbit LD50; 12800 mg/kg skin-rabbit LD50; 667 mg/kg intraperitoneal-rabbit LD50; 1184 mg/kg intravenous-rabbit LD50; 2560 mg/kg intraperitoneal-guinea pig LD50; 3444 mg/kg intraperitoneal-hamster LD50; 20 gm/kg parenteral-frog LDLo; 6 gm/kg subcutaneous-mammal LDLo; 7 ml/kg/7 day(s) intermittent oral-rat TDLo; 100 mg/m<sup>3</sup>/4 hour(s)-17 week(s) intermittent inhalation-rat TCLo; 8000 ppm/8 hour(s)-20 week(s) intermittent inhalation-rat TCLo; 5000 ppm/6 hour(s)-90 day(s) intermittent inhalation-rat TCLo; 2500 ppm/6 hour(s)-2 year(s) intermittent inhalation-rat TCLo; 10000 ppm/6 hour(s)-11 day(s) intermittent inhalation-mouse TCLo; 5000 ppm/6 hour(s)-13 week(s) intermittent inhalation-mouse TCLo; 5000 ppm/6 hour(s)-13 week(s) intermittent inhalation-mouse TCLo; 5000 ppm/6 hour(s)-78 week(s) intermittent inhalation-mouse TCLo

**CARCINOGEN STATUS:** IARC: Human Inadequate Evidence, Animal Inadequate Evidence, Group 3; EC: Category 1

Human Sufficient Evidence. IARC Group 1. Workers involved in the manufacture of isopropyl alcohol by the strong-acid process, involving the formation of isopropyl oils, showed an increase in paranasal and laryngeal cancer.

LOCAL EFFECTS:

Irritant: inhalation, eye

ACUTE TOXICITY LEVEL:

Slightly Toxic: inhalation, dermal absorption, ingestion

TARGET ORGANS: central nervous system

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: kidney disorders, liver disorders,

respiratory disorders, skin disorders and allergies

MUTAGENIC DATA:

Not determined

REPRODUCTIVE EFFECTS DATA:

Not determined

HEALTH EFFECTS:

INHALATION:

ACUTE EXPOSURE:

ISOPROPYL ALCOHOL: Human subjects exposed to 400 ppm for 3-5 minutes had mild irritation of the nose and throat. At 800 ppm the irritation was not severe but uncomfortable. Chest tightness and wheezing have also been reported in humans. Higher concentrations may cause effects as detailed in acute ingestion. The length of time required to produce deep narcosis in animals was inversely proportional to the concentration: The onset of deep narcosis ranged from 460 minutes at 3250 ppm to 100 minutes at 24,500 ppm.

CHRONIC EXPOSURE:

ISOPROPYL ALCOHOL: Mice subjected to 10900 ppm isopropyl alcohol in air for about 4 hours/day until they had accumulated 123 hours of exposure were narcotized but survived. Reversible fatty changes were observed in the liver. Male mice exposed to either 1000 or 5000 ppm of isopropyl alcohol vapor for 6 hours a day for 9 exposures exhibited hyaline droplet nephropathy. Reproductive effects have been reported in animals. There has been an increased incidence of cancer of the paranasal sinuses, and possibly of the larynx, in the manufacture of isopropyl alcohol by the strong acid process, involving the formation of isopropyl oils. It is not clear which substances are responsible.

SKIN CONTACT:

ACUTE EXPOSURE:

ISOPROPYL ALCOHOL: Contact with the skin may cause slight irritation.

Contact dermatitis has been reported in a few sensitive individuals.

Substance may be dermally absorbed resulting in systemic toxicity as detailed in acute ingestion. Toxic effects may become more marked if absorption and inhalation occur concurrently.

CHRONIC EXPOSURE:

ISOPROPYL ALCOHOL: Repeated or prolonged exposure may cause dermatitis due to the defatting action on the skin. Repeated and prolonged exposure to the skin of rabbits caused slight erythema, drying, and superficial desquamation.

EYE CONTACT:

ACUTE EXPOSURE:

ISOPROPYL ALCOHOL: May cause severe irritation with eye damage. In rabbit eyes, a drop caused mild transitory injury and a 50% aqueous solution after 3 minutes caused moderate irritation. Contact with a 70% solution caused conjunctivitis, iritis, and corneal opacity.

CHRONIC EXPOSURE:

ISOPROPYL ALCOHOL: Prolonged or repeated exposure to vapors may cause conjunctivitis.

INGESTION:

ACUTE EXPOSURE:

ISOPROPYL ALCOHOL: Ingestion may cause abdominal pain, hematemesis, nausea, vomiting, and hemorrhage. Central nervous system depression may occur with headache, dizziness, flushing, incoordination, hallucinations, stupor, confusion, hypotension, areflexia, and refractory narcosis. Oliguria followed by diuresis and coma may also occur. Other symptoms may include hypoglycemia, tenderness and edema of muscles, and arrhythmias. Vomiting with aspiration may cause aspiration pneumonia.

CHRONIC EXPOSURE:

ISOPROPYL ALCOHOL: No adverse effects resulted in humans following daily ingestion of 2.6 and 6.4 mg/kg for 6 weeks. Rats that ingested 0.5 to 10.0% isopropyl alcohol in drinking water for 27 weeks showed decreased body weight. Prolonged oral administration in rabbits produced anesthesia and death. Reproductive effects have been reported in animals.

SECTION 12 ECOLOGICAL INFORMATION

Not determined

SECTION 13 DISPOSAL CONSIDERATIONS

Dispose in accordance with all applicable regulations.

SECTION 14 TRANSPORT INFORMATION

U.S. DEPARTMENT OF TRANSPORTATION:

DOT PSN Code: HWY

DOT Proper Shipping Name: ISOPROPANOL OR ISOPROPYL ALCOHOL

DOT Class: 3  
DOT ID Number: UN1219  
DOT Pack Group: II  
DOT Label: FLAMMABLE LIQUID  
IMO PSN Code: ITK  
IMO Proper Shipping Name: ISOPROPYL ALCOHOL  
IMO Regulations Page Number: 3244  
IMO UN Number: 1219  
IMO UN Class: 3.2  
IMO Subsidiary Risk Label: -  
IATA PSN Code: ONH  
IATA UN ID Number: 1219  
IATA Proper Shipping Name: ISOPROPANOL  
IATA UN Class: 3  
IATA Label: FLAMMABLE LIQUID

SECTION 15 REGULATORY INFORMATION
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California Proposition 65: Not regulated.

CANADIAN REGULATIONS:

WHMIS CLASSIFICATION: Not determined.

EUROPEAN REGULATIONS:

EC CLASSIFICATION (CALCULATED): Not determined.

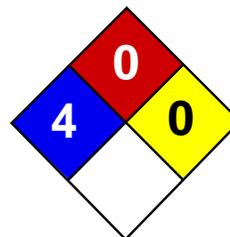
SECTION 16 OTHER INFORMATION
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MSDS SUMMARY OF CHANGES

SECTION 2 COMPOSITION, INFORMATION ON INGREDIENTS

SECTION 3 HAZARDS IDENTIFICATION

SECTION 11 TOXICOLOGICAL INFORMATION



Health	3
Fire	0
Reactivity	0
Personal Protection	

## Material Safety Data Sheet

### Nitric acid, 70% MSDS

#### Section 1: Chemical Product and Company Identification

**Product Name:** Nitric acid, 70%

**Catalog Codes:** SLN1963, SLN1549

**CAS#:** Mixture.

**RTECS:** Not applicable.

**TSCA:** TSCA 8(b) inventory: Water; Nitric acid, fuming

**CI#:** Not applicable.

**Synonym:** Nitric Acid, 70%

**Chemical Name:** Not applicable.

**Chemical Formula:** Not applicable.

**Contact Information:**

**Sciencelab.com, Inc.**

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: [ScienceLab.com](http://ScienceLab.com)

**CHEMTREC (24HR Emergency Telephone), call:**

1-800-424-9300

**International CHEMTREC, call:** 1-703-527-3887

**For non-emergency assistance, call:** 1-281-441-4400

#### Section 2: Composition and Information on Ingredients

**Composition:**

Name	CAS #	% by Weight
Water	7732-18-5	30
Nitric acid, fuming	7697-37-2	70

**Toxicological Data on Ingredients:** Nitric acid, fuming: VAPOR (LC50): Acute: 244 ppm 0.5 hours [Rat]. 344 ppm 0.5 hours [Rat].

#### Section 3: Hazards Identification

**Potential Acute Health Effects:**

Very hazardous in case of skin contact (corrosive, irritant, permeator), of eye contact (irritant, corrosive), of ingestion, . Slightly hazardous in case of inhalation (lung sensitizer). Liquid or spray mist may produce tissue damage particularly on mucous membranes of eyes, mouth and respiratory tract. Skin contact may produce burns. Inhalation of the spray mist may produce severe irritation of respiratory tract, characterized by coughing, choking, or shortness of breath. Prolonged exposure may result in skin burns and ulcerations. Over-exposure by inhalation may cause respiratory irritation. Severe over-exposure can result in death. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

**Potential Chronic Health Effects:**

CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to lungs, mucous membranes, upper respiratory

tract, skin, eyes, teeth. Repeated or prolonged exposure to the substance can produce target organs damage. Repeated or prolonged contact with spray mist may produce chronic eye irritation and severe skin irritation. Repeated or prolonged exposure to spray mist may produce respiratory tract irritation leading to frequent attacks of bronchial infection.

## Section 4: First Aid Measures

### **Eye Contact:**

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention immediately.

### **Skin Contact:**

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Cold water may be used. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

### **Serious Skin Contact:**

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

### **Inhalation:**

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

### **Serious Inhalation:**

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. **WARNING:** It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

### **Ingestion:**

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

**Serious Ingestion:** Not available.

## Section 5: Fire and Explosion Data

**Flammability of the Product:** Non-flammable.

**Auto-Ignition Temperature:** Not applicable.

**Flash Points:** Not applicable.

**Flammable Limits:** Not applicable.

**Products of Combustion:** Not available.

**Fire Hazards in Presence of Various Substances:** of combustible materials

### **Explosion Hazards in Presence of Various Substances:**

Explosive in presence of reducing materials, of metals, of alkalis. Slightly explosive in presence of combustible materials. Non-explosive in presence of open flames and sparks, of shocks.

**Fire Fighting Media and Instructions:** Not applicable.

### **Special Remarks on Fire Hazards:**

Flammable in presence of cellulose or other combustible materials. Phosphine, hydrogen sulfide, selenide all ignite when fuming nitric acid is dripped into gas. Phosphine ignites in concentrated nitric acid. Nickel tetraphosphide ignites with fuming nitric acid. Contact with metals may evolve flammable hydrogen gas. A jet of ammonia will ignite nitric acid vapor. Cellulose may be converted to the highly flammable nitrate ester on contact with the vapor of nitric acid as well as the liquid itself.

### **Special Remarks on Explosion Hazards:**

Reacts explosively with metallic powders, carbides, cyanides, sulfides, alkalis and turpentine. Can react explosively with many reducing agents. Arsine, phosphine, tetraborane all oxidized explosively in presence of nitric acid. Cesium and rubidium acetylides explode in contact with nitric acid. Explosive reaction with Nitric Acid + Nitrobenzene + water. Detonation with Nitric Acid + 4-Methylcyclohexane. The addition of warm fuming nitric acid to phosphine causes explosion. Addition of water to nitration mixture diluted with an equal volume of water can cause a low order explosion. Cyclopentadiene reacts explosively with fuming nitric acid. Mixtures of fuming nitric acid and acetonitrile are high explosives. (Nitric acid, fuming)

## Section 6: Accidental Release Measures

### Small Spill:

Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container. If necessary: Neutralize the residue with a dilute solution of sodium carbonate.

### Large Spill:

Corrosive liquid. Oxidizing material. Poisonous liquid. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Avoid contact with a combustible material (wood, paper, oil, clothing...). Keep substance damp using water spray. Do not touch spilled material. Use water spray curtain to divert vapor drift. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Neutralize the residue with a dilute solution of sodium carbonate. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

## Section 7: Handling and Storage

### Precautions:

Keep locked up.. Keep container dry. Keep away from heat. Keep away from sources of ignition. Keep away from combustible material.. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Never add water to this product. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as reducing agents, combustible materials, organic materials, metals, acids, alkalis, moisture. May corrode metallic surfaces. Store in a metallic or coated fiberboard drum using a strong polyethylene inner package.

### Storage:

Keep container tightly closed. Keep container in a cool, well-ventilated area. Separate from acids, alkalis, reducing agents and combustibles. See NFPA 43A, Code for the Storage of Liquid and Solid Oxidizers. Do not store above 23°C (73.4°F).

## Section 8: Exposure Controls/Personal Protection

### Engineering Controls:

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

### Personal Protection:

Face shield. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves. Boots.

### Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

### Exposure Limits:

TWA: 2 STEL: 4 (ppm) from ACGIH (TLV) [United States] TWA: 2 STEL: 4 from OSHA (PEL) [United States] Consult local authorities for acceptable exposure limits.

## Section 9: Physical and Chemical Properties

**Physical state and appearance:** Liquid.

**Odor:** Acid. Disagreeable and choking. (Strong.)

**Taste:** Not available.

**Molecular Weight:** Not applicable.

**Color:** Colorless to light yellow.

**pH (1% soln/water):** Acidic.

**Boiling Point:** 121°C (249.8°F)

**Melting Point:** -41.6°C (-42.9°F)

**Critical Temperature:** Not available.

**Specific Gravity:** 1.408 (Water = 1)

**Vapor Pressure:** 6 kPa (@ 20°C)

**Vapor Density:** 2.5 (Air = 1)

**Volatility:** Not available.

**Odor Threshold:** 0.29 ppm

**Water/Oil Dist. Coeff.:** Not available.

**Ionicity (in Water):** Not available.

**Dispersion Properties:** See solubility in water, diethyl ether.

**Solubility:**

Easily soluble in cold water, hot water. Soluble in diethyl ether.

## Section 10: Stability and Reactivity Data

**Stability:** The product is stable.

**Instability Temperature:** Not available.

**Conditions of Instability:** Incompatible materials

**Incompatibility with various substances:**

Highly reactive with alkalis. Reactive with reducing agents, combustible materials, organic materials, metals, acids.

**Corrosivity:**

Extremely corrosive in presence of aluminum, of copper, of brass. Non-corrosive in presence of glass, of stainless steel(304), of stainless steel(316)

**Special Remarks on Reactivity:**

A strong oxidizer. Reacts violently with alcohol, organic material, turpene, charcoal. Violent reaction with Nitric acid + Acetone and Sulfuric acid. Incompatible with combustible materials, metallic powders, hydrogen sulfide, carbides, aldehydes, cyanides, chromic acid, hydrogen sulfide, metals, metal powders, organic solvents, acetic acid, alcohols. Nitric Acid will react with water or steam to produce heat and toxic, corrosive and flammable vapors. (Nitric acid, fuming)

**Special Remarks on Corrosivity:**

In presence of traces of oxides, it attacks all base metals except aluminum and special chromium steels. It will attack some forms of plastics, rubber, and coatings. Nitric Acid corrodes almost all metals except gold, and white gold, forming nitrates. No corrosive effect on bronze. No corrosivity data for zinc, and steel

**Polymerization:** Will not occur.

## Section 11: Toxicological Information

**Routes of Entry:** Absorbed through skin. Dermal contact. Eye contact. Inhalation. Ingestion.

**Toxicity to Animals:**

LD50: Not available. LC50: Not available.

**Chronic Effects on Humans:**

Contains material which may cause damage to the following organs: lungs, mucous membranes, upper respiratory tract, skin, eyes, teeth.

**Other Toxic Effects on Humans:**

Extremely hazardous in case of inhalation (lung corrosive). Very hazardous in case of skin contact (corrosive, irritant, permeator), of eye contact (corrosive), of ingestion, .

**Special Remarks on Toxicity to Animals:** LDL - Lowest Published Lethal Dose [Human] - Route: Oral; Dose: 430 mg/kg (Nitric acid, fuming)

**Special Remarks on Chronic Effects on Humans:** May cause adverse reproductive effects based on animal data (effects on newborn, fetotoxicity)

**Special Remarks on other Toxic Effects on Humans:**

Acute Potential Health Effects: Skin: Severely irritates skin. Causes skin burns and may cause deep and penetrating ulcers of the skin with a characteristic yellow to brownish discoloration. May be fatal if absorbed through skin. Eyes: Severely irritates eyes. Causes eye burns. May cause irreversible eye injury. Ingestion: May be fatal if swallowed. Causes serious gastrointestinal tract irritation or burns with nausea, vomiting, severe abdominal pain, and possible "coffee grounds" appearance of the vomitus . May cause perforation of the digestive tract. Inhalation: May be fatal if inhaled. Vapor is extremely hazardous. Vapor may cause nitrous gas poisoning. Effects may be delayed. May cause irritation of the mucous membranes and respiratory tract with burning pain in the nose and throat, coughing, sneezing, wheezing, shortness of breath and pulmonary edema. Other symptoms may include nausea, and vomiting. Chronic Potential Health Effects: Repeated inhalation may produce changes in pulmonary function and/or chronic bronchitis. It may also affect behavior (headache, dizziness, drowsiness, muscle contraction or spasticity, weakness, loss of coordinaton, mental confusion), and urinary system (kidney faillure, decreased urinary output after several hours of uncorrected circulatory collapse). Repeated exposure may cause discoloration and/or erroision of teeth (dental enamel). Eye irritation and respiratory tract signs and symptoms resembling those of frequent upper respiratory viral infections have been associated with chronic nitric acid exposure.

**Section 12: Ecological Information**

**Ecotoxicity:** Not available.

**BOD5 and COD:** Not available.

**Products of Biodegradation:**

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

**Toxicity of the Products of Biodegradation:** The products of degradation are less toxic than the product itself.

**Special Remarks on the Products of Biodegradation:** Not available.

**Section 13: Disposal Considerations**

**Waste Disposal:**

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

**Section 14: Transport Information**

**DOT Classification:** Class 8: Corrosive material

**Identification:** : Nitric acid (Nitric acid, fuming) UNNA: 2031 PG: II

**Special Provisions for Transport:** Marine Pollutant

**Section 15: Other Regulatory Information**

**Federal and State Regulations:**

New York release reporting list: Nitric acid, fuming Rhode Island RTK hazardous substances: Nitric acid, fuming Pennsylvania RTK: Nitric acid, fuming Florida: Nitric acid, fuming Minnesota: Nitric acid, fuming Massachusetts RTK: Nitric acid, fuming New Jersey: Nitric acid, fuming TSCA 8(b) inventory: Water; Nitric acid, fuming SARA 302/304/311/312 extremely hazardous substances: Nitric acid, fuming SARA 313 toxic chemical notification and release reporting: Nitric acid, fuming 70% CERCLA: Hazardous substances.: Nitric acid, fuming: 1000 lbs. (453.6 kg);

**Other Regulations:** OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

**Other Classifications:****WHMIS (Canada):**

CLASS D-1A: Material causing immediate and serious toxic effects (VERY TOXIC). CLASS D-2A: Material causing other toxic effects (VERY TOXIC). CLASS E: Corrosive liquid.

**DSCL (EEC):**

R8- Contact with combustible material may cause fire. R35- Causes severe burns. S23- Do not breathe gas/fumes/vapour/spray [\*\*\*] S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S36- Wear suitable protective clothing. S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

**HMIS (U.S.A.):**

**Health Hazard:** 3

**Fire Hazard:** 0

**Reactivity:** 0

**Personal Protection:**

**National Fire Protection Association (U.S.A.):**

**Health:** 4

**Flammability:** 0

**Reactivity:** 0

**Specific hazard:**

**Protective Equipment:**

Gloves. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Face shield.

**Section 16: Other Information**

**References:** Not available.

**Other Special Considerations:** Not available.

**Created:** 10/10/2005 10:58 AM

**Last Updated:** 06/09/2012 12:00 PM

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# Material Data Safety Sheet (MSDS): HYDROCHLORIC ACID

1. Product Identification	7. Handling and Storage
2. Composition	8. Exposure Controls/Personal Protection
3. Hazards Identification	9. Physical and Chemical Properties
4. First Aid Measures	10. Stability and Reactivity
5. Fire Fighting Measures	11. Toxicological Information
6. Accidental Release Measures	12. Ecological Information
	13. Disposal Considerations
	16. Other Information

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contact the manufacturer, or check one of the various Web-based databases such as those compiled by BU's Office of Environmental Health & Safety ([www.bu.edu/ehs/msds/index.htm](http://www.bu.edu/ehs/msds/index.htm)).

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## 1. Product Identification

MSDS Name: **Hydrochloric Acid**, Reagent ACS

Chlorohydric acid, hydrogen chloride, muriatic acid, spirits of salt.

Company Identification: Acros Organics N.V.

One Reagent Lane

Fairlawn, NJ 07410

For information in North America, call: 800-ACROS-01

For emergencies in the US, call CHEMTREC: 800-424-9300

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## 2. Composition/Information on Ingredients

CAS#	Chemical Name	%	EINECS#
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7647-01-0	Hydrochloric acid, reagent ACS	37%	231-595-7
7732-18-5	Water	Balance	231-791-2

Hazard Symbols: C

Risk Phrases: 34 37

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### 3. Hazards Identification

#### Emergency Overview

#### EMERGENCY OVERVIEW

Appearance: Clear, colorless to faintly yellow.

**Danger! Corrosive.** Sensitizer. Causes eye and skin burns. May cause severe respiratory and digestive tract irritation with possible burns.

Target Organs: None.

#### Potential Health Effects

##### Eye:

May cause irreversible eye injury. Vapor or mist may cause irritation and severe burns. Contact with liquid is corrosive to the eyes and causes severe burns. May cause painful sensitization to light. May cause conjunctivitis.

##### Skin:

May be absorbed through the skin in harmful amounts. Contact with liquid is corrosive and causes severe burns and ulceration. May cause photosensitization in certain individuals.

##### Ingestion:

May cause circulatory system failure. Causes severe digestive tract burns with abdominal pain, vomiting, and possible death. May cause corrosion and permanent tissue destruction of the esophagus and digestive tract.

##### Inhalation:

Causes severe irritation of upper respiratory tract with coughing, burns, breathing difficulty, and possible coma. May cause pulmonary edema and severe respiratory disturbances.

##### Chronic:

Prolonged or repeated skin contact may cause dermatitis. Repeated exposure may cause erosion of teeth. May cause conjunctivitis and photosensitization.

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#### **4. First Aid Measures**

**Eyes:**

Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower lids. Get medical aid

immediately. Do NOT allow victim to rub or keep eyes closed.

**Skin:**

Get medical aid. Rinse area with large amounts of water for at least 15 minutes. Remove contaminated clothing and shoes.

**Ingestion:**

Do NOT induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Get medical aid immediately.

**Inhalation:**

Remove from exposure to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.

**Notes to Physician:**

Treat symptomatically and supportively.

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#### **5. Fire Fighting Measures**

**General Information:**

As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Not flammable, but reacts with most metals to form flammable hydrogen gas. Use water spray to keep fire-exposed containers cool.

**Extinguishing Media:**

Substance is nonflammable; use agent most appropriate to extinguish surrounding fire.

Autoignition Temperature: Not available.

Flash Point: Not available.

NFPA Rating: Not published.

Explosion Limits, Lower: Not available.

Upper: Not available.

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#### **6. Accidental Release Measures**

**General Information:** Use proper personal protective equipment as indicated in Section 8.

**Spills/Leaks:**

Large spills may be neutralized with dilute alkaline solutions of soda ash, or lime. Absorb spill using an absorbent, non-combustible material such as earth, sand, or vermiculite.

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## 7. Handling and Storage

### Handling:

Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Use with adequate ventilation. Do not get on skin or in eyes. Do not ingest or inhale.

### Storage:

Keep away from heat and flame. Do not store in direct sunlight. Store in a cool, dry, well-ventilated area away from incompatible substances.

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## 8. Exposure Controls/Personal Protection

### Engineering Controls:

Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.

### Exposure Limits

Chemical Name ACGIH NIOSH OSHA - Final PELs

Hydrochloric acid, reagent ACS C 5 ppm; C 7.5 mg/m<sup>3</sup> 50 ppm IDLH C 5 ppm; C 7 mg/m<sup>3</sup>

### OSHA Vacated PELs:

Hydrochloric acid, reagent ACS:

No OSHA Vacated PELs are listed for this chemical.

### Personal Protective Equipment

#### Eyes:

Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

#### Skin:

Wear appropriate protective gloves to prevent skin exposure.

#### Clothing:

Wear appropriate protective clothing to prevent skin exposure.

#### Respirators:

Follow the OSHA respirator regulations found in 29CFR 1910.134 or European Standard EN 149. Always use a NIOSH or European Standard EN 149 approved respirator when necessary.

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## 9. Physical and Chemical Properties (Hydrochloric Acid)

Appearance:	Clear, colorless to faintly yellow liquid
Odor:	Strong, pungent
Solubility:	823g/L water at 32F
Density:	1.16-1.19
pH:	1.1 (0.1N sol)
% Volatiles by volume @ 21C (70F):	Not available
Boiling Point:	230 deg F
Melting Point:	-101 deg F
Vapor Density (Air=1):	1.257
Vapor Pressure:	160 mm Hg
Evaporation Rate (Butyl acetate =1):	2.0

Molecular Formula: HCl  
Molecular Weight: 36.46

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## 10. Stability and Reactivity

### Chemical Stability:

Stable under normal temperatures and pressures.

### Conditions to Avoid:

Incompatible materials, light.

### Incompatibilities with Other Materials:

Acetate, acetic anhydride, alcohols + hydrogen cyanide, 2-aminoethanol, ammonium hydroxide, calcium carbide, calcium phosphide, cesium acetylene carbide, cesium carbide, chlorosulfonic acid, 1,1-difluoroethylene, ethylene diamine, ethyleneimine, fluorine, lithium silicide, magnesium boride, mercuric sulfate, oleum, perchloric acid, potassium permanganate,  $\gamma$ -propiolactone, propylene oxide, rubidium acetylene carbide, rubidium carbide, silver perchlorate + carbon tetrachloride, sodium, sodium hydroxide, sulfuric acid, uranium phosphide, vinyl acetate. Substance polymerizes on contact with

aldehydes or epoxides.

Hazardous Decomposition Products:

Hydrogen chloride, chlorine, carbon monoxide, carbon dioxide, hydrogen gas.

Hazardous Polymerization: May occur.

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**11. Toxicological Information**

RTECS#:

CAS# 7647-01-0: MW4025000

CAS# 7732-18-5: ZC0110000

LD50/LC50:

CAS# 7647-01-0: Inhalation, mouse: LC50 =1108 ppm/1H; Inhalation, rat: LC50 =3124 ppm/1H; Oral, rabbit: LD50 = 900 mg/kg.

CAS# 7732-18-5: Oral, rat: LD50 = >90 mL/kg.

Carcinogenicity:

Hydrochloric acid, reagent ACS -

IARC: Group 3 carcinogen

Epidemiology:

No information available.

Teratogenicity:

Embryo or Fetus: Stunted fetus, inh-rat TClO=450 mg/m3/III Specific

Developmental Abnormalities: homeostasis, inh-rat TClO=450 mg/m3/III.

Reproductive Effects:

No information available.

Neurotoxicity:

No information available.

Mutagenicity:

No information available.

Other Studies:

None.

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**12. Ecological Information**

Ecotoxicity:

Trout LC100=10 mg/L/24H Shrimp LC50=100-330 ppm Starfish LC50=100-330mg/L/48H Shore crab  
LC50=240 mg/L/48H Chronic plant toxicity=100 ppm

Environmental Fate:

Substance will neutralize soil carbonate-based components.

Physical/Chemical:

No information available.

Other:

None.

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### 13. Disposal Considerations

Dispose of in a manner consistent with federal, state, and local regulations.

RCRA D-Series Maximum Concentration of Contaminants: None listed.

RCRA D-Series Chronic Toxicity Reference Levels: None listed.

RCRA F-Series: None listed.

RCRA P-Series: None listed.

RCRA U-Series: None listed

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### 16. Other Information

MSDS Creation Date: 11/09/1995 Revision #4 Date: 4/28/1998

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no way shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

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## Material Data Safety Sheet (MSDS): SULFURIC ACID

1. Product Identification	7. Handling and Storage
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Return to MSDS Index

### 1. Product Identification

MSDS Name: **Sulfuric acid**, reagent acs

**Synonyms: Hydrogen Sulfate, Oil of Vitriol, Vitriol Brown Oil, Matting Acid, Battery Acid**

Company Identification: Acros Organics N.V.

One Reagent Lane

Fairlawn, NJ 07410

For information in North America, call: 800-ACROS-01

For emergencies in the US, call CHEMTREC: 800-424-9300

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### 2. Composition/Information on Ingredients

CAS#	Chemical Name	%	EINECS#

7664-93-9	Sulfuric acid	95-98.0%	231-639-5
7732-18-5	Water	Balance	231-791-2

Hazard Symbols: XI C

Risk Phrases: 35 36/38

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### 3. Hazards Identification

#### EMERGENCY OVERVIEW

Appearance: colorless to brown.

**Danger! Harmful if inhaled. Corrosive.** Hygroscopic. Causes digestive and respiratory tract burns. Causes digestive and respiratory tract irritation. Causes severe eye and skin irritation and burns. Target Organs: None known.

#### Potential Health Effects

Eye:

May cause irreversible eye injury. Causes eye irritation and burns.

Skin:

Causes severe skin irritation and burns.

Ingestion:

Causes gastrointestinal tract burns.

Inhalation:

Harmful if inhaled. May cause severe irritation of the respiratory tract with sore throat, coughing, shortness of breath and delayed lung edema. Causes chemical burns to the respiratory tract.

Chronic:

Prolonged or repeated skin contact may cause dermatitis. Prolonged or repeated inhalation may cause nosebleeds, nasal congestion, erosion of the teeth, perforation of the nasal septum, chest pain and bronchitis. Prolonged or repeated eye contact may cause conjunctivitis.

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### 4. First Aid Measures

Eyes:

Get medical aid immediately. Do NOT allow victim to rub or keep eyes closed. Extensive irrigation is required (at least 30 minutes).

Skin:

Get medical aid immediately. Flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. **SPEEDY ACTION IS CRITICAL!**

Ingestion:

Do NOT induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give

anything by mouth to an unconscious person. Get medical aid immediately.

**Inhalation:**

Get medical aid immediately. Remove from exposure to fresh air immediately. If breathing is difficult, give oxygen.

**Notes to Physician:**

Treat symptomatically and supportively.

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## 5. Fire Fighting Measures

**General Information:**

Wear appropriate protective clothing to prevent contact with skin and eyes. Wear a self-contained breathing apparatus (SCBA) to prevent contact with thermal decomposition products. Contact with water can cause violent liberation of heat and splattering of the material.

**Extinguishing Media:**

Do NOT use water directly on fire. Use water spray to cool fire-exposed containers. Use carbon dioxide or dry chemical.

Autoignition Temperature: Not available.

Flash Point: 340 deg C ( 644.00 deg F)

NFPA Rating: Not published.

Explosion Limits, Lower: Not available.

Upper: Not available.

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## 6. Accidental Release Measures

**General Information:** Use proper personal protective equipment as indicated in Section 8.

**Spills/Leaks:**

Cover with sand, dry lime or soda ash and place in a closed container for disposal.

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## 7. Handling and Storage

**Handling:**

Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Use only in a well ventilated area. Do not get in eyes, on skin, or on clothing. Keep container tightly closed. Do not

ingest or inhale. Do not allow contact with water. Discard contaminated shoes.

#### Storage:

Keep container closed when not in use. Store in a cool, dry, well-ventilated area away from incompatible substances. Corrosives area.

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## 8. Exposure Controls/Personal Protection

#### Engineering Controls:

Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.

#### Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Sulfuric acid	1 mg/m <sup>3</sup> ; 3 mg/m <sup>3</sup> STEL	1 mg/m <sup>3</sup> TWA; 15 mg/m <sup>3</sup> IDLH	1 mg/m <sup>3</sup> TWA

#### OSHA Vacated PELs:

Sulfuric acid: 1 mg/m<sup>3</sup> TWA

#### Personal Protective Equipment

##### Eyes:

Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

##### Skin:

Wear appropriate protective gloves to prevent skin exposure.

##### Clothing:

Wear appropriate protective clothing to prevent skin exposure.

##### Respirators:

Follow the OSHA respirator regulations found in 29CFR 1910.134 or European Standard EN 149. Always use a NIOSH or European Standard EN 149 approved respirator when necessary.

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**9. Physical and Chemical Properties ()**

Appearance:	colorless to brown liquid
Odor:	Odorless
Solubility:	
Density:	1.8400 g/cm <sup>3</sup>
pH:	Not available
% Volatiles by volume @ 21C (70F):	
Boiling Point:	280 deg C @ 760.00mm Hg
Melting Point:	3 deg C
Vapor Density (Air=1):	1.2 kg/m <sup>3</sup>
Vapor Pressure (mm Hg):	< 0.00120 mm Hg
Evaporation Rate:	Slower than ether
Viscosity:	Not available

Molecular Formula: H<sub>2</sub>O<sub>4</sub>S

Molecular Weight: 98.08

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**10. Stability and Reactivity**

Chemical Stability:

Stable under normal temperatures and pressures.

Conditions to Avoid:

Contact with water, metals, excess heat, combustible materials, organic materials.

Incompatibilities with Other Materials:

Acids (mineral, oxidizing, e.g. chromic acid, hypochlorous acid, nitric acid, sulfuric acid), alcohols and glycols (e.g. butyl alcohol, ethanol, methanol, ethylene glycol), aldehydes (e.g. acetaldehyde, acrolein, chloral hydrate, formaldehyde), amines (aliphatic and aromatic, e.g. dimethyl amine, propylamine, pyridine, triethylamine), azo, diazo, and hydrazines (e.g. dimethyl hydrazine, hydrazine, methyl hydrazine), caustics (e.g. ammonia, ammonium hydroxide, calcium hydroxide, potassium hydroxide, sodium hydroxide), cyanides (e.g. potassium cyanide, sodium cyanide), dithiocarbamates (e.g. ferbam, maneb, metham, thiram), fluorides (inorganic, e.g. ammonium fluoride, calcium fluoride, cesium fluoride), isocyanates (e.g. methyl isocyanate), metals (alkali and alkaline, e.g. cesium, potassium, sodium), metals as powders (e.g. hafnium, raney nickel), metals and metal compounds (toxic, e.g. beryllium, lead acetate, nickel carbonyl, tetraethyl lead), nitrides (e.g. potassium nitride, sodium n.

Hazardous Decomposition Products:

Oxides of sulfur.

Hazardous Polymerization: Has not been reported.

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## 11. Toxicological Information

RTECS#:

CAS# 7664-93-9; WS5600000

LD50/LC50:

CAS# 7664-93-9: Inhalation, mouse: LC50 =320 mg/m<sup>3</sup>/2H; Inhalation, rat: LC50 =510 mg/m<sup>3</sup>/2H;  
Oral, rat: LD50 = 2140 mg/kg.

Carcinogenicity:

Sulfuric acid -

ACGIH: A2 - Suspected Human Carcinogen

OSHA: Select carcinogen

IARC: Group 1 carcinogen

Epidemiology:

Workers exposed to industrial sulfuric acid mist showed a statistical increase in laryngeal cancer. This data suggests a possible relationship between carcinogenesis and inhalation of sulfuric acid mist.

Teratogenicity:

No data available.

Reproductive Effects:

No data available.

Neurotoxicity:

No data available.

Mutagenicity:

No data available.

Other Studies:

No data available.

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## 12. Ecological Information

Ecotoxicity:

Sulfuric acid is harmful to aquatic life in very low concentrations. It may be dangerous if it enters water intakes. The aquatic toxicity for bluegill in fresh water was 24.5 ppm/24 hr. which was lethal.

Environmental Fate:

Not available.

Physical/Chemical:

Not available.

Other:

Not available.

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### 13. Disposal Considerations

Dispose of in a manner consistent with federal, state, and local regulations.

RCRA D-Series Maximum Concentration of Contaminants: None listed.

RCRA D-Series Chronic Toxicity Reference Levels: None listed.

RCRA F-Series: None listed.

RCRA P-Series: None listed.

RCRA U-Series: None listed.

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### 16. Other Information

MSDS Creation Date: 2/01/1996 Revision #3 Date: 10/01/1997

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no way shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

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# MATERIAL SAFETY DATA SHEET

## Hydrogen Peroxide (20 to 40%)



MSDS Ref. No.: 7722-84-1-3

Date Approved: 06/03/2008

Revision No.: 11

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This document has been prepared to meet the requirements of the U.S. OSHA Hazard Communication Standard, 29 CFR 1910.1200 and Canada's Workplace Hazardous Materials Information System (WHMIS) requirements.

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## 1. PRODUCT AND COMPANY IDENTIFICATION

- PRODUCT NAME:** Hydrogen Peroxide (20 to 40%)
- ALTERNATE PRODUCT NAME(S):** Durox® Reg. & LR 35%, Oxypure® 35%, Standard 27.5 & 35%, Super D® 25 & 35, Technical 35%, HTP 35%, OHP 35%, Chlorate Grade, 20%, Semiconductor Reg, Seg, RGS, RGS 2, RGS 3, 31%
- GENERAL USE:**
- Durox® 35% Reg. & LR - meets the Food Chemical Codex requirements for aseptic packaging and other food related applications.
  - Oxypure® 35% - certified by NSF to meet NSF/ANSI Standard 60 requirements for drinking water treatment.
  - Standard 27.5 and 35% - most suitable grade for industrial bleaching, processing, pollution abatement and general oxidation reactions.
  - Semiconductor Reg, Seg, RGS, RGS 2, RGS 3, 31% - conform to ACS and Semi Specs. for wafer etching and cleaning, and applications requiring low residues.
  - Super D® 25 and 35% - meets US Pharmacopoeia specifications for 3% topical solutions when diluted with proper quality water. While manufactured to the USP standards for purity and to FMC's demanding ISO 9002 quality standards, FMC does not claim that it's Hydrogen Peroxide is manufactured in accordance with all pharmaceutical cGMP conditions.
  - Technical 35% - essentially free of inorganic metals suitable for chemical synthesis.
  - HTP 35% - specially formulated for aerospace equipment conditioning.
  - OHP 35% - specially formulated for OHP process, advanced oxidation, and activated peroxide applications
  - Chlorate Grade 20% - specially formulated for use in chlorate manufacture or processing.

## MANUFACTURER

FMC CORPORATION  
FMC Peroxygens  
1735 Market Street  
Philadelphia, PA 19103  
(215) 299-6000 (General Information)  
msdsinfo@fmc.com (Email - General Information)

FMC of Canada Ltd.  
FMC Peroxygens  
PG Pulp Mill Road  
Prince George, BC V2N2S6  
(250) 561-4200 (General Information)

## EMERGENCY TELEPHONE NUMBERS

(281) 474-8750 (Plant: Pasadena, TX, US - Call Collect)  
(250) 561-4221 (Plant: Prince George, BC, Canada - Call Collect)  
(303) 595-9048 (Medical - U.S. - Call Collect)

For leak, fire, spill, or accident emergencies, call:  
(800) 424-9300 (CHEMTREC - U.S.A.)  
(613) 996-6666 (CANUTEC - Canada)

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## 2. HAZARDS IDENTIFICATION

### EMERGENCY OVERVIEW:

- Clear, colorless, odorless liquid
- Oxidizer.
- Contact with combustibles may cause fire.
- Decomposes yielding oxygen that supports combustion of organic matters and can cause overpressure if confined.
- Corrosive to eyes, nose, throat, lungs and gastrointestinal tract.

**POTENTIAL HEALTH EFFECTS:** Corrosive to eyes, nose, throat and lungs. May cause irreversible tissue damage to the eyes including blindness. May cause skin irritation.

---

## 3. COMPOSITION / INFORMATION ON INGREDIENTS

Chemical Name	CAS#	Wt.%	EC No.	EC Class
Hydrogen Peroxide	7722-84-1	20 - 40	231-765-0	O, C, Xn; R5- R8-R35-R20/22
Water	7732-18-5	60 - 80	231-791-2	Not classified

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## 4. FIRST AID MEASURES

**EYES:** Immediately flush with water for at least 15 minutes, lifting the upper and lower eyelids intermittently. See a medical doctor or ophthalmologist immediately.

**SKIN:** Wash with plenty of soap and water. Get medical attention if irritation occurs and persists.

**INGESTION:** Rinse mouth with water. Dilute by giving 1 or 2 glasses of water. Do not induce vomiting. Never give anything by mouth to an unconscious person. See a medical doctor immediately.

**INHALATION:** Remove to fresh air. If breathing difficulty or discomfort occurs and persists, contact a medical doctor.

**NOTES TO MEDICAL DOCTOR:** Hydrogen peroxide at these concentrations is a strong oxidant. Direct contact with the eye is likely to cause corneal damage especially if not washed immediately. Careful ophthalmologic evaluation is recommended and the possibility of local corticosteroid therapy should be considered. Because of the likelihood of corrosive effects on the gastrointestinal tract after ingestion, and the unlikelihood of systemic effects, attempts at evacuating the stomach via emesis induction or gastric lavage should be avoided. There is a remote possibility, however, that a nasogastric or orogastric tube may be required for the reduction of severe distension due to gas formation.

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## 5. FIRE FIGHTING MEASURES

**EXTINGUISHING MEDIA:** Flood with water.

**FIRE / EXPLOSION HAZARDS:** Product is non-combustible. On decomposition releases oxygen which may intensify fire.

**FIRE FIGHTING PROCEDURES:** Any tank or container surrounded by fire should be flooded with water for cooling. Wear full protective clothing and self-contained breathing apparatus.

**FLAMMABLE LIMITS:** Non-combustible

**SENSITIVITY TO IMPACT:** No data available

**SENSITIVITY TO STATIC DISCHARGE:** No data available

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## 6. ACCIDENTAL RELEASE MEASURES

**RELEASE NOTES:** Dilute with a large volume of water and hold in a pond or diked area until hydrogen peroxide decomposes. Hydrogen peroxide may be decomposed by adding sodium metabisulfite or sodium sulfite after diluting to about 5%. Dispose according to methods outlined for waste disposal.

Combustible materials exposed to hydrogen peroxide should be immediately submerged in or rinsed with large amounts of water to ensure that all hydrogen peroxide is removed. Residual hydrogen peroxide that is allowed to dry (upon evaporation hydrogen peroxide can concentrate) on organic materials such as paper, fabrics, cotton, leather, wood or other combustibles can cause the material to ignite and result in a fire.

## 7. HANDLING AND STORAGE

**HANDLING:** Wear chemical splash-type monogoggles and full-face shield, impervious clothing, such as rubber, PVC, etc., and rubber or neoprene gloves and shoes. Avoid cotton, wool and leather. Avoid excessive heat and contamination. Contamination may cause decomposition and generation of oxygen gas which could result in high pressures and possible container rupture. Hydrogen peroxide should be stored only in vented containers and transferred only in a prescribed manner (see FMC Technical Bulletins). Never return unused hydrogen peroxide to original container, empty drums should be triple rinsed with water before discarding. Utensils used for handling hydrogen peroxide should only be made of glass, stainless steel, aluminum or plastic.

**STORAGE:** Store drums in cool areas out of direct sunlight and away from combustibles. For bulk storage refer to FMC Technical Bulletins.

**COMMENTS:** VENTILATION: Provide mechanical general and/or local exhaust ventilation to prevent release of vapor or mist into the work environment.

## 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

### EXPOSURE LIMITS

Chemical Name	ACGIH	OSHA	Supplier
Hydrogen Peroxide	1 ppm (TWA)	1 ppm (PEL) 1.4 mg/m <sup>3</sup> (PEL)	

**ENGINEERING CONTROLS:** Ventilation should be provided to minimize the release of hydrogen peroxide vapors and mists into the work environment. Spills should be minimized or confined immediately to prevent release into the work area. Remove contaminated clothing immediately and wash before reuse.

### PERSONAL PROTECTIVE EQUIPMENT

**EYES AND FACE:** Use chemical splash-type monogoggles and a full-face shield made of polycarbonate, acetate, polycarbonate/acetate, PETG or thermoplastic.

**RESPIRATORY:** If concentrations in excess of 10 ppm are expected, use NIOSH/DHHS approved self-contained breathing apparatus (SCBA), or other approved atmospheric-supplied respirator (ASR) equipment (e.g., a full-face airline respirator (ALR)). DO NOT use any form of air-purifying respirator (APR) or filtering facepiece (AKA dust mask), especially those containing oxidizable sorbants such as activated carbon.

**PROTECTIVE CLOTHING:** For body protection wear impervious clothing such as an approved splash protective suit made of SBR Rubber, PVC (PVC Outershell w/Polyester Substrate), Gore-Tex (Polyester trilaminate w/Gore-Tex), or a specialized HAZMAT Splash or Protective Suite (Level A, B, or C). For foot protection, wear approved boots made of NBR, PVC, Polyurethane, or neoprene. Overboots made of Latex or PVC, as well as firefighter boots or specialized HAZMAT boots are also permitted. DO NOT wear any form of boot or overboots made of nylon or nylon blends. DO NOT use cotton, wool or leather, as these materials react RAPIDLY with higher concentrations of hydrogen peroxide. Completely submerge hydrogen peroxide contaminated clothing or other materials in water prior to drying. Residual hydrogen peroxide, if allowed to dry on materials such as paper, fabrics, cotton, leather, wood or other combustibles can cause the material to ignite and result in a fire.

**GLOVES:** For hand protection, wear approved gloves made of nitrile, PVC, or neoprene. DO NOT use cotton, wool or leather for these materials react RAPIDLY with higher concentrations of hydrogen peroxide. Thoroughly rinse the outside of gloves with water prior to removal. Inspect regularly for leaks.

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## 9. PHYSICAL AND CHEMICAL PROPERTIES

<b>ODOR:</b>	Odorless
<b>APPEARANCE:</b>	Clear, colorless liquid
<b>AUTOIGNITION TEMPERATURE:</b>	Non-combustible
<b>BOILING POINT:</b>	103°C/218°F (20%); 107°C/225°F (31%); 108°C/226°F (35%)
<b>COEFFICIENT OF OIL / WATER:</b>	Not available
<b>DENSITY / WEIGHT PER VOLUME:</b>	Not available
<b>EVAPORATION RATE:</b>	> 1 (Butyl Acetate = 1)
<b>FLASH POINT:</b>	Non-combustible
<b>FREEZING POINT:</b>	-15°C/6°F (20%); -26°C/-15°F (31%); -33°C/-27°F (35%)
<b>ODOR THRESHOLD:</b>	Not available
<b>OXIDIZING PROPERTIES:</b>	Strong oxidizer
<b>PERCENT VOLATILE:</b>	100
<b>pH:</b>	<= 3.7 5.0 - 6.0 @ 25 °C (1% solution)
<b>SOLUBILITY IN WATER:</b>	100 %
<b>SPECIFIC GRAVITY:</b>	1.07 @ 20°C/4°C (20%); 1.11 @ 20°C/4°C (31%); 1.13 @ 20°C/4°C (35%)
<b>VAPOR DENSITY:</b>	(Air = 1): Not available
<b>VAPOR PRESSURE:</b>	28 mmHg @ 30°C (20%); 24 mmHg @ 30°C (31%); 23 mmHg @ 30°C (35%)

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## 10. STABILITY AND REACTIVITY

<b>CONDITIONS TO AVOID:</b>	Excessive heat or contamination could cause product to become unstable.
<b>STABILITY:</b>	Stable (heat and contamination could cause decomposition)
<b>POLYMERIZATION:</b>	Will not occur
<b>INCOMPATIBLE MATERIALS:</b>	Reducing agents, wood, paper and other combustibles, iron and other heavy metals, copper alloys and caustic.
<b>HAZARDOUS DECOMPOSITION PRODUCTS:</b>	Oxygen which supports combustion.
<b>COMMENTS:</b>	Materials to Avoid : Dirt, organics, cyanides and combustibles such as wood, paper, oils, etc.

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## 11. TOXICOLOGICAL INFORMATION

**EYE EFFECTS:** 35% hydrogen peroxide: Extremely irritating/corrosive (rabbit) [FMC Study Number: 183-748]

**SKIN EFFECTS:** 35% hydrogen peroxide: Mildly irritating after 4-hour exposure (rabbit) [FMC Study Number: 183-747]

**DERMAL LD<sub>50</sub>:** 35% hydrogen peroxide: > 2,000 mg/kg (rabbit) [FMC Study Number: 183-746]

**ORAL LD<sub>50</sub>:** 35% hydrogen peroxide: 1,193 mg/kg (rat) [FMC Study Number: 183-745]

**INHALATION LC<sub>50</sub>:** 50% hydrogen peroxide: > 0.17 mg/l (rat) [FMC Study Number: 189-1080]

**TARGET ORGANS:** Eyes, nose, throat and lungs

**ACUTE EFFECTS FROM OVEREXPOSURE:** Extremely irritating/corrosive to eyes and gastrointestinal tract. May cause irreversible tissue damage to the eyes including blindness. Inhalation of mist or vapors may be severely irritating to nose, throat and lungs. May cause skin irritation.

**CHRONIC EFFECTS FROM OVEREXPOSURE:** The International Agency for Research on Cancer (IARC) has concluded that there is inadequate evidence for carcinogenicity of hydrogen peroxide in humans, but limited evidence in experimental animals (Group 3 - not classifiable as to its carcinogenicity to humans). The American Conference of Governmental Industrial Hygienists (ACGIH) has concluded that hydrogen peroxide is a 'Confirmed Animal Carcinogen with Unknown Relevance to Humans' (A3).

**CARCINOGENICITY:**

Chemical Name	IARC	NTP	OSHA	Other
Hydrogen Peroxide	Not listed	Not listed	Not listed	(ACGIH) Listed (A3, Animal Carcinogen)

**12. ECOLOGICAL INFORMATION**

**ECOTOXICOLOGICAL INFORMATION:** Channel catfish 96-hour  $LC_{50}$  = 37.4 mg/L  
 Fathead minnow 96-hour  $LC_{50}$  = 16.4 mg/L  
 Daphnia magna 24-hour  $EC_{50}$  = 7.7 mg/L  
 Daphnia pulex 48-hour  $LC_{50}$  = 2.4 mg/L  
 Freshwater snail 96-hour  $LC_{50}$  = 17.7 mg/L  
 For more information refer to ECETOX "Icira" Assessment of Commodity Chemicals No. 22, Hydrogen Peroxide." ISSN-0773-6339, January 1993

**CHEMICAL FATE INFORMATION:** Hydrogen peroxide in the aquatic environment is subject to various reduction or oxidation processes and decomposes into water and oxygen. Hydrogen peroxide half-life in freshwater ranged from 8 hours to 20 days, in air from 10-20 hrs. and in soils from minutes to hours depending upon microbiological activity and metal contaminants.

**13. DISPOSAL CONSIDERATIONS**

**DISPOSAL METHOD:** An acceptable method of disposal is to dilute with a large amount of water and allow the hydrogen peroxide to decompose followed by discharge into a suitable treatment system in accordance with all regulatory agencies. The appropriate regulatory agencies should be contacted prior to disposal.

**14. TRANSPORT INFORMATION****U.S. DEPARTMENT OF TRANSPORTATION (DOT)**

<b>PROPER SHIPPING NAME:</b>	Hydrogen peroxide, aqueous solutions with not less than 20% but not more than 40% hydrogen peroxide
<b>PRIMARY HAZARD CLASS / DIVISION:</b>	5.1 (Oxidizer)
<b>UN/NA NUMBER:</b>	UN 2014
<b>PACKING GROUP:</b>	II
<b>LABEL(S):</b>	Oxidizer, Corrosive
<b>PLACARD(S):</b>	5.1 (Oxidizer)

Hydrogen Peroxide (20 to 40%) (7722-84-1-3)

Date: 06/03/2008

**ADDITIONAL INFORMATION:**

DOT Marking: Hydrogen Peroxide,  
aqueous solution with not less than 20%,  
but not more than 40% Hydrogen Peroxide,  
UN 2014

Hazardous Substance/RQ: Not applicable  
49 STCC Number: 4918775

DOT Spec: stainless steel/high purity  
aluminum cargo tanks and rail cars. UN  
Spec: HDPE drums. Contact FMC for  
specific details.

**INTERNATIONAL MARITIME DANGEROUS GOODS (IMDG)**

**PROPER SHIPPING NAME:**

Hydrogen peroxide, aqueous solutions with  
not less than 20%, but not more than 60%  
hydrogen peroxide.

**INTERNATIONAL CIVIL AVIATION ORGANIZATION (ICAO) /  
INTERNATIONAL AIR TRANSPORT ASSOCIATION (IATA)**

**PROPER SHIPPING NAME:**

Hydrogen peroxide, aqueous solutions with  
not less than 20%, but not more than 40%  
hydrogen peroxide (\*).

**OTHER INFORMATION:**

(\*) Air regulations permit shipment of Hydrogen Peroxide (20 - 40%) in non-vented containers for Air Cargo Only aircraft, as well as for Passenger and Cargo aircraft. HOWEVER, all FMC Hydrogen Peroxide containers are vented and therefore, air shipments of FMC H<sub>2</sub>O<sub>2</sub> is not permitted. IATA air regulations state that venting of packages containing oxidizing substances is not permitted for air transport.

Protect from physical damage. Keep drums in upright position. Drums should not be stacked in transit. Do not store drum on wooden pallets.

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## **15. REGULATORY INFORMATION**

### **UNITED STATES**

**SARA TITLE III (SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT)**

**SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355, APPENDIX A):**  
Not listed

**SECTION 311 HAZARD CATEGORIES (40 CFR 370):**  
Fire Hazard, Immediate (Acute) Health Hazard

**SECTION 312 THRESHOLD PLANNING QUANTITY (40 CFR 370):**

The Threshold Planning Quantity (TPQ) for this product, if treated as a mixture, is 10,000 lbs; however, this product contains the following ingredients with a TPQ of less than 10,000 lbs.:  
None, (conc. <52%)

**SECTION 313 REPORTABLE INGREDIENTS (40 CFR 372):**

Not listed

**CERCLA (COMPREHENSIVE ENVIRONMENTAL RESPONSE COMPENSATION AND LIABILITY ACT)**

**CERCLA DESIGNATION & REPORTABLE QUANTITIES (RQ) (40 CFR 302.4):**

Unlisted (Hydrogen Peroxide 20-40%); RQ = 100 lbs.; Ignitability, Corrosivity

**TSCA (TOXIC SUBSTANCE CONTROL ACT)**

**TSCA INVENTORY STATUS (40 CFR 710):**

Listed

**RESOURCE CONSERVATION AND RECOVERY ACT (RCRA)**

**RCRA IDENTIFICATION OF HAZARDOUS WASTE (40 CFR 261):**

Waste Number: D001, D002

**CANADA**

**WHMIS (WORKPLACE HAZARDOUS MATERIALS INFORMATION SYSTEM):**

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all the information required by the Controlled Products Regulations.

Hazard Classification / Division: C  
E  
D2B

Product Identification Number: 2014  
Ingredient Disclosure List: Listed  
Domestic Substance List: All components listed

**INTERNATIONAL LISTINGS**

Hydrogen peroxide:

China: Listed  
Japan (ENCS): (1)-419  
Korea: KE-20204  
Philippines (PICCS): Listed

**HAZARD AND RISK PHRASE DESCRIPTIONS:**

EC Symbols: O (Oxidizer)

	C	(Corrosive)
	Xn	(Harmful)
EC Risk Phrases:	R5	(Heating may cause an explosion.)
	R8	(Contact with combustible material may cause fire)
	R35	(Causes severe burns.)
	R20/22	(Harmful by inhalation and if swallowed.)

## 16. OTHER INFORMATION

### HMIS

Health	3
Flammability	0
Physical Hazard	1
Personal Protection (PPE)	H

Protection = H (Safety goggles, gloves, apron, the use of a supplied air or SCBA respirator is required in lieu of a vapor cartridge respirator)

HMIS = Hazardous Materials Identification System

Degree of Hazard Code:

- 4 = Severe
- 3 = Serious
- 2 = Moderate
- 1 = Slight
- 0 = Minimal

### NFPA

Health	3
Flammability	0
Reactivity	1
Special	OX

SPECIAL = OX (Oxidizer)

NFPA (National Fire Protection Association)

Degree of Hazard Code:

- 4 = Extreme
- 3 = High
- 2 = Moderate
- 1 = Slight
- 0 = Insignificant

### **REVISION SUMMARY:**

This MSDS replaces Revision #10, dated April 27, 2006.

Changes in information are as follows:  
Section 1 (Product and Company Identification)  
Section 3 (Composition / Information on Ingredients)  
Section 15 (Regulatory Information)  
Section 16 (Other Information)

Durox, Oxypure, Super D and FMC Logo - FMC Trademarks

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## SODIUM BISULFATE

### Product and Company Identification

**Product Name:** Sodium bisulfate, anhydrous globular, technical

**Product Code:** SBS01

**Synonyms:** Sodium acid sulfate, Nitre cake, Sodium hydrogen sulfate

**Product Use:** Cleaning compounds, pH adjustment

**Date of MSDS Preparation:** January 2003

**Manufacturer:** Jones-Hamilton Co.

-or-

8400 Enterprise Drive  
Newark, CA 94560

30354 Tracy Road  
Walbridge, OH 43465

**24-Hour Emergency Phone Number:**

California: (510) 797-2471

Ohio: (419) 666-9838

CHEMTREC: (800) 424-9300

### Composition/Information on Ingredients

**Chemical Formula:** NaHSO<sub>4</sub>

Component	CAS#	% (by weight)	Exposure Limits
Sodium bisulfate	7681-38-1	91.5-94.7	None established
Sodium sulfate	7757-82-6	4.8-8.0	None established
Moisture	7732-18-5	0.1-0.8	None established

**OSHA:** This material is classified as an irritant under current OSHA regulations.

### Hazards Identification

**Emergency Overview:** Off-white granular material, with the consistency of salt. Presents little or no hazard if spilled and no unusual hazard if involved in a fire. However, keep out of streams and ditches.

#### Potential Health Effects

**Eye:** Causes mild to severe irritation. May cause burn if not flushed with water.

**Skin:** Prolonged exposure may cause moderate irritation. May cause burn if not flushed with water.

**Inhalation:** Inhalation of dust may irritate or burn nose, throat and lungs.

**Ingestion:** Small amounts (tablespoonful) swallowed are not likely to cause injury; however, swallowing large amounts may irritate or burn digestive tract.

**Chronic (Cancer) Information:** Not known to cause cancer. Not listed as carcinogen by IARC, NTP or OSHA.

**Teratology (Birth Defect) Information:** No data available.

**Reproduction Information:** No data available.

**Potential Environmental Effects:** Material in dry form is not hazardous to the environment. However, readily dissolves in water to form a weak acid solution. Therefore, keep out of streams and ditches.

### First Aid Measures

**Note to Physician:** Supportive care. Treatment based on judgment of the physician in response to reactions of the patient. May aggravate pre-existing respiratory conditions.

**Eyes:** Immediately flush eyes with water for at least 15 minutes, lifting eyelids to thoroughly flush. If redness or irritation persists, get prompt medical attention.

**Skin:** Immediately flush affected area with water for at least 15 minutes. If burn occurs, seek immediate medical attention.

**Inhalation:** Remove to fresh air. If irritation or discomfort persists, seek medical attention.

**Ingestion:** If large amounts are ingested (greater than a teaspoonful), drink large quantities of milk or water. Follow with milk of magnesia, beaten eggs or vegetable oil. Do not induce vomiting. Contact physician immediately.

### Fire Fighting Measures

**Flammable Properties:** NA. Material will not burn

**Flammable Limits:** NA. Material is non-combustible.

**Extinguishing Media:** Use extinguishing media appropriate for surrounding fire. Because material will readily dissolve in water to form a weak acid solution, avoid water contact with material if possible.

**Hazardous Combustion Products:** At temperatures over 806°F (430°C), product will decompose generating oxides or sulfur.

**Fire Fighting Instructions:** Product readily dissolves in water to form a weak acid solution. If using water, wear acid protective equipment. No gases or toxic fumes are emitted from this reaction. However, if elevated temperatures (>806°F) are reached, self-contained breathing apparatus should be worn.

### Accidental Release Measures

**Land Spill:** Vacuum or shovel material and place in disposal container. Avoid excessive dust generation. Dilute residual material with ample supply of water and direct to sanitary sewer if Federal, State or Local regulations permit.

**Water Spill:** Readily dissolves in water to form a weak acid solution. If water is isolated or can be contained, neutralize with weak alkaline solution.

Notify appropriate authorities if required by regulations.

### Handling and Storage

**Handling:** Wear all recommended personal protective clothing when handling. Avoid contact with eyes. Wash thoroughly after handling. Minimize dust generation. Avoid breathing dust.

**Storage:** Material is hygroscopic and will readily absorb moisture. Keep containers tightly closed. Do not store where exposed to moist conditions. Do not store near strong alkalis.

### Exposure Controls/Personal Protection

**Engineering Controls:** Provide general and/or local exhaust ventilation to maintain airborne particulate below nuisance levels (>10 mg/m<sup>3</sup>).

**Respiratory Protection:** In dusty atmospheres (>10 mg/m<sup>3</sup>), use a NIOSH approved dust respirator.

**Skin Protection:** Rubber gloves and cotton-blend coveralls.

**Eye Protection:** Safety glasses or goggles.

**General Hygiene Considerations:** There are no known health hazards associated with this material when used as recommended. Follow good industrial hygiene practices including but not limited to: (1) wash hands after use and before eating; (2) avoid breathing dust; and (3) wear safety glasses.

### Physical and Chemical Properties

**Appearance:** Off-white granular material.

**Physical State:** Dry (anhydrous) crystalline solid spherical shape beads.

**Molecular Formula:** NaHSO<sub>4</sub>

**Bulk Density:** 80-85 lbs/ft<sup>3</sup> (loose)

**Percent Volatile:** Non-volatile

**Odor:** Fresh to pungent.

**Solubility:** 1080 g/l @ 68°F (20°C)

**Particle Size:** ±0.75 mm diameter

**Melting Point:** 350°F (177°C)

**Molecular Weight:** 120

### Stability and Reactivity

**Stability:** Stable

**Incompatibility:** Avoid contact with strong alkaline material such as caustic. Dissolves readily in water to form a weak acid solution. Do not mix with liquid chlorine bleach, ammonia cleansers or similar products.

**Conditions to Avoid:** Do not store dry product where exposed to moist conditions.

**Hazardous Decomposition Products:** Only if heated over 806°F (430°C), at which sulfur dioxide and sulfur trioxide are formed.

**Hazardous Polymerization:** Will not occur.

### Toxicological Information

**Reported Human Effects:** No human data are available for this product.

**Reported Animal Effects:** Oral - LD50 (rat) 2800 mg/kg.

Skin irritation - This material is neither corrosive nor destructive to the skin of New Zealand rabbits. Occasionally, a very slight rash may appear.

### Ecological Information

**Ecotoxicological Information:** This product readily dissolves in water to form a weak acid solution. A 0.05 percent or greater (by weight) solution of this product will likely be acutely harmful to fish and other water organisms.

**Chemical Fate Information:** Material will decompose in soil. Studies show that there are no adverse effects of applying the main ingredient in this product (sodium bisulfate) directly to crops. In fact, there are existing products on the market that use sodium bisulfate as a soil additive to improve crop production. However, do not apply excessive quantities to soil.

### **Disposal Considerations**

If this product as supplied becomes a waste, it does not meet the criteria of a hazardous waste as defined under the Resource Conservation and Recovery Act (RCRA), 40 CFR Part 261. Dispose of in accordance with local, State and Federal laws and regulations.

### **Transport Information**

**Domestic (Land, Department of Transportation):** Not regulated.

**International (Water, IMO):** Not regulated.

**Shipment in Canada:** Not regulated.

**International (Air, ICAO & IATA):** Not regulated.

**Surface Shipments in Europe:** Not regulated.

### **Regulatory Information**

**OSHA:** This product is classified as an irritant by definition of Hazard Communication Standard (29 CFR 1910.1200).

**HMIS Rating:** Health - 1; Flammability - 0; Reactivity - 1; Protective equipment - F.

**NFPA Rating:** Health - 1; Flammability - 0; Reactivity - 1; Special precautions - None.

**TSCA:** Listed in U.S. TSCA Section 8(b) Inventory.

**CERCLA (RQ):** This product contains no hazardous substances listed in 40 CFR Part 302.

**SARA Title III:** Section 311/312 Hazard Class - Acute. This product contains none of the substances subject to the reporting requirements of Section 313 (40 CFR Part 372).

**California Proposition 65:** This product does not contain any ingredient known to the State of California to cause cancer or reproductive toxicity as listed under the Safe Drinking Water and Toxic Enforcement Act of 1986.

**New Jersey:** Department of Health RTK List - sn 1704. Special Hazardous Substances - Corrosive

**Australia:** List of Designated Hazardous Substances - Corrosive (R34), Harmful (R37).

**Canada - WHMIS:** Controlled Product Hazard Class D2B. This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all of the information required by the CPR.

**Canada - CEPA:** All components of this product are on the Domestic Substances List (DSL), and acceptable for use under the provisions of CEPA.

**European Union (EU):** Dangerous Substances (Annex I)

- Risk Phrases: R36/37/38

- Labels: XI

- Safety Phrases: S8, S22, S24/25, S26, S36 & S50

**Germany:** Water Classification (VwVwS) - Water Hazard Class: I

**Switzerland:** Toxic Substance Classification - Giftklasse 3

**Inventories:** Australian Inventory of Chemical Substances; China; European Inventory of Existing Commercial Chemical Substances (231-665-7); European Union Inventory of Cosmetic Ingredients, Other Ingredients; ICCA High Production Volume Working List; Japan Existing and New Chemical Substances (1-83, 1-491, 1-501); Korea Existing and Evaluated Chemical Substances (KE-31481); Philippines Inventory of Chemicals and Chemical Substances; OECD List of High Production Volume Chemicals.

### **Other Information**

**Disclaimer:** The information provided herein relates only to the specific material described herein and does not relate to its use by customer whether alone or in combination with any other material in any process. The information set forth herein is furnished free of charge and is based on technical data that Jones-Hamilton Co. believes to be reliable, but Jones-Hamilton Co. does not make any representation or warranty as to the accuracy or completeness of this information. This information is intended for use by persons having technical skill and at their own discretion and risk. Customer is responsible for determining whether the information included herein is appropriate for customer's use, and customer assumes full responsibility for conclusions it derives from this information. Neither Jones-Hamilton Co. nor any of its officers, employees, directors, agents or other representatives shall have any liability to customer or any of its officers, employees, directors, agents or other representatives resulting from customer's use of this information. Inasmuch as Jones-Hamilton Co. has no reason to know how customer intends to use the information provided herein, and since condition of use are outside of our control, we make no warranties, express or implied, and assume no liability

## Section 1. Chemical product and company identification

<b>Product name</b>	: Helium
<b>Supplier</b>	: AIRGAS INC., on behalf of its subsidiaries 259 North Radnor-Chester Road Suite 100 Radnor, PA 19087-5283 1-610-687-5253
<b>Product use</b>	: Synthetic/Analytical chemistry.
<b>Synonym</b>	: helium (dot); Helium-4; He; o-Helium; UN 1046; UN 1963; Liquid Helium; Helium, Refrigerated Liquid
<b>MSDS #</b>	: 001025
<b>Date of Preparation/Revision</b>	: <b>5/6/2013.</b>
<b>In case of emergency</b>	: 1-866-734-3438

## Section 2. Hazards identification

<b>Physical state</b>	: Gas. [Colorless, Odorless Gas, Cryogenic liquid and gas]
<b>Emergency overview</b>	: WARNING! GAS: CONTENTS UNDER PRESURE. Do not puncture or incinerate container. Can cause rapid suffocation. May cause severe frostbite. LIQUID: Extremely cold liquid and gas under pressure. Can cause rapid suffocation. May cause severe frostbite.  Do not puncture or incinerate container. Contact with rapidly expanding gases or liquids can cause frostbite.
<b>Routes of entry</b>	: Inhalation
<b>Potential acute health effects</b>	
<b>Eyes</b>	: Contact with rapidly expanding gas may cause burns or frostbite. Contact with cryogenic liquid can cause frostbite and cryogenic burns.
<b>Skin</b>	: Contact with rapidly expanding gas may cause burns or frostbite. Contact with cryogenic liquid can cause frostbite and cryogenic burns.
<b>Inhalation</b>	: Acts as a simple asphyxiant.
<b>Ingestion</b>	: Ingestion is not a normal route of exposure for gases. Contact with cryogenic liquid can cause frostbite and cryogenic burns.
<b>Medical conditions aggravated by over-exposure</b>	: Acute or chronic respiratory conditions may be aggravated by overexposure to this gas.

See toxicological information (Section 11)

## Section 3. Composition, Information on Ingredients

<u>Name</u>	<u>CAS number</u>	<u>% Volume</u>	<u>Exposure limits</u>
Helium	7440-59-7	100	Oxygen Depletion [Asphyxiant]

## Section 4. First aid measures

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.

- Eye contact** : Check for and remove any contact lenses. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical attention immediately.
- Skin contact** : None expected.
- Frostbite** : Try to warm up the frozen tissues and seek medical attention.
- Inhalation** : Move exposed person to fresh air. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.
- Ingestion** : As this product is a gas, refer to the inhalation section.

## Section 5. Fire-fighting measures

- Flammability of the product** : Non-flammable.
- Products of combustion** : No specific data.
- Fire-fighting media and instructions** : Use an extinguishing agent suitable for the surrounding fire.  
  
Apply water from a safe distance to cool container and protect surrounding area. If involved in fire, shut off flow immediately if it can be done without risk.  
  
Contains gas under pressure. In a fire or if heated, a pressure increase will occur and the container may burst or explode.
- 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** : Immediately contact emergency personnel. Keep unnecessary personnel away. Use suitable protective equipment (section 8). Shut off gas supply if this can be done safely. Isolate area until gas has dispersed.
- Environmental precautions** : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.
- Methods for cleaning up** : Immediately contact emergency personnel. Stop leak if without risk. Note: see section 1 for emergency contact information and section 13 for waste disposal.

## Section 7. Handling and storage

- Handling** : High pressure gas. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.  
Never allow any unprotected part of the body to touch uninsulated pipes or vessels that contain cryogenic liquids. Prevent entrapment of liquid in closed systems or piping without pressure relief devices. Some materials may become brittle at low temperatures and will easily fracture.
- Storage** : Cylinders should be stored upright, with valve protection cap in place, and firmly secured to prevent falling or being knocked over. Cylinder temperatures should not exceed 52 °C (125 °F).  
For additional information concerning storage and handling refer to Compressed Gas Association pamphlets P-1 Safe Handling of Compressed Gases in Containers and P-12 Safe Handling of Cryogenic Liquids available from the Compressed Gas Association, Inc.

## Section 8. Exposure controls/personal protection

- Engineering controls** : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.
- Personal protection**
- Eyes** : 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 or dusts.  
When working with cryogenic liquids, wear a full face shield.
- Skin** : 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.
- Respiratory** : Use a properly fitted, air-purifying or air-fed 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.  
The applicable standards are (US) 29 CFR 1910.134 and (Canada) Z94.4-93
- Hands** : 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.  
Insulated gloves suitable for low temperatures
- Personal protection in case of a large spill** : Self-contained breathing apparatus (SCBA) should be used to avoid inhalation of the product.

### Product name

helium

Oxygen Depletion [Asphyxiant]

Consult local authorities for acceptable exposure limits.

## Section 9. Physical and chemical properties

- Molecular weight** : 4 g/mole
- Molecular formula** : He
- Boiling/condensation point** : -268.9°C (-452°F)
- Melting/freezing point** : -272.2°C (-458°F)
- Critical temperature** : -267.9°C (-450.2°F)
- Vapor density** : 0.14 (Air = 1) Liquid Density@BP: 7.8 lb/ft<sup>3</sup> (125 kg/m<sup>3</sup>)
- Specific Volume (ft<sup>3</sup>/lb)** : 96.1538
- Gas Density (lb/ft<sup>3</sup>)** : 0.0104

## Section 10. Stability and reactivity

- Stability and reactivity** : The product is stable.
- Hazardous decomposition products** : Under normal conditions of storage and use, hazardous decomposition products should not be produced.
- Hazardous polymerization** : Under normal conditions of storage and use, hazardous polymerization will not occur.

## Section 11. Toxicological information

### Toxicity data

- Other toxic effects on humans** : No specific information is available in our database regarding the other toxic effects of this material to humans.
- Specific effects**
- Carcinogenic effects** : No known significant effects or critical hazards.
- Mutagenic effects** : No known significant effects or critical hazards.
- Reproduction toxicity** : No known significant effects or critical hazards.

## Section 12. Ecological information

### Aquatic ecotoxicity

Not available.

**Environmental fate** : Not available.

**Environmental hazards** : No known significant effects or critical hazards.

**Toxicity to the environment** : Not available.

## Section 13. Disposal considerations

Product removed from the cylinder must be disposed of in accordance with appropriate Federal, State, local regulation. Return cylinders with residual product to Airgas, Inc. Do not dispose of locally.

## Section 14. Transport information

Regulatory information	UN number	Proper shipping name	Class	Packing group	Label	Additional information
<b>DOT Classification</b>	UN1046	HELIUM, COMPRESSED	2.2	Not applicable (gas).		<b>Limited quantity</b> Yes.
	UN1963	Helium, refrigerated liquid				<b>Packaging instruction</b> <b>Passenger aircraft</b> Quantity limitation: 75 kg <b>Cargo aircraft</b> Quantity limitation: 150 kg
<b>TDG Classification</b>	UN1046	HELIUM, COMPRESSED	2.2	Not applicable (gas).		<b>Explosive Limit and Limited Quantity Index</b> 0.125
	UN1963	Helium, refrigerated liquid				<b>Passenger Carrying Road or Rail Index</b> 75
<b>Mexico Classification</b>	UN1046	HELIUM, COMPRESSED	2.2	Not applicable (gas).		-
	UN1963	Helium, refrigerated liquid				

“Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product.”

## Section 15. Regulatory information

### United States

- U.S. Federal regulations** :
- United States inventory (TSCA 8b):** This material is listed or exempted.
  - SARA 302/304/311/312 extremely hazardous substances:** No products were found.
  - SARA 302/304 emergency planning and notification:** No products were found.
  - SARA 302/304/311/312 hazardous chemicals:** helium
  - SARA 311/312 MSDS distribution - chemical inventory - hazard identification:** helium: Sudden release of pressure
  - Clean Water Act (CWA) 307:** No products were found.
  - Clean Water Act (CWA) 311:** No products were found.

**Clean Air Act (CAA) 112 regulated flammable substances:** No products were found.  
**Clean Air Act (CAA) 112 regulated toxic substances:** No products were found.

### State regulations

- :
- Connecticut Carcinogen Reporting:** This material is not listed.
  - Connecticut Hazardous Material Survey:** This material is not listed.
  - Florida substances:** This material is not listed.
  - Illinois Chemical Safety Act:** This material is not listed.
  - Illinois Toxic Substances Disclosure to Employee Act:** This material is not listed.
  - Louisiana Reporting:** This material is not listed.
  - Louisiana Spill:** This material is not listed.
  - Massachusetts Spill:** This material is not listed.
  - Massachusetts Substances:** This material is listed.
  - Michigan Critical Material:** This material is not listed.
  - Minnesota Hazardous Substances:** This material is not listed.
  - New Jersey Hazardous Substances:** This material is listed.
  - New Jersey Spill:** This material is not listed.
  - New Jersey Toxic Catastrophe Prevention Act:** This material is not listed.
  - New York Acutely Hazardous Substances:** This material is not listed.
  - New York Toxic Chemical Release Reporting:** This material is not listed.
  - Pennsylvania RTK Hazardous Substances:** This material is listed.
  - Rhode Island Hazardous Substances:** This material is not listed.

### Canada

- WHMIS (Canada)** :
- Class A: Compressed gas.
  - CEPA Toxic substances:** This material is not listed.
  - Canadian ARET:** This material is not listed.
  - Canadian NPRI:** This material is not listed.
  - Alberta Designated Substances:** This material is not listed.
  - Ontario Designated Substances:** This material is not listed.
  - Quebec Designated Substances:** This material is not listed.

## Section 16. Other information

### United States

#### Label requirements

- :
- GAS:**
    - CONTENTS UNDER PRESURE.
    - Do not puncture or incinerate container.
    - Can cause rapid suffocation.
    - May cause severe frostbite.
  - LIQUID:**
    - Extremely cold liquid and gas under pressure.
    - Can cause rapid suffocation.
    - May cause severe frostbite.

### Canada

#### Label requirements

- :
- Class A: Compressed gas.

**Helium**

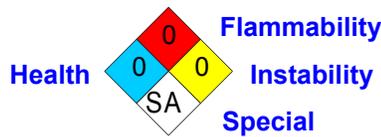
**Hazardous Material Information System (U.S.A.)**

Health	1
Flammability	0
Physical hazards	0

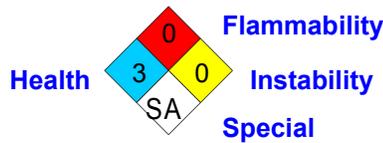
**liquid:**

Health	3
Fire hazard	0
Reactivity	0
Personal protection	

**National Fire Protection Association (U.S.A.)**



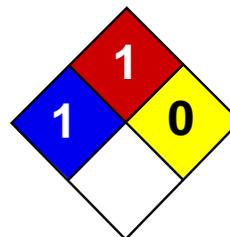
**liquid:**



**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.



Health	1
Fire	1
Reactivity	0
Personal Protection	E

## Material Safety Data Sheet Graphite MSDS

### Section 1: Chemical Product and Company Identification

**Product Name:** Graphite

**Catalog Codes:** SLG2131

**CAS#:** 7782-42-5

**RTECS:** MD9659600

**TSCA:** TSCA 8(b) inventory: Graphite

**CI#:** Not available.

**Synonym:**

**Chemical Name:** Graphite

**Chemical Formula:** C

**Contact Information:**

**Sciencelab.com, Inc.**

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: [ScienceLab.com](http://ScienceLab.com)

**CHEMTREC (24HR Emergency Telephone), call:**

1-800-424-9300

**International CHEMTREC, call:** 1-703-527-3887

**For non-emergency assistance, call:** 1-281-441-4400

### Section 2: Composition and Information on Ingredients

**Composition:**

Name	CAS #	% by Weight
Graphite	7782-42-5	100

**Toxicological Data on Ingredients:** Graphite LD50: Not available. LC50: Not available.

### Section 3: Hazards Identification

**Potential Acute Health Effects:** Slightly hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation.

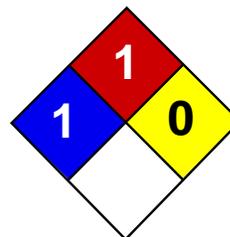
**Potential Chronic Health Effects:**

CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to upper respiratory tract. The substance may be toxic to cardiovascular system. Repeated or prolonged exposure to the substance can produce target organs damage.

### Section 4: First Aid Measures

**Eye Contact:**

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.



Health	1
Fire	1
Reactivity	0
Personal Protection	E

## Material Safety Data Sheet Graphite MSDS

### Section 1: Chemical Product and Company Identification

**Product Name:** Graphite

**Catalog Codes:** SLG2131

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**Composition:**

Name	CAS #	% by Weight
Graphite	7782-42-5	100

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**Potential Chronic Health Effects:**

CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to upper respiratory tract. The substance may be toxic to cardiovascular system. Repeated or prolonged exposure to the substance can produce target organs damage.

### Section 4: First Aid Measures

**Eye Contact:**

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

**Skin Contact:** Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

**Serious Skin Contact:** Not available.

**Inhalation:**

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

**Serious Inhalation:** Not available.

**Ingestion:**

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

**Serious Ingestion:** Not available.

## Section 5: Fire and Explosion Data

**Flammability of the Product:** May be combustible at high temperature.

**Auto-Ignition Temperature:** Not available.

**Flash Points:** CLOSED CUP: Higher than 93.3°C (200°F).

**Flammable Limits:** Not available.

**Products of Combustion:** Not available.

**Fire Hazards in Presence of Various Substances:** Slightly flammable to flammable in presence of open flames and sparks, of heat, of oxidizing materials.

**Explosion Hazards in Presence of Various Substances:**

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available. Slightly explosive in presence of moisture.

**Fire Fighting Media and Instructions:**

SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

**Special Remarks on Fire Hazards:**

It will ignite on contact with chlorine trifluoride and fluorine. Graphite dust may ignite on contact with air. May re-ignite after fire is extinguished.

**Special Remarks on Explosion Hazards:** Material in powder form, capable of creating an explosion on contact with water.

## Section 6: Accidental Release Measures

**Small Spill:**

Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

**Large Spill:**

Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

## Section 7: Handling and Storage

**Precautions:**

Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not breathe dust. Keep away from incompatibles such as oxidizing agents.

**Storage:** Keep container tightly closed. Keep container in a cool, well-ventilated area. Do not store above 23°C (73.4°F).

## Section 8: Exposure Controls/Personal Protection

### Engineering Controls:

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

**Personal Protection:** Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

### Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

### Exposure Limits:

TWA: 2 (mg/m<sup>3</sup>) from ACGIH (TLV) [United States] [1999] Inhalation Respirable. TWA: 3 (mg/m<sup>3</sup>) [Australia] Inhalation TWA: 2.5 (mg/m<sup>3</sup>) from NIOSH Inhalation Respirable. TWA: 2.5 (mg/m<sup>3</sup>) from OSHA (PEL) [United States] Inhalation Respirable. TWA: 10 [United Kingdom (UK)] Inhalation Total. TWA: 4 [United Kingdom (UK)] Respirable. Consult local authorities for acceptable exposure limits.

## Section 9: Physical and Chemical Properties

**Physical state and appearance:** Solid. (Crystalline solid.)

**Odor:** Odorless.

**Taste:** Tasteless.

**Molecular Weight:** 12.01 g/mole

**Color:** Black

**pH (1% soln/water):** Not applicable.

**Boiling Point:** Not available.

**Melting Point:** 3650°C (6602°F)

**Critical Temperature:** 681°C (1257.8°F)

**Specific Gravity:** 2.25 (Water = 1)

**Vapor Pressure:** Not applicable.

**Vapor Density:** Not available.

**Volatility:** Not available.

**Odor Threshold:** Not available.

**Water/Oil Dist. Coeff.:** Not available.

**Ionicity (in Water):** Not available.

**Dispersion Properties:** Not available.

**Solubility:** Insoluble in cold water.

## Section 10: Stability and Reactivity Data

**Stability:** The product is stable.

**Instability Temperature:** Not available.

**Conditions of Instability:** Excess heat, incompatible materials.

**Incompatibility with various substances:** Highly reactive with oxidizing agents.

**Corrosivity:** Non-corrosive in presence of glass.

**Special Remarks on Reactivity:**

Reacts vigorously with liquid potassium, and potassium peroxide. If graphite contacts liquid potassium, rubidium or caesium at 300 C, intercalation compounds may be formed.

**Special Remarks on Corrosivity:** Not available.

**Polymerization:** Will not occur.

## Section 11: Toxicological Information

**Routes of Entry:** Inhalation. Ingestion.

**Toxicity to Animals:**

LD50: Not available. LC50: Not available.

**Chronic Effects on Humans:**

Causes damage to the following organs: upper respiratory tract. May cause damage to the following organs: cardiovascular system.

**Other Toxic Effects on Humans:** Slightly hazardous in case of skin contact (irritant), of ingestion, of inhalation.

**Special Remarks on Toxicity to Animals:** Not available.

**Special Remarks on Chronic Effects on Humans:** Not available.

**Special Remarks on other Toxic Effects on Humans:**

Nuisance dust. Acute Potential Health Effects: Skin: Causes skin irritation. Eyes: Dust causes eye irritation. Inhalation: May be harmful if inhaled. Dust causes respiratory tract and mucous membrane irritation. Ingestion: May be harmful if swallowed. May cause gastrointestinal (digestive) tract irritation with nausea and vomiting. Chronic Potential Health Effects: Inhalation of high concentrations of graphite dust over prolonged periods of time may cause pneumoconiosis. Symptoms can include cough, shortness of breath, and decrease of pulmonary function. Preexisting pulmonary disorders such as emphysema may possibly be aggravated by prolonged exposure to high concentrations of graphite dust. This toxicology of this substance has not been fully investigated.

## Section 12: Ecological Information

**Ecotoxicity:** Not available.

**BOD5 and COD:** Not available.

**Products of Biodegradation:**

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

**Toxicity of the Products of Biodegradation:** The product itself and its products of degradation are not toxic.

**Special Remarks on the Products of Biodegradation:** Not available.

## Section 13: Disposal Considerations

**Waste Disposal:**

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

### Section 14: Transport Information

**DOT Classification:** Not a DOT controlled material (United States).

**Identification:** Not applicable.

**Special Provisions for Transport:** Not applicable.

### Section 15: Other Regulatory Information

**Federal and State Regulations:**

Rhode Island RTK hazardous substances: Graphite Pennsylvania RTK: Graphite Minnesota: Graphite Massachusetts RTK: Graphite Tennessee: Graphite TSCA 8(b) inventory: Graphite

**Other Regulations:** EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

**Other Classifications:**

**WHMIS (Canada):** CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

**DSCL (EEC):**

This product is not classified according to the EU regulations. Not applicable.

**HMIS (U.S.A.):**

**Health Hazard:** 1

**Fire Hazard:** 1

**Reactivity:** 0

**Personal Protection:** E

**National Fire Protection Association (U.S.A.):**

**Health:** 1

**Flammability:** 1

**Reactivity:** 0

**Specific hazard:**

**Protective Equipment:**

Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Safety glasses.

### Section 16: Other Information

**References:** Not available.

**Other Special Considerations:** Not available.

**Created:** 10/09/2005 05:40 PM

**Last Updated:** 05/21/2013 12:00 PM

*The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall ScienceLab.com be liable for any claims, losses, or damages of any third party or for*

*lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if ScienceLab.com has been advised of the possibility of such damages.*



# Material Safety Data Sheet

**Mirachem<sup>®</sup> 500** Cleaner/Degreaser

(Formulation No. 2500)

## Section I - Chemical Product and Company Identification

Manufacturer Name: The Mirachem Corporation  
P.O. Box 14059  
Phoenix, Arizona 85063-4059  
Date Prepared: 9/24/93  
Revision Date: 4/10/12

Emergency Phone: 1-(800) 847-3527

## Section II - Composition/Information on Ingredients

<u>Hazardous Components</u>	<u>CAS Number</u>	<u>OSHA PEL</u>	<u>ACGIH TLV</u>	<u>Other Limits</u>	<u>% by wt.</u>
None	N/A	N/A	N/A	N/A	N/A

N/A = Not Applicable      N.E. = Not Established

## Section III - Hazards Identification

Emergency Overview: Clear, non-flammable, water based cleaner with a light citrus odor.

Potential Health Effects:

Eye Contact: May cause mild temporary irritation.  
Skin Contact: Prolonged or repeated exposure may cause mild irritation.  
Inhalation: No adverse effects expected.  
Ingestion: No adverse health effects are anticipated to occur as a result of acute ingestion. Chronic effects are not known.

Carcinogenicity: None of the components in this material are listed by IARC, NTP, OSHA, or ACGIH as a carcinogen.

Signs/Symptoms of Overexposure: Prolonged contact may cause mild irritation or dryness to sensitive skin.  
Medical Conditions Generally Aggravated by Exposure: None known.

## Section IV - First Aid Measures

Eyes: Immediately flush with clean water. Consult physician if necessary.  
Skin: Rinse with water.  
Ingestion: If swallowed, treat symptomatically and supportively. Do not induce vomiting. If victim conscious and alert, give two glasses of water or milk to drink. If vomiting occurs, keep head below hips to prevent aspiration. Contact Physician.  
Inhalation: No adverse effects anticipated.

## Section V - Fire and Explosion Hazard

Flash Point (Method Used): >212°F (PMCC, nonflammable)      Explosive Limits: N/A  
Extinguishing Media: N/A      Autoignition Temperature: N/A  
Special Fire Fighting Procedures: N/A      Unusual Fire Fighting and Explosion Hazards: N/A

## Section VI - Accidental Release

Small Spills: Flush with water into containing area or to sewer where applicable within Federal, State or Local disposal requirements.  
Large Spills: Dike and pump into suitable containers, clean up residual with absorbent material and wash with water. Dispose of in accordance with Federal, State or Local disposal requirements.

## Section VII - Handling & Storage

Handling & Storage: Wear protective goggles or face shield if splashing or spraying liquid. Protect from freezing.  
Precautions:  
Other Precautions: Keep container tightly closed. Keep out of reach of children.

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**Section VIII - Exposure Controls, Personal Protection**

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Respiratory Protection: No respiratory protection is necessary.  
Ventilation: Good general ventilation is sufficient.  
Protective Clothing: When prolonged skin contact is expected, wear protective gloves (nitrile, vinyl or latex of 4 mil thickness or greater).  
Eye Protection: Wear safety glasses.  
Work/Hygienic Practices: Use good personal hygiene practices, wash hands before eating, drinking, smoking, or using toilet facilities.

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**Section IX - Physical/Chemical Characteristics**

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Boiling Point:	>212°F	Specific Gravity (H <sub>2</sub> O = 1):	0.997
Vapor Pressure, mm Hg @ 20°C	0.0018	pH:	8.7-9.5
(absolute, calculated) @ 37°C	0.0021	Evaporation Rate (Butyl Acetate = 1):	> 1
Vapor Density (AIR =1):	> 1	Freezing Point, °F:	32
Solubility in Water:	Complete	VOC undiluted *	80 g/l (0.67 lbs/gal)
Appearance and Odor:	Clear liquid with a mild citrus odor	2:1 dilution	25 g/l (0.21 lbs/gal)

\* The VOC in this product has a vapor pressure of less than 0.1 mm Hg. Under many jurisdictions, this is classified as low vapor pressure VOC. This material is not listed as a "Hazardous Air Pollutant (HAP)" under the Clean Air Act (CAA) list of volatile or organic hazardous air pollutants.

N/A = Not Applicable

N.E. = Not Established

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**Section X - Stability & Reactivity**

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Stability:	Unstable Stable	X	Incompatibility (Materials to Avoid):	Strong Acids and Alkalies demulsify product.
Hazardous Decomposition or By-products:	Thermal decomposition may produce CO <sub>2</sub>			
Hazardous Polymerization:	May Occur		Will Not Occur	X

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**Section XI - Toxicological Information**

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Acute Oral:	LD <sub>50</sub> > 13.0 g/kg
Acute Dermal:	LD <sub>50</sub> > 5.0 g/kg
Primary Eye Irritation	No evidence of corrosion. All corneal involvement or irritation cleared within 72 hours.
Primary Skin Irritation	Primary Irritation Index (PII) = 2.6 based on erythema and edema . No corrosion was found.

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**Section XII - Ecological Information**

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Aerobic Aquatic Biodegradation (EPA Method 796.3100)	The percentage biodegradation in 28 days was 85.8%.
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**Section XIII - Disposal Considerations**

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Waste Disposal: (Unused Material) Flush uncontaminated material to sewer where applicable within Federal, State or Local disposal requirements.

Note: Chemical additions to, processing of, or otherwise altering this material may make this waste management information incomplete, inaccurate, or otherwise inappropriate. Furthermore, State and local waste disposal requirements may be more restrictive or otherwise different from Federal laws and regulations.

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**Section XIV - Transportation Information**

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D.O.T Shipping Name:	Not Regulated	D.O.T Hazard Class:	None
UN Shipping Name:	N/A	UN/NA Number:	N/A
UN Class or Division	N/A	UN Packing Group:	None
NMFC Freight Class	Compound, Cleaning Fluid, NOI 48580 Sub 3		

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**Section XV - US Regulatory Information**

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Notice: The information herein is presented in good faith and believed to be accurate as of the effective date shown above. However, no warrantee, express or implied is given. Regulatory requirements are subject to change and may differ from one location to another; it is the buyer's responsibility to ensure that its activities comply with federal, state, and local laws. The following specific information is made for the purpose of complying with numerous federal, state, and local laws and regulations.

Mirachem 500 Cleaner/Degreaser  
Formulation No. 2500

Revision Date: 04/10/12  
Page 2 of 4

Federal Regulations:

Workplace Classification	This product is considered non-hazardous under the OSHA Hazard Communication Standard (29CFR 1910.1200)			
SARA Title III				
Section 311/312	This product is not a hazardous chemical under 29CFR 1910.1200, and therefore is not covered by Title III of SARA.			
Section 313	This product does not contain a chemical, which is listed in Section 313 at or <u>above de minimis</u> concentrations.			
CERCLA Information (40CFR 302.4)	Releases of this product to air, land, or water are not reportable to the National Response Center under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) or to state and local emergency planning committees under the Superfund Amendments and Reauthorization Act (SARA) Title III Section 304.			
Waste Classification	When a decision is made to discard unused portions of this product, it does not meet RCRA's characteristic definition of ignitability, corrosivity, or reactivity, and none of the materials used in this product are listed in 40 CFR 261.33. The toxicity characteristic (TC), however, has not been evaluated by the Toxicity Characteristic Leaching Procedure (TCLP).  Note: Chemical additions to, processing of, or otherwise altering this material may make this waste management information incomplete, inaccurate, or otherwise inappropriate. Furthermore, State and local waste disposal requirements may be more restrictive or otherwise different from Federal laws and regulations.			
TSCA	All components of this product are in compliance with the inventory listing requirements of the U.S. Toxic Substances Control Act.			
NFPA Ratings	Health = 1	Flammability = 0	Reactivity = 0	Special = 0
NPCA-HMIS Ratings	Health = 1	Flammability = 0	Reactivity = 0	Protective Equipment = None

State Regulations:

Arizona

Maricopa County Under the definitions of Rule 331, this product is considered a Low-VOC Cleaner.

California

California Safe Drinking Water and Toxic Enforcement - Prop. 65 This product does not contain any materials currently listed by California as chemicals known to cause cancer or known to have reproductive toxicity under Proposition 65.

Volatile Organic Compounds (VOC) The VOC content of this product is 80 grams/Liter (0.67 pounds/gallon) with a composite partial pressure at 20°C of less than 1 mm Hg.

BAAQMD This product meets the requirements of the Bay Area Air Quality Management District Regulation 8, Rule 16 when used at a 1:1 dilution with water. The VOC content at this dilution is 40 grams/Liter (0.33 pounds/gallon) with a composite partial pressure at 20°C of less than 1 mm Hg.

SCAQMD This product, when used at normal use dilutions of 2:1 or greater is certified by the South Coast Air Quality Management District as a Clean Air Solvent (CAS). The VOC content at a 2:1 dilution as determined by SCAQMD is 25 g/L (0.21 lbs./gal.) with a composite partial pressure at 20°C of less than 1 mm Hg.

Georgia

Rule 391-3-02 At use dilution, this product is greater than 80% water which qualifies this as an "Aqueous Cleaning Solvent". As an "Aqueous Cleaning Solvent" this product is exempt from Rule 391-3-02.

Michigan

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Rule R 336.1281 & R 336.1212	The absolute (composite) vapor pressure of this product in either concentrated or diluted form is less than 0.1 mm Hg under standard conditions. Part (e) under R 336.1281 exempts this product from the requirement for a "Permit to Install". The vapor pressure for this product exempts it from the recordkeeping requirements of R 366.1212 as indicated in Part (3)(b) and clarified by MDEQ interoffice communication of July 5, 2011.
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Texas

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Texas Rule 106.454 – Degreasing Units	Under this rule, Mirachem 500 is classified as a zero VOC product. The true vapor pressure is calculated to be < 0.6 pounds per square inch, absolute (psia) at an operating temperature of 100°F. This product meets the requirements of section (2)(C) for a remote reservoir cleaner and as such Section (1)(A) (i) and (ii) do not apply. Completion of Form PI-7 and monthly record keeping is not required.
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Section XVI - International Regulatory Information

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Notice: The information herein is presented in good faith and believed to be accurate as of the effective date shown above. However, no warrantee, express or implied is given. Regulatory requirements are subject to change and may differ from one location to another; it is the buyer's responsibility to ensure that its activities comply with their federal, state/province, and local laws. The following specific information is made for the purpose of complying with numerous specific foreign regulations.

Australia	This product is not classified as hazardous according to criteria of Worksafe Australia. Mirachem has reviewed Australia's List of Hazardous Substances and Australia's Standard of the Uniform Scheduling of Drugs and Poisons and determined that no ingredient in this product is listed in either listing. We have also verified with NICNAS at the Australian National Occupational Health & Safety Commission (NOHSC) that all of the components in this formulation are listed in the Australian Inventory of Chemical Substances (AICS) and that no notification will be necessary under the Industrial Chemicals (Notification and Assessment) Act 1989.
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Canada	Non-controlled under WHMIS. All of the components in this product are listed in the Canadian "Domestic Substances List" (DSL).
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European Union	All materials in this formulation are listed in the "European Inventory of Existing Commercial Chemical Substances" (EINECS). This product is not a hazardous preparation according to the EC-Directive 88/379/EEC.
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Korea	All materials in this formulation are listed in the Korean "Existing Chemicals List" (ECL). No material in this product is made from animal by-products.
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Philippines	All materials in this formulation are listed in the "Philippines Inventory of Chemicals and Chemical Substances" (PICCS).
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Japan	All materials in this formulation are listed in Japan's Inventory of "Existing and New Chemical Substances" (ENCS). This product meets the requirements of the Chemical Substance Control Law (MITI)
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China	All materials in this formulation are listed in China's "Inventory of Existing Chemical Substances in China" (IECSC).
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# MATERIAL SAFETY DATA SHEET

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## SECTION 01 – CHEMICAL PRODUCT AND COMPANY IDENTIFICATION:

**Chemical Name:** REFRACTORY CEMENT  
**Manufacturer:** Kel Kem Ltd.  
#3 – 1333 Cornwall Road  
Oakville, Ontario L6J 7T5  
Tel: (905) 829-5888  
Fax: (905) 829-3247  
Canutec 24 Hour Emergency Tel: (613)-996-6666 (Collect)  
**Date:** April 1, 2011  
**Prepared by:** Gerry van Konynenburg  
**WHMIS Classification:** D2A, D2B  
**Product Use:** Cement Compound  
**Product Code(s):** KK0307

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## SECTION 02 – COMPOSITION / INFORMATION ON INGREDIENTS:

<u>Ingredients</u>	<u>CAS No.</u>	<u>%</u>	<u>OSHA PEL</u>	<u>ACGIH TLV</u>
Calcium Metasilicate	13983-17-0	1.0 – 5.0	n/a	n/a
Silica, Quartz	14808-60-7	0.1 – 1.0	0.1 mg/m <sup>3</sup>	0.05 mg/m <sup>3</sup>
Hydrous Aluminum Silicate	1332-58-7	30.0 – 60.0	n/a	n/a
Sodium Silicate	1344-09-8	40.0 – 70.0	n/a	5 mg/m <sup>3</sup>
Sodium Hydroxide	1310-73-2	1.0 – 5.0	2 mg/m <sup>3</sup>	2 mg/m <sup>3</sup>

The ingredients listed above are controlled products as defined in CPR, am. SOR/88-555 or 29 CFR 1910.1200

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## SECTION 03 – HAZARDS IDENTIFICATION:

### ROUTES OF ENTRY INTO THE BODY (ACUTE EFFECTS):

**Eyes:** Direct contact may cause severe irritation. Symptoms may include watering, itching and burning.  
**Skin:** May cause severe irritation including itching and inflammation.  
**Inhalation:** Upper respiratory tract irritation.  
**Ingestion:** Gastrointestinal irritation. Symptoms may include abdominal pain, nausea, diarrhea and vomiting.

### WHMIS HAZARD SYMBOL(S):



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## SECTION 04 - FIRST AID MEASURES:

**Eyes:** Flush with copious quantities of lukewarm water. Do not attempt to physically remove the solids from the eye. Seek medical attention immediately.  
**Skin:** Remove contaminated clothing. Wash thoroughly with warm water and non-abrasive soap. Seek medical attention if you feel ill or a reaction develops.  
**Inhalation:** Remove to fresh air and provide water. Seek medical attention if you feel ill or a reaction develops.  
**Ingestion:** Do not induce vomiting. Provide water and get immediate medical attention.

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## SECTION 05 - FIRE FIGHTING MEASURES:

**Flammable Conditions:** Not applicable  
**Extinguishing Media:** Not applicable  
**Fire Fighting Measures:** Not applicable  
**Flash Point:** Not applicable

Flammability Limits:	Lower Explosion Limit - not applicable Upper Explosion Limit - not applicable
Autoignition Temperature:	Not applicable
Hazardous Decomposition Products:	Not applicable
Sensitivity - Impact:	None
Static:	None

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**SECTION 06 – ACCIDENTAL RELEASE MEASURES:**

Containment / Clean Up:	Restrict access to the area of the spill. Provide ventilation and protective clothing. Scrape up compound and place in container for disposal. Local, state, provincial, federal laws and regulations may apply to releases and disposal of this material, as well as those materials and items employed in the cleanup.
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**SECTION 07 – HANDLING AND STORAGE:**

Handling and Storage:	Store in an adequately ventilated area under dry conditions between 50°F (10°C) to 77°F (25°C) and keep container tightly sealed when not in use.
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**SECTION 08 – EXPOSURE CONTROL / PERSONAL PROTECTION:**

Component Exposure Limits:	See Section 2.
Respiratory:	Respiratory protection to be provided.
Ventilation:	In indoor applications, passive ventilation (opening of doors and windows) is recommended. Local exhaust as necessary to keep exposure levels within guidelines.
Personal Protective Equipment:	Safety glasses with side-protection, impermeable gloves (e.g., neoprene, nitrile, silver shield (R)), coveralls or apron are important in preventing contamination of eyes, skin and clothing. Wash thoroughly after handling.

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**SECTION 09 - PHYSICAL AND CHEMICAL PROPERTIES:**

Physical State:	Paste
Odor and Appearance:	Odorless, buff-coloured paste
Odor Threshold:	Not available
Specific Gravity:	1.8
Vapor Pressure:	Not available
Vapor Density:	Not available
Evaporation Rate:	Not available
Boiling Point:	100°C (212°F) due to water component
Freezing Point:	Not available
pH:	Not available
Coeff. Oil/Water Distribution:	Not available

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**SECTION 10 – STABILITY AND REACTIVITY:**

Chemical Stability:	Stable
Incompatible Materials:	Not available
Reactive Conditions:	Not available
Hazardous Polymerization:	Will not occur

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**SECTION 11 - TOXICOLOGICAL INFORMATION:**

Effects of overexposure:	Acute hazards are to eyes and skin if contacted. The silica in this product is totally encapsulated and thus present no inhalation danger to the user.
Sensitization:	Not Known
Carcinogenicity:	Respirable quartz silica from occupational sources is listed by IARC as a human carcinogen.
Reproductive Toxicity:	Not known
Teratogenicity:	Not known
Mutagenicity:	Not known
Synergistic Products:	Not known

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**SECTION 12 – ECOLOGICAL INFORMATION:**

Air:	Complete information is not yet available.
Water:	Complete information is not yet available.

Soil: Complete information is not yet available.

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**SECTION 13 – DISPOSAL CONSIDERATIONS:**

Waste Disposal: Dispose in accordance with Federal, State / Provincial and local regulations.

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**SECTION 14 - TRANSPORT INFORMATION:**

Shipping Information: Not subject to DOT, TDG, IMDG Code or IATA Regulations.

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**SECTION 15 - REGULATORY INFORMATION:**

TSCA Inventory Status: Chemical components listed on TSCA inventory except as exempted.  
NFPA Profile: Health 2, Flammability 0, Reactivity 0  
SARA TITLE III Chemical Listings: **Section 302 Extremely Hazardous Substances:** None  
**Section 304 CERCLA Hazardous Substances:** This product contains the following toxic chemicals which are subject to reporting: 1.2% by weight Caustic Soda (CAS# 01310-73-3).  
**Section 312 Hazard Class:** Acute: Yes; Chronic: No; Fire: No; Pressure: No; Reactive: No  
**Section 313 Toxic Chemicals:** This product contains the following toxic chemicals which are subject to reporting: 1.2% by weight Caustic Soda (CAS# 01310-73-3).  
State Substance List: This product contains a listed substance(s) that appears on one or more of the Substance Lists for Pennsylvania, Massachusetts and New Jersey: sodium hydroxide (CAS# 01310-73-2); sodium silicate (CAS# 01344-09-8); calcium metasilicate (CAS#13983-17-0); hydrous aluminum silicate (CAS# 1332-58-7); and silica, quartz (CAS# 14808-60-7).  
California Proposition 65 List: None known  
Volatile Organic Content: None  
WHMIS Classification: D2A, D2B  
Domestic Substance List: Chemical components listed on DSL except as exempted.

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**SECTION 16 - OTHER INFORMATION:**

The information is provided in good faith and is correct to the best of Kel Kem Ltd.'s knowledge as of the date hereof and is designed to assist our customers; however Kel Kem Ltd. Makes no representation as to its completeness or accuracy. Final determination of suitability of any material is the sole responsibility of the user. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.  
Kel Kem Ltd. Disclaims all expressed or implied warranties or representations.