Energy Storage For a Better World

July 7, 2023

West Virginia Department of Environmental Protection
Division of Air Quality
601 57th Street, SE
Charleston, WV 25304

Via email: *DEPAirQualityPermitting@wv.gov*

Re: Construction Air Permit Application
Form Energy, Inc.
1725 Main Street
Weirton, WV 26062

To Whom it May Concern,

Please find enclosed the air permit construction application for the Form Energy, Inc (Form Energy) facility located at 1725 Main Street, Weirton, West Virginia 26062. The air permit construction application reflects proposed facility operations. The air permit construction application was based on the information provided by the facility.

The proposed Form Energy facility will operate as an iron-air battery production facility. The proposed facility will begin construction in 2023 with operation beginning in 2024. Because of the timeframe of proposed operation beginning in 2024, equipment specifications have not been selected for all emissions unit equipment listed in the attached application. Potential-to-emit calculations and the attached air permit construction application were created using the maximum ratings of future equipment needed for the production process and maximum potential throughputs. The air permit construction application and operating air permit application will be updated with equipment specifications as soon as equipment is selected. The facility plans to use control equipment to maintain emissions below major source.

The proposed facility operations are first-of-its-kind and proprietary. Previously these operations have been tested at a pilot-plant level and this facility in Weirton, WV will scale-up the operations. The Phase 1 and 2 facility in this application plans to operate for ~5 years, with adjustments, to test the scale-up of the operations. In the future, after the facility in this application has operated for ~5 years, a Phase 3 - 500MW facility is anticipated to be built adjacent to the west of the Phase 1 and 2 - 5MW and 50MW facility. See Attachment E – Phase 1&2 include the 5MW and 50MW facilities in this application and Phase 3 shows the anticipated future 500MW facility.

Energy Storage For a Better World

If you have any questions regarding this plan, please call at (412)-522-0299.

Sincerely,
Form Energy, Inc.

Thank you.

Matthew E. Caprarese, P.E.
Sr. Engineering Manager, Factory
1725 Main Street
Weirton, WV 26062

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Table of Contents

Attachment M: Air Pollution Control Device Sheet(s)

Attachment N: Supporting Emissions Calculations

Attachment O: Monitoring/Recordkeeping/Reporting/Testing Plans

Attachment P: Public Notice

Attachment Q: Business Confidential Claims

Application Fee

WEST VIRGINIA DEPARTMENT OF ENVIRONMENTAL PROTECTION

DIVISION OF AIR QUALITY

601 57th Street, SE
Charleston, WV 25304
(304) 926-0475
www.dep.wv.gov/daq

APPLICATION FOR NSR PERMIT AND TITLE V PERMIT REVISION (OPTIONAL)

PLEASE CHECK ALL THAT APPLY TO **NSR (45CSR13)** (IF KNOWN):

☒ **CONSTRUCTION** ☐ **MODIFICATION** ☐ **RELOCATION**
☐ **CLASS I ADMINISTRATIVE UPDATE** ☐ **TEMPORARY**
☐ **CLASS II ADMINISTRATIVE UPDATE** ☐ **AFTER-THE-FACT**

PLEASE CHECK TYPE OF **45CSR30 (TITLE V)** REVISION (IF ANY):

☐ **ADMINISTRATIVE AMENDMENT** ☐ **MINOR MODIFICATION**
☐ **SIGNIFICANT MODIFICATION**

IF ANY BOX ABOVE IS CHECKED, INCLUDE TITLE V REVISION INFORMATION AS **ATTACHMENT S** TO THIS APPLICATION

FOR TITLE V FACILITIES ONLY: Please refer to "Title V Revision Guidance" in order to determine your Title V Revision options (Appendix A, "Title V Permit Revision Flowchart") and ability to operate with the changes requested in this Permit Application.

Section I. General

1. Name of applicant *(as registered with the WV Secretary of State's Office):*
Form Energy, Inc.

2. Federal Employer ID No. ***(FEIN):***
82-2266384

3. Name of facility *(if different from above):*
Form Energy, Inc.

4. The applicant is the:
☐ **OWNER** ☐ **OPERATOR** ☒ **BOTH**

5A. Applicant's mailing address:
1725 Main Street
Weirton, WV 26062

5B. Facility's present physical address:
1725 Main Street
Weirton, WV 26062

6. **West Virginia Business Registration.** Is the applicant a resident of the State of West Virginia? ☐ **YES** ☒ **NO**
- If **YES,** provide a copy of the **Certificate of Incorporation/Organization/Limited Partnership** (one page) including any name change amendments or other Business Registration Certificate as **Attachment A.**
- If **NO,** provide a copy of the **Certificate of Authority/Authority of L.L.C./Registration** (one page) including any name change amendments or other Business Certificate as **Attachment A.**

7. If applicant is a subsidiary corporation, please provide the name of parent corporation:

8. Does the applicant own, lease, have an option to buy or otherwise have control of the *proposed site?* ☒ **YES** ☐ **NO**
- If **YES,** please explain: Lease with West Virginia Development Authority / Business Development Corporation of Northern Panhandle of West Virginia
- If **NO,** you are not eligible for a permit for this source.

9. Type of plant or facility (stationary source) to be **constructed, modified, relocated, administratively updated** or **temporarily permitted** (e.g., coal preparation plant, primary crusher, etc.): Iron-air battery production plant.

10. North American Industry Classification System **(NAICS)** code for the facility:
335910

11A. DAQ Plant ID No. (for existing facilities only):
–

11B. List all current 45CSR13 and 45CSR30 (Title V) permit numbers associated with this process (for existing facilities only):

All of the required forms and additional information can be found under the Permitting Section of DAQ's website, or requested by phone.

12A.

- For **Modifications, Administrative Updates** or **Temporary permits** at an existing facility, please provide directions to the *present location* of the facility from the nearest state road;
- For **Construction** or **Relocation permits,** please provide directions to the *proposed new site location* from the nearest state road. Include a **MAP** as **Attachment B.**

12.B. New site address (if applicable):	12C. Nearest city or town:	12D. County:
1725 Main Street Weirton, WV 26062	Weirton, WV	Hancock
12.E. UTM Northing (KM): 4474479	12F. UTM Easting (KM): 465439	12G. UTM Zone: 44

13. Briefly describe the proposed change(s) at the facility:
N/A

14A. Provide the date of anticipated installation or change: December 2023 – If this is an **After-The-Fact** permit application, provide the date upon which the proposed change did happen: / /	14B. Date of anticipated Start-Up if a permit is granted: March 2024

14C. Provide a **Schedule** of the planned **Installation** of/**Change** to and **Start-Up** of each of the units proposed in this permit application as **Attachment C** (if more than one unit is involved).

15. Provide maximum projected **Operating Schedule** of activity/activities outlined in this application:
Hours Per Day 24 Days Per Week 7 Weeks Per Year 52

16. Is demolition or physical renovation at an existing facility involved? ☒ **YES** ☐ **NO**

17. **Risk Management Plans.** If this facility is subject to 112(r) of the 1990 CAAA, or will become subject due to proposed changes (for applicability help see www.epa.gov/ceppo), submit your **Risk Management Plan (RMP)** to U. S. EPA Region III.

18. **Regulatory Discussion.** List all Federal and State air pollution control regulations that you believe are applicable to the proposed process *(if known).* A list of possible applicable requirements is also included in Attachment S of this application (Title V Permit Revision Information). Discuss applicability and proposed demonstration(s) of compliance *(if known).* Provide this information as **Attachment D.**

Section II. Additional attachments and supporting documents.

19. Include a check payable to WVDEP – Division of Air Quality with the appropriate **application fee** (per 45CSR22 and 45CSR13).

20. Include a **Table of Contents** as the first page of your application package.

21. Provide a **Plot Plan,** e.g. scaled map(s) and/or sketch(es) showing the location of the property on which the stationary source(s) is or is to be located as **Attachment E** (Refer to ***Plot Plan Guidance***) **.**

– Indicate the location of the nearest occupied structure (e.g. church, school, business, residence).

22. Provide a **Detailed Process Flow Diagram(s)** showing each proposed or modified emissions unit, emission point and control device as **Attachment F.**

23. Provide a **Process Description** as **Attachment G.**

– Also describe and quantify to the extent possible all changes made to the facility since the last permit review (if applicable).

All of the required forms and additional information can be found under the Permitting Section of DAQ's website, or requested by phone.

24. Provide **Material Safety Data Sheets (MSDS)** for all materials processed, used or produced as **Attachment H.**

– For chemical processes, provide a MSDS for each compound emitted to the air.

25. Fill out the **Emission Units Table** and provide it as **Attachment I.**

26. Fill out the **Emission Points Data Summary Sheet (Table 1 and Table 2)** and provide it as **Attachment J.**

27. Fill out the **Fugitive Emissions Data Summary Sheet** and provide it as **Attachment K.**

28. Check all applicable **Emissions Unit Data Sheets** listed below:

☐ Bulk Liquid Transfer Operations	☐ Haul Road Emissions	☐ Quarry
☐ Chemical Processes	☐ Hot Mix Asphalt Plant	☐ Solid Materials Sizing, Handling and Storage Facilities
☐ Concrete Batch Plant	☐ Incinerator	☒ Storage Tanks
☐ Grey Iron and Steel Foundry	☐ Indirect Heat Exchanger	

☒ General Emission Unit, specify FUGITIVE EMISSIONS FROM AMBIENT REFRIGERANTS

Fill out and provide the **Emissions Unit Data Sheet(s)** as **Attachment L.**

29. Check all applicable **Air Pollution Control Device Sheets** listed below:

☐ Absorption Systems	☐ Baghouse	☐ Flare
☐ Adsorption Systems	☐ Condenser	☐ Mechanical Collector
☐ Afterburner	☐ Electrostatic Precipitator	☐ Wet Collecting System

☒ Other Collectors, specify two (2) Regenerative Thermal Oxidizers (RTO) and Two (2) Cartridge Dust Collectors

Fill out and provide the **Air Pollution Control Device Sheet(s)** as **Attachment M.**

30. Provide all **Supporting Emissions Calculations** as **Attachment N,** or attach the calculations directly to the forms listed in Items 28 through 31.

31. **Monitoring, Recordkeeping, Reporting and Testing Plans.** Attach proposed monitoring, recordkeeping, reporting and testing plans in order to demonstrate compliance with the proposed emissions limits and operating parameters in this permit application. Provide this information as **Attachment O.**

➢ Please be aware that all permits must be practically enforceable whether or not the applicant chooses to propose such measures. Additionally, the DAQ may not be able to accept all measures proposed by the applicant. If none of these plans are proposed by the applicant, DAQ will develop such plans and include them in the permit.

32. **Public Notice.** At the time that the application is submitted, place a **Class I Legal Advertisement** in a newspaper of general circulation in the area where the source is or will be located (See 45CSR§13-8.3 through 45CSR§13-8.5 and ***Example Legal Advertisement*** for details). Please submit the **Affidavit of Publication** as **Attachment P** immediately upon receipt.

33. **Business Confidentiality Claims.** Does this application include confidential information (per 45CSR31)?

☒ **YES** ☐ **NO**

➢ If **YES,** identify each segment of information on each page that is submitted as confidential and provide justification for each segment claimed confidential, including the criteria under 45CSR§31-4.1, and in accordance with the DAQ's *"**Precautionary Notice – Claims of Confidentiality"*** guidance found in the ***General Instructions*** as **Attachment Q.**

Section III. Certification of Information

34. **Authority/Delegation of Authority.** Only required when someone other than the responsible official signs the application. Check applicable **Authority Form** below:

☐ Authority of Corporation or Other Business Entity	☐ Authority of Partnership
☐ Authority of Governmental Agency	☐ Authority of Limited Partnership

Submit completed and signed **Authority Form** as **Attachment R.**

All of the required forms and additional information can be found under the Permitting Section of DAQ's website, or requested by phone.

35A. **Certification of Information.** To certify this permit application, a Responsible Official (per 45CSR§13-2.22 and 45CSR§30-2.28) or Authorized Representative shall check the appropriate box and sign below.

Certification of Truth, Accuracy, and Completeness

I, the undersigned ☒ **Responsible Official** / ☐ **Authorized Representative,** hereby certify that all information contained in this application and any supporting documents appended hereto, is true, accurate, and complete based on information and belief after reasonable inquiry I further agree to assume responsibility for the construction, modification and/or relocation and operation of the stationary source described herein in accordance with this application and any amendments thereto, as well as the Department of Environmental Protection, Division of Air Quality permit issued in accordance with this application, along with all applicable rules and regulations of the West Virginia Division of Air Quality and W.Va. Code § 22-5-1 et seq. (State Air Pollution Control Act). If the business or agency changes its Responsible Official or Authorized Representative, the Director of the Division of Air Quality will be notified in writing within 30 days of the official change.

Compliance Certification

Except for requirements identified in the Title V Application for which compliance is not achieved, I, the undersigned hereby certify that, based on information and belief formed after reasonable inquiry, all air contaminant sources identified in this application are in compliance with all applicable requirements.

SIGNATURE Soufiane Halily DATE: July 7, 2023

35B. Printed name of signee: Soufiane Halily		35C. Title: Vice President
35D. E-mail: shalily@formenergy.com	36E. Phone: 281.650.8877	36F. FAX: NA
36A. Printed name of contact person (if different from above): Matthew Caprarese		36B. Title: Sr. Engineering Manager, Factory
36C. E-mail: mcaprarese@formenergy.com	36D. Phone: (412) 522-0299	36E. FAX: NA

PLEASE CHECK ALL APPLICABLE ATTACHMENTS INCLUDED WITH THIS PERMIT APPLICATION:

- ☒ **Attachment A: Business Certificate**
- ☒ **Attachment B: Map(s)**
- ☒ **Attachment C: Installation and Start Up Schedule**
- ☒ **Attachment D: Regulatory Discussion**
- ☒ **Attachment E: Plot Plan**
- ☒ **Attachment F: Detailed Process Flow Diagram(s)**
- ☒ **Attachment G: Process Description**
- ☒ **Attachment H: Material Safety Data Sheets (MSDS)**
- ☒ **Attachment I: Emission Units Table**
- ☒ **Attachment J: Emission Points Data Summary Sheet**
- ☒ **Attachment K: Fugitive Emissions Data Summary Sheet**
- ☒ **Attachment L: Emissions Unit Data Sheet(s)**
- ☒ **Attachment M: Air Pollution Control Device Sheet(s)**
- ☒ **Attachment N: Supporting Emissions Calculations**
- ☒ **Attachment O: Monitoring/Recordkeeping/Reporting/Testing Plans**
- ☒ **Attachment P: Public Notice**
- ☒ **Attachment Q: Business Confidential Claims**
- ☐ **Attachment R: Authority Forms**
- ☐ **Attachment S: Title V Permit Revision Information**
- ☒ **Application Fee**

Please mail an original and three (3) copies of the complete permit application with the signature(s) to the DAQ, Permitting Section, at the address listed on the first page of this application. Please DO NOT fax permit applications.

FOR AGENCY USE ONLY – IF THIS IS A TITLE V SOURCE:

- ☐ ***Forward 1 copy of the application to the Title V Permitting Group and:***
- ☐ ***For Title V Administrative Amendments:***
  - ☐ ***NSR permit writer should notify Title V permit writer of draft permit,***
- ☐ ***For Title V Minor Modifications:***
  - ☐ ***Title V permit writer should send appropriate notification to EPA and affected states within 5 days of receipt,***
  - ☐ ***NSR permit writer should notify Title V permit writer of draft permit.***
- ☐ ***For Title V Significant Modifications processed in parallel with NSR Permit revision:***
  - ☐ ***NSR permit writer should notify a Title V permit writer of draft permit,***
  - ☐ ***Public notice should reference both 45CSR13 and Title V permits,***
  - ☐ ***EPA has 45 day review period of a draft permit.***

All of the required forms and additional information can be found under the Permitting Section of DAQ's website, or requested by phone.

Attachment A:

Business Certificate

State of West Virginia

Certificate

I, Mac Warner, Secretary of State,
of the State of West Virginia, hereby certify that

FORM ENERGY, INC.

has filed the appropriate registration documents in my office according to the provisions of the West Virginia Code and hereby declare the organization listed above as duly registered with the Secretary of State's Office.

Given under my hand and
the Great Seal of West Virginia
on this day of
January 17, 2023

Mac Warner

Secretary of State

State of West Virginia

Certificate

I, Mac Warner, Secretary of State of the State of West Virginia, hereby certify that

FORM ENERGY, INC.

a corporation formed under the laws of Delaware filed an application to be registered as a foreign corporation authorizing it to transact business in West Virginia. The application was found to conform to law and a "Certificate of Authority" was issued by the West Virginia Secretary of State on January 13, 2023.

I further certify that the corporation has not been revoked by the State of West Virginia nor has a Certificate of Withdrawal been issued to the corporation by the West Virginia Secretary of State.

Accordingly, I hereby issue this Certificate of Authorization

CERTIFICATE OF AUTHORIZATION

Validation ID:4WV68_XF446

Given under my hand and the Great Seal of the State of West Virginia on this day of

June 14, 2023

Mac Warner

Secretary of State

Attachment B:

Map(s)

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

Project Manager:	LRB
Drawn by:	LKS
Checked by:	LRB
Approved by:	LRB

Project No.	N4227337
Scale:	AS SHOWN
File Name:	N4227337
Date:	02/2023

Terracon
800 Morrison Rd
Gahanna, OH 43230-6643

SITE DIAGRAM

Haskell - Form Energy Air Permitting
1725 Main Street
Weirton, WV

Attachment
B

Attachment C:

Installation and Start Up Schedule

ATTACHMENT C

INSTALLATION AND STARTUP SCHEDULE

This permit application is for the installation of a new iron air battery manufacturing facility at the location in Weirton, West Virginia. Installation will occur in three phases. Phase 1 and 2 will begin simultaneously, to install the 5MW and 50MW facilities on the site. Phase 3 will begin within 5 years after production has begun for Phase 1 and 2 and will include a scaleup of the facility to 500MW. Installation of equipment for Phase 1 and 2 will commence upon issuance of the permit and it is anticipated that it will take approximately four months to install the equipment with startup occurring shortly thereafter. Installation of the Phase 1 and 2 equipment is anticipated to begin in December of 2023 with startup anticipated to begin in March of 2024. Phase 3 equipment and scaleup is anticipated to begin in March of 2029, subject to change.

Attachment D:

Regulatory Discussion

ATTACHMENT D

REGULATORY DISCUSSION

The facility is required to comply with the requirements contained in the applicable provisions of the following regulations.

- 45CSR7 – "To Prevent and Control Particulate Matter Air Pollution from Manufacturing Processes and Associated Operations"

  Sets state imposed opacity and particulate matter mass emission standards for the chemical process and the natural gas fired units. The facility must maintain compliance with the most stringent limit between the state rule, federal rule and source specific permit conditions. The chemical processes are controlled by dust collectors and scrubbers which act to provide compliance with the rule. The gas fired units burn natural gas and will comply with the rule based on the fuel combusted.

- 45CSR10 – "To Prevent and Control Air Pollution from the Emission of Sulfur Oxides"

  Sets state imposed sulfur dioxide mass emission standard for fuel burning units, such as the furnaces, ovens, and heaters. The facility must maintain compliance with the most stringent limit between the state rule, federal rule and source specific permit conditions. The furnaces, ovens, and heaters burn natural gas and will comply with the rule based on the fuel combusted.

- 45CSR13 – "Permits for Construction, Modification, Relocation and Operation of

  Stationary Sources of Air Pollutants, Notification Requirements, Temporary Permits, General Permits, and Procedures for Evaluation".

  This rule establishes criteria for permitting construction of stationary sources of air pollution, including all sources at the Form Energy facility included in this application.

- 45CSR16 – "Standards of performance for new stationary sources"

  This rule establishes standards of performance for new stationary sources of air pollution.

- 45CSR17 – "To prevent and control particulate matter air pollution from materials handling, preparation, storage and other sources of fugitives particulate matter"

  This rule establishes standards for particulate matter air pollutant sources, including the powders used in the Form Energy process and the natural-gas fired equipment used in the process.

- 45CSR21 – "Regulation to prevent and control air pollution from the emission of volatile organic compounds."

This rule establishes standards for volatile organic compound air pollutant sources, including the solvents used in the Form Energy process and the natural-gas fired equipment used in the process.

- 45CSR22 – "Air Quality Management Fee Program"

  This program established fees to be paid to the state. This facility is a non-Title V source and will pay fees under Regulation 22.

- 45CSR30 – "Requirements for operating permits"

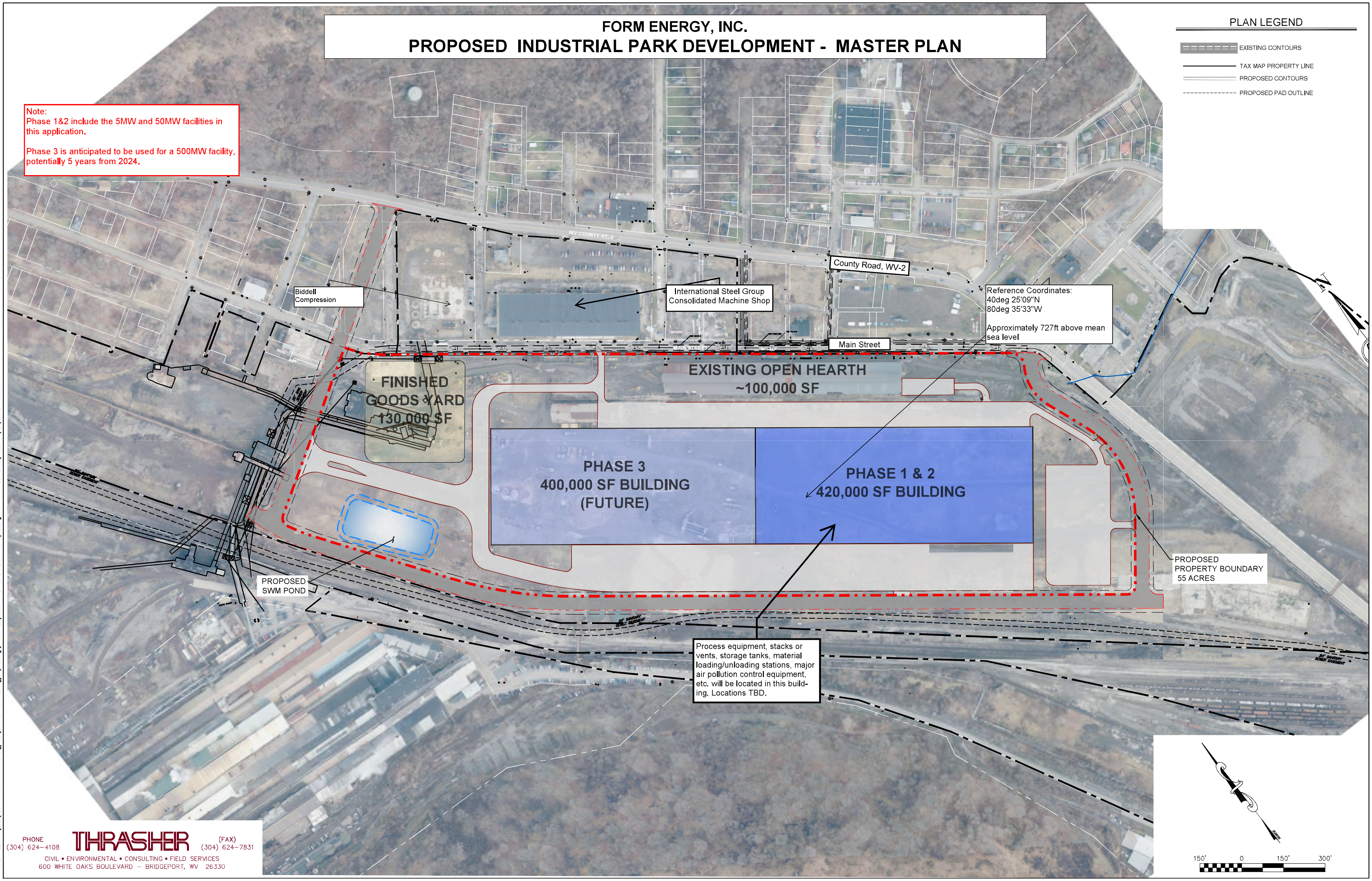
  The facility is a non-Title V source and is not required to pay fees or obtain a permit under this regulation.

- 45CSR31 – "Confidential information."

  This rule establishes criteria for confidential information, including the proprietary process related information in the Form Energy process.

Attachment E:

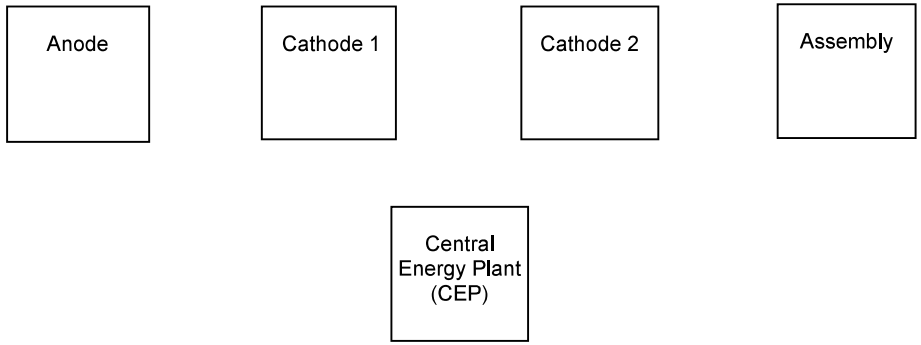
Plot Plan



CAD FILE: R:\030\T30-11159.00-Form Energy L3\L4 Site-Form Energy-\Drawing\Infraworks\Master--C1-SITE PLAN-TTO-opt2.dwg PLOT DATE/TIME: 1/26/2023 11:55 AM

Attachment F:

Detailed Process Flow Diagram(s)



Form energy

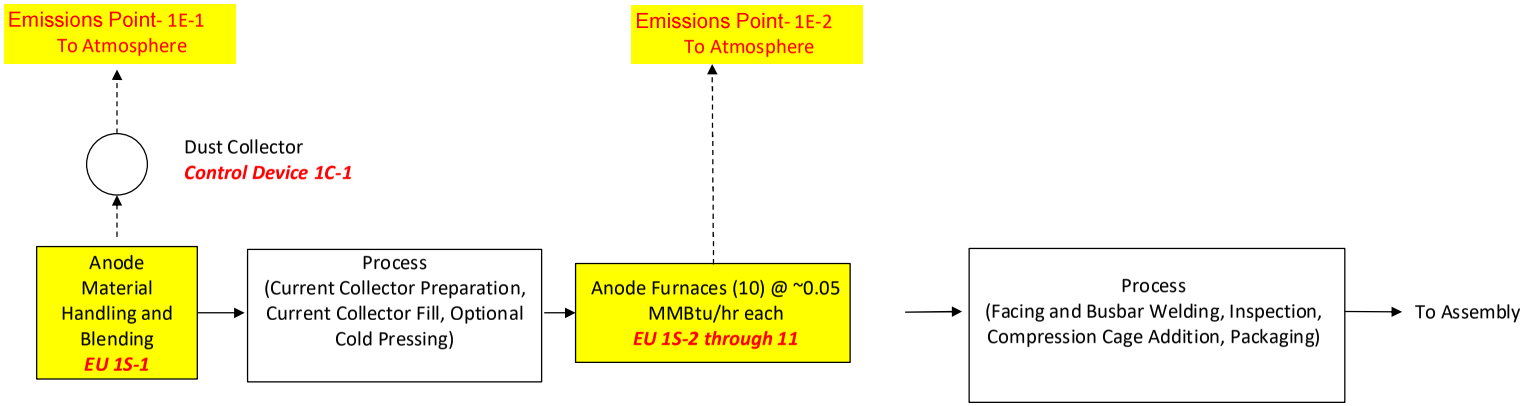
Form Energy, Inc.
Process Flow Diagram
Factory 1 - Weirton, WV

Figure 1
Plant Wide

DATE: 07/02/2023

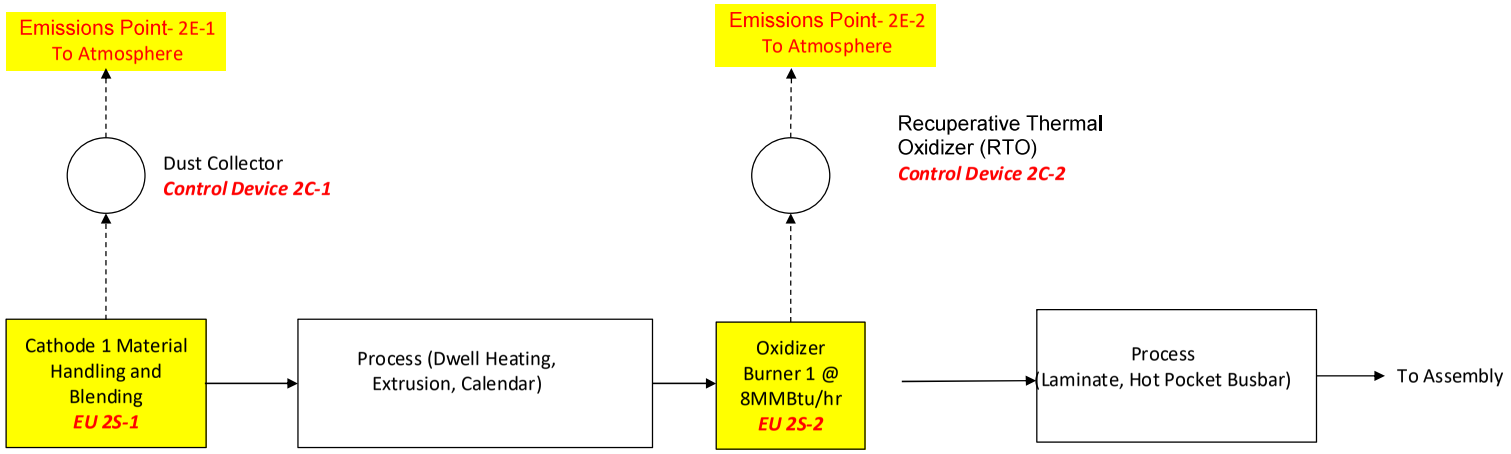
DRAWN BY: MEC

Anode Process Line



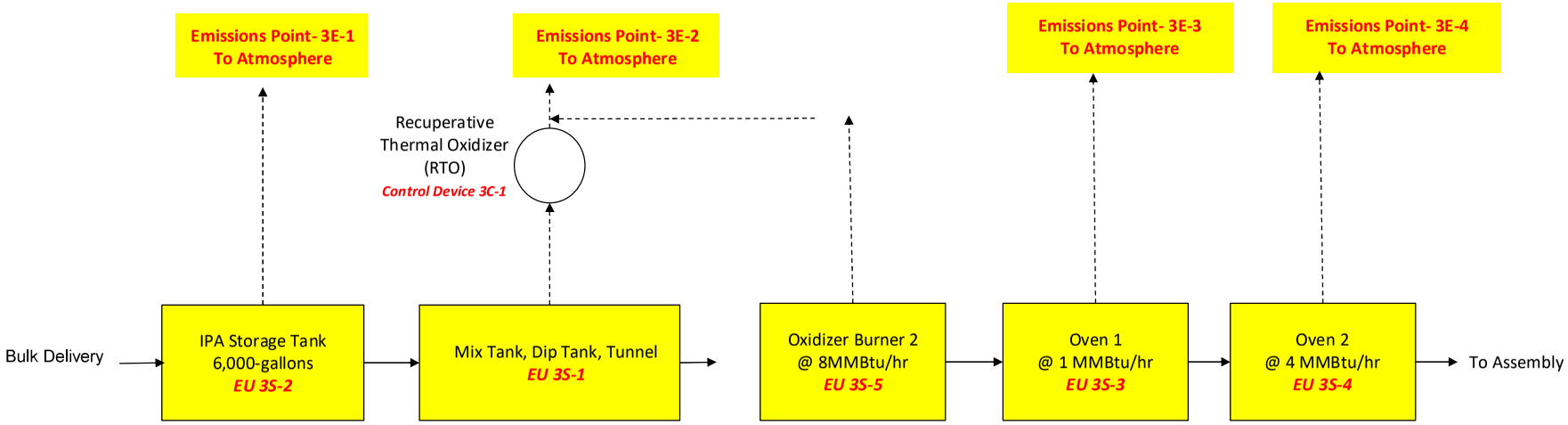
Form energy	**Form Energy, Inc.** **Process Flow Diagram** **Factory 1 - Weirton, WV**	**Figure 2** **Anode Processing**	DATE: 07/02/2023 DRAWN BY: MEC

Cathode 1 Process Line



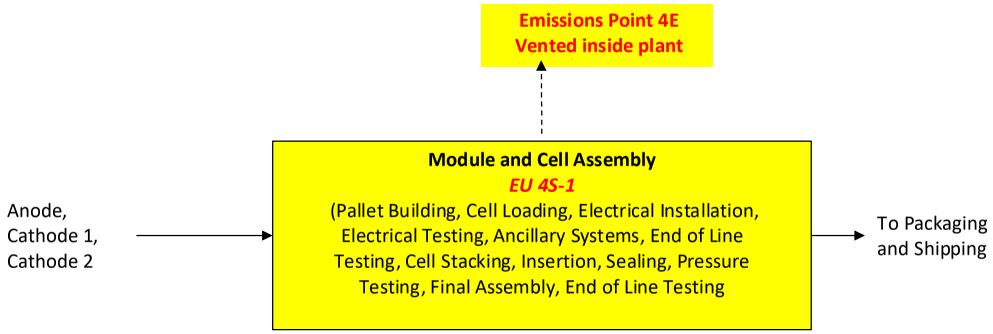
Form energy	**Form Energy, Inc.** **Process Flow Diagram** **Factory 1 - Weirton, WV**	**Figure 3** **GDE Processing**	DATE: 07/02/2023 DRAWN BY: MEC

Cathode 2 Process Line



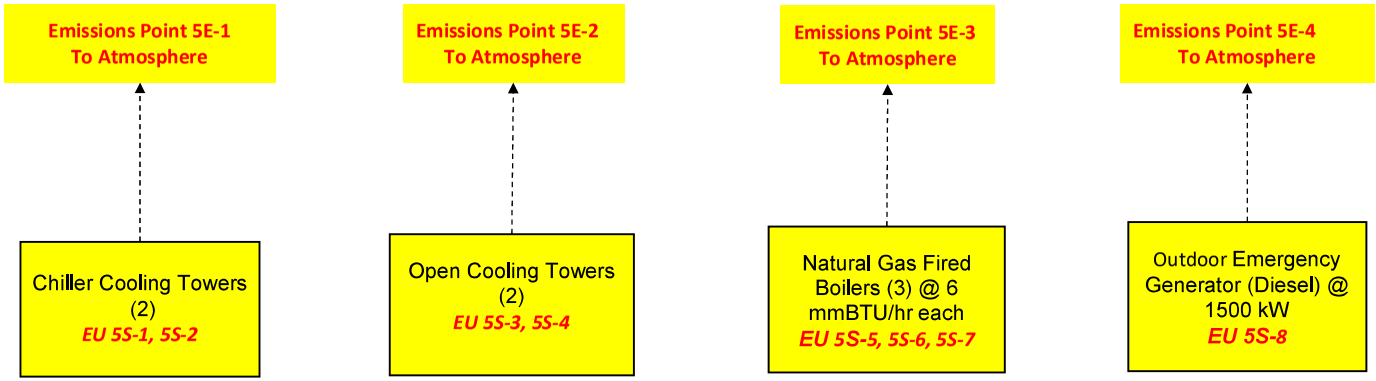
Form energy	**Form Energy, Inc.** **Process Flow Diagram** **Factory 1 - Weirton, WV**	**Figure 4** **OEE Processing**	DATE: 07/02/2023 DRAWN BY: MEC

Assembly Process Line



Form energy	**Form Energy, Inc.** **Process Flow Diagram** **Factory 1 - Weirton, WV**	**Figure 5** **Assembly**	DATE: 07/02/2023 DRAWN BY: MEC

Central Energy Plant (CEP)



Form energy	**Form Energy, Inc.** **Process Flow Diagram** **Factory 1 - Weirton, WV**	**Figure 6** **CEP**	DATE: 07/02/2023 DRAWN BY: MEC

Attachment G:

Process Description

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ATTACHMENT G

PROCESS DESCRIPTION

The proposed facility will produce iron-air batteries. Each individual battery module is about the size of a side-by-side washer/dryer set and contains a stack of approximately 50 one meter-tall cells. The cells include iron and air electrodes, the parts of the battery that enable the electrochemical reactions to store and discharge electricity. Each of these cells are filled with water-based, non-flammable electrolyte. Using a principle called "reverse rusting," the cells "breathe" in air, which transforms the iron into iron oxide and produces energy. Iron-air batteries could solve some of the lithium energy storage limitations. Lithium-ion batteries expand energy over only a short period of time and the compound lithium is not readily available, and can explode. Iron-air batteries are less expensive to create and last longer with no risk of thermal runaway, no heavy metals, and high recyclability.

The iron-air batteries are produced in four stages: anode, cathode 1, cathode 2, and assembly.

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Attachment H:

Material Safety Data Sheets (MSDS)

Binder 1.2 - [redacted]
Binder 3.1 - [redacted]
Carbon Black
- Carbon 1
- Carbon 2
- Carbon 4
- Carbon 5

Catalyst 4 – [redacted]
Fiber 1 – [redacted]
Isopropyl Alcohol 99%
[redacted]
Isopar L Fluid
Rhino 3155 Hardener
Polyalphaolefin Oil
[redacted]
Form Oil

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[redacted]

Version 6.0

Revision Date 07/19/2011 Ref. 150000002329

This SDS adheres to the standards and regulatory requirements of the United States and may not meet the regulatory requirements in other countries.

SECTION 1. PRODUCT AND COMPANY IDENTIFICATION

Product name : [redacted]
Product Grade/Type : K10, CFP 6000, CFP 6000-N, CFP614A,
6-J, 6C, 6C-J, 6C-N, 6C-N X
60, 62, 62-N, 62-N X, 62-J, 62XT, 62XT X,65, 65-A, 65-N, 67, 68, TE3979, TE3981
600A, 601A, 602A, 603, 604J, 605 XT, 610A, 612A, 613A, 615, 636-N, 637-N, 640-J, 640XT, 669, 669-N
TE3905, TE3907, TE3911, TE3912, TE3963, TE3964, TE3967, TE3971, TE3972, TE5402, TE3989

MSDS Number : 150000002329

Product Use : Resin for moulding and/or extrusion

Manufacturer : DuPont
1007 Market Street
Wilmington, DE 19898

Product Information : 1-800-441-7515 (outside the U.S. 1-302-774-1000)
Medical Emergency : 1-800-441-3637 (outside the U.S. 1-302-774-1139)
Transport Emergency : CHEMTREC: 1-800-424-9300 (outside the U.S. 1-703-527-3887)

SECTION 2. HAZARDS IDENTIFICATION

Potential Health Effects

Skin [redacted] : Dust may cause: Discomfort, itching, redness, or swelling.

Eyes [redacted] : Dust may cause: tearing, Redness, Discomfort.

Inhalation

Polytetrafluoroethylene : Dust may cause: Respiratory tract irritation
The thermal decomposition vapours of fluorinated polymers may cause polymer fume fever with flu-like symptoms in humans, especially when smoking contaminated tobacco.
Symptoms usually appear after several hours and resolve within 1 to 2 days.
Repeated episodes of polymer fume fever may result in persistent lung effects.
Polymer may extensively decompose if severely overheated or burned.
Inhalation of fluorinated decomposition products may cause lung irritation and pulmonary oedema.
Symptoms may be delayed for several hours.
Symptoms may be severe or life-threatening.

Carcinogenicity
None of the components present in this material at concentrations equal to or greater than 0.1% are listed by IARC, NTP, or OSHA, as a carcinogen.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Component	CAS-No.	Concentration
[redacted]	[redacted]	100 %

SECTION 4. FIRST AID MEASURES

Skin contact : No hazards which require special first aid measures. Wash off with soap and water. Cool skin rapidly with cold water after contact with molten material. Do not peel polymer from the skin. Consult a physician.

Eye contact : Hold eye open and rinse slowly and gently with water for 15-20 minutes. Get medical attention immediately.

Inhalation : Move to fresh air in case of accidental inhalation of fumes from overheating or combustion. Consult a physician.

Ingestion	:	Not a probable route of exposure. However, in case of accidental ingestion, call a physician.

SECTION 5. FIREFIGHTING MEASURES

Flammable Properties

Flash point	:	not applicable
Ignition temperature	:	530 - 550 °C (986 - 1,022 °F) Method : ASTM D 1929
Autoignition temperature	:	520 - 560 °C (968 - 1,040 °F) Method: ASTM D 1929
Fire and Explosion Hazard	:	Hazardous thermal decomposition products: acid fluorides Fluorinated compounds Hydrogen fluoride Carbon monoxide
Suitable extinguishing media	:	Carbon dioxide (CO2), Dry powder, Foam, Water
Firefighting Instructions	:	In the event of fire, wear self-contained breathing apparatus. Wear suitable protective equipment. Wear neoprene gloves during cleaning up work after a fire. Protect from hydrogen fluoride fumes which react with water to form hydrofluoric acid.

SECTION 6. ACCIDENTAL RELEASE MEASURES

NOTE: Review FIRE FIGHTING MEASURES and HANDLING (PERSONNEL) sections before proceeding with clean-up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean-up.

Safeguards (Personnel)	:	Ventilate the area. Refer to protective measures listed in sections 7 and 8. Material can create slippery conditions.
Spill Cleanup	:	Sweep up and shovel into suitable containers for disposal. Clean contaminated floors and objects thoroughly while observing environmental regulations.

Accidental Release Measures : No special environmental precautions required.

SECTION 7. HANDLING AND STORAGE

Handling (Personnel) : For personal protection see section 8. Protect from contamination. When opening containers, avoid breathing vapours that may be emanating. Avoid breathing dust. Avoid contamination of cigarettes or tobacco with dust from this material. Provide appropriate exhaust ventilation at dryers, machinery and at places where dust or volatiles can be generated. In case of insufficient ventilation, wear suitable respiratory equipment. Do not use a torch to clean this material from equipment without local exhaust ventilation and respirator. Wash hands and face before breaks and immediately after handling the product.

Handling (Physical Aspects) : Take necessary action to avoid static electricity discharge (which might cause ignition of organic vapours).

Storage : Keep container tightly closed in a dry and well-ventilated place. Protect from contamination.
Stable under recommended storage conditions.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering controls : Ensure adequate ventilation, especially in confined areas. Good general ventilation should be provided to keep dust concentrations below the exposure limits. Local exhaust ventilation should be employed to minimize airborne contamination.

Personal protective equipment

Respiratory protection : When workers are facing concentrations above the exposure limit they must use appropriate certified respirators.

Hand protection : Additional protection: Protective gloves (Type : Kevlar® - heat resistant, use possible until worn out)

Eye protection : Safety glasses with side-shields

Skin and body protection : When handling hot material, use heat resistant gloves.
If there is a potential for contact with hot/molten material wear heat resistant clothing and footwear.
Regular cleaning of equipment, work area and clothing.

Exposure Guidelines

Exposure Limit Values

PTFE Fine Powder

Dust (inhalable and respirable fraction)

TLV	(ACGIH)	10 mg/m3 TWA Inhalable particles.	
		3 mg/m3 TWA Respirable particles.	
PEL:	(OSHA)	5 mg/m3 TWA Respirable fraction.	
		Remarks	All inert or nuisance dusts, whether mineral, inorganic, or organic, not listed specifically by substance name are covered by the Particulates Not Otherwise Regulated (PNOR) limit which is the same as the inert or nuisance dust limit of Table Z-3.
		15 mg/m3 TWA Total dust.	

Polytetrafluoroethylene

AEL *	(DUPONT)	10 mg/m3	8 hr. TWA Total dust.
AEL *	(DUPONT)	5 mg/m3	8 hr. TWA Respirable dust.

* AEL is DuPont's Acceptable Exposure Limit. Where governmentally imposed occupational exposure limits which are lower than the AEL are in effect, such limits shall take precedence.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Form : powder

Color	:	white
Odor	:	none
pH	:	not applicable
Melting point/range	:	327 - 342 °C (621 - 648 °F)
% Volatile	:	0 %
Vapour Pressure	:	not applicable
Density	:	2.14 - 2.24 g/cm3
Water solubility	:	insoluble
Limiting oxygen index	:	> 95 %

SECTION 10. STABILITY AND REACTIVITY

Stability	:	Stable under normal conditions.
Conditions to avoid	:	To avoid thermal decomposition, do not overheat. Abnormally long processing time or high temperatures can produce irritating and toxic fumes. Stable under normal conditions.
Incompatibility	:	Finely divided aluminium Powdered metals, potent oxidizers like fluorine (F2), and, related compounds, Contact with incompatible materials can cause fire and explosion.
Hazardous decomposition products	:	Hazardous thermal decomposition products:: Hydrogen fluoride, Carbonyl fluoride, acid fluorides
Hazardous reactions	:	During drying, cleaning and moulding, small amounts of hazardous gases and/or particulate matter may be released. These may irritate eyes, nose and throat. Large molten masses may give off hazardous gases.

SECTION 11. TOXICOLOGICAL INFORMATION

[redacted]

Inhalation : The thermal decomposition vapours of fluorinated polymers may cause polymer fume fever with flu-like symptoms in humans, especially when smoking contaminated tobacco.

[redacted]

Oral LD50	:	> 11,280 mg/kg , rat
Skin irritation	:	No skin irritation, rabbit No skin irritation, human
Skin sensitization	:	Patch test on human volunteers did not demonstrate sensitization properties., human
Repeated dose toxicity	:	Oral - feed rat No toxicologically significant effects were found.
Further information	:	The substance is a polymer and is not expected to produce toxic effects.

SECTION 12. ECOLOGICAL INFORMATION

Aquatic Toxicity

[redacted]

	:	The substance is a polymer and is not expected to produce toxic effects.
Additional ecological information	:	This product has no known eco-toxicological effects.

SECTION 13. DISPOSAL CONSIDERATIONS

Waste Disposal	:	Like most thermoplastic plastics the product can be recycled. If recycling is not practicable, dispose of in compliance with local regulations. Incinerate only if incinerator is capable of scrubbing out hydrogen fluoride and other acidic combustion products.
Environmental Hazards	:	Empty containers should be taken to an approved waste handling site for recycling or disposal.

SECTION 14. TRANSPORT INFORMATION

Not classified as dangerous in the meaning of transport regulations.

SECTION 15. REGULATORY INFORMATION

TSCA Status	:	On the inventory, or in compliance with the inventory
SARA 313 Regulated Chemical(s)	:	SARA 313: This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.
California Prop. 65	:	WARNING! This product contains a chemical known to the State of California to cause cancer.Tetrafluoroethylene
PA Right to Know Regulated Chemical(s)	:	Substances on the Pennsylvania Hazardous Substances List present at a concentration of 1% or more (0.01% for Special Hazardous Substances): Polytetrafluoroethylene

SECTION 16. OTHER INFORMATION

		NFPA
Health	:	2
Flammability	:	1
Reactivity/Physical hazard	:	0

Restrictions for use : Do not use DuPont materials in medical applications involving implantation in the human body or contact with internal body fluids or tissues unless the material has been provided from DuPont under a written contract that is consistent with DuPont policy regarding medical applications and expressly acknowledges the contemplated use. For further information, please contact your DuPont representative. You may also request a copy of the DuPont POLICY Regarding Medical Applications H-50103-3 and DuPont CAUTION Regarding Medical Applications H-50102-3.

Before use also read the following DuPont bulletin(s):
Fluoropolymer Safe Handling Guide published by the Society of the Plastics Industry.
For further information contact the local DuPont office or DuPont's nominated distributors.

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

Significant change from previous version is denoted with a double bar.

CLAIMED CONFIDENTIAL

MICRO POWDERS, INC.
580 WHITE PLAINS ROAD • TARRYTOWN, NY 10591
TEL 914-793-4058 • FAX 914-472-7098 • EMAIL mpi@micropowders.com

SAFETY DATA SHEET

SECTION 1 - Identification:

PRODUCT NAME [redacted]

SDS NUMBER: [redacted]

MANUFACTURER'S NAME: Micro Powders, Inc.
ADDRES : 580 White Plains Road
Tarrytown, NY 10591

CHEMTREC PHONE:	800-424-9300	DATE PRINTED:	8/15/2010
INFORMATION PHONE:	914-793-4058	NAME OF PREPARER:	Warren Pushaw

INTENDED USE: Additive for printing inks, paints and coatings to provide slip, mar and abrasion resistance properties.

SECTION 2 - Hazard identification:

HAZARD CLASSIFICATION: Not classified as hazardous.

EMERGENCY OVERVIEW

These products are micronized powders. Static charges on the powders may ignite flammable atmospheres. High levels of product dust in the atmosphere may present a dust explosion hazard.

(See Dust Hazard Reference in Section 16.)

No significant health hazard expected from exposure to products.

HMIS CODES: H F R P
1 1 0 E

INHALATION HEALTH RISKS AND SYMPTOMS OF EXPOSURE: Treat powder as a nuisance dust. Keep dust level below 5mg/m3 for respirable fraction and 10mg/m3 for total dust (ACGIH/TWA). OSHA PEL 5mg/m3. Exposure may cause dizziness, headache, respiratory irritation or unconsciousness.

EYE CONTACT HEALTH RISKS AND SYMPTOMS OF EXPOSURE: Particulates may cause mechanical eye irritation. Flush eyes with copious amounts of water for at least 15 minutes.

SKIN CONTACT HEALTH RISKS AND SYMPTOMS OF EXPOSURE: Negligible dermal irritant. Exposure may lead to itching, scaling, drying and irritation of skin.

INGESTION HEALTH RISKS AND SYMPTOMS OF EXPOSURE: Generally non toxic unless large quantities are ingested.

HEALTH HAZARDS (ACUTE & CHRONIC):

ACUTE EFFECTS: High concentrations of polymer fumes may cause eye, nose and respiratory irritation, dizziness or unconsciousness.

CHRONIC EFFECTS: Repeated skin contact can lead to drying, defatting, itching, stinging and irritation.

N.T.P. CARCINOGEN: No I.A.R.C. CARCINOGEN: No OSHA REGULATED: No

MEDICAL CONDITIONS GENERALLY AGGREVATED BY EXPOSURE: May irritate people with skin problems, asthma and lung diseases. Susceptible individuals may have an allergic reaction.

SECTION 3 - Composition/information on ingredients:

None of the components of this product are categorized as hazardous. Therefore, they do not need to be listed. If listed below, it is for informational purposes only. Confidential Business Information has been omitted by ruling of the competent authorities.

COMPONENTS

[redacted]

AVOID HIGH CONCENTRATIONS OF POLYMER FUMES WHEN MELTING.

SECTION 4 - First-aid measures:

IF IN EYES: Flush with copious amounts of water for at least 15 minutes. *IMMEDIATE MEDICAL ATTENTION IS NECESSARY.*

IF ON SKIN: If burned by hot wax, quench immediately with cold tap water. Dry burn area and loosely cover to protect against infection. Do not apply ointment or salves. *IMMEDIATE MEDICAL ATTENTION IS NECESSARY.*

For skin irritation, wash skin with soap and water and use emollient skin cream.

IF INHALED: Treat as a nuisance dust. Remove victim to fresh air and provide oxygen if breathing is difficult. Immediate medical attention not normally required. No delayed effects expected.

IF INGESTED: Not a normal or expected route of introduction. If large quantities are ingested - *IMMEDIATE MEDICAL ATTENTION IS NECESSARY.* Do not give anything to an unconscious person.

INSTRUCTION FOR PHYSICIANS:: No specific advice. Treat according to symptoms present.

SECTION 5 - Fire-fighting measures:

OSHA FLAMMABILITY CLASS : Combustible solid.

SUITABLE EXTINGUISHING MEDIA: Carbon Dioxide, dry chemical or fine water spray. Avoid water stream on molten burning material as it may scatter and spread the fire.

SPECIAL FIREFIGHTING PROCEDURES: Wear self-contained breathing apparatus and protective clothing approved by NIOSH. Watch footing on floors and stairs because of possible melting and spreading of material. Use spray to keep containers cool.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Flash point > 450 F >232 C. Melts in proximity to fires causing slippery floors and stairs. When powder is suspended in air, these products could be FLAMMABLE/EXPLOSIVE. In these circumstances, keep away from heat, sparks and open flames. Static charges on powders or powders in liquids may ignite flammable atmospheres. See Section 7 "HANDLING AND STORAGE" for suggestions on how to use these products under such conditions. Also refer to NFPA Bulletin 654, "Prevention of Fire and Dust Explosions in the Chemical, Dye, Pharmaceutical, and Plastics Industries", for safe handling procedures.

SECTION 6 - Accidental release measures:

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: Wear recommended personal protective equipment. Remove ignition sources. Sweep up with a minimum of dusting. Keep away from heat or flame. Collect in containers (e.g. fiberboard drums or cartons). If hot liquid, attempt to confine spill and let the polymer solidify. Once solid, it may be recovered as the powder. Report major leaks and spills to the appropriate local, state and federal government agencies.

HAZARD WARNING

These products are micronized powders. Static charges on the powders may ignite flammable atmospheres. High levels of product dust in the atmosphere may present a dust explosion hazard.

(See Dust Hazard Reference in Section 16. Read Section 7.)

See the Regulatory Information (Section #15) regarding reporting requirements.

SECTION 7 - Handling and storage:

SPECIAL HANDLING AND STORAGE: (Always wear recommended personal protective equipment.) Avoid breathing fumes from heating operations. Avoid spillage which can cause very slippery conditions on floors. Use good personal hygiene and housekeeping.

STATIC ELECTRICITY AND FINE PARTICLE SIZE WAXES

Electrostatic charges of non-conductive materials is a natural phenomenon ranging from harmless to a nuisance to a hazard, depending on the degree of charging and the environment where the discharge takes place. In the case of micronized polymers and waxes, very high levels of static electricity develop in their manufacture, transportation and handling. These products, being poor conductors of electricity, can and will hold a static charge for long periods of time. With this in mind, a great deal of care should be exercised when handling this type of product in or around flammable liquids, particularly if the liquid is at or near its flashpoint. The generation of static electricity cannot be prevented because its intrinsic origins are present at every particle interface. Some common sense approaches to the hazards involved with static electricity are as follows:

- Use only conductive equipment and keep all components grounded and bonded to the same vessel in order to equalize any potential charge.
- Avoid projections and probes that could lead to discharge between the charged polymer and probe.
- Avoid a flammable condition by the use of inert gases in the container or by providing sufficient exhaust so as to prevent a buildup of flammable solvent vapors.
- Never pour micronized polymers or waxes from a drum or large container directly into hot flammable solvents.
- Add micronized polymers or waxes slowly and in small quantities to hot flammable solvents.
- Do not permit the product to free fall directly into the solvent. Use a pipe or chute that leads down to the level of the solvent. Make sure the pipe or chute is grounded and bonded.
- If mechanical equipment must be used, a slow-turning screw feeder that is grounded and is preferred.
- Good housekeeping is of prime importance. The building and equipment should be designed to eliminate shelves and ledges and similar places where materials can accumulate.

The above are only suggestions and should not be taken as recommended practices in your establishment and in no way should be considered as comprehensive engineering controls. A more detailed discussion and recommended practices can be found in NFPA 77 issued by the National Fire Protection Association Inc. in 1988.

STORAGE RECOMMENDATIONS:
Avoid excessive heat. Do not store near strong oxidizing agents and amines.

SECTION 8 - Exposure controls/personal protection:

ENGINEERING CONTROLS:
Use adequate ventilation during heating processes or if dusty conditions prevail when handling powdered materials. For storage and ordinary handling, general ventilation is adequate.

RESPIRATORY PROTECTION: Use a NIOSH approved dust respirator with powdered wax. During melting or conveying in molten state, use organic vapor respirator.

VENTILATION: Face velocity greater than 60 cfm (adequate to capture wax dust or fumes).

SKIN PROTECTION: Use heat resistant, impervious gloves to avoid repeated/prolonged skin contact with molten material and powder. Other protective garments as necessary.

EYE PROTECTION: Chemical goggles around molten material and in dusty conditions.

OTHER PROTECTIVE EQUIPMENT OR CLOTHING: As needed to prevent repeated/prolonged contact.

WORK / HYGIENIC PRACTICES: Wash skin thoroughly with soap and warm water after handling and before smoking, eating or applying makeup. If clothes become contaminated, change to clean clothing. Do not wear contaminated clothing until properly laundered. Further information relating to the safe handling and use of fluorocarbon polymers may be found in DWE (NIOSH), Publication No. 77-193.

EXPOSURE GUIDELINES: Powdered forms may generate nuisance particulates upon handling.
ACGIH TLV = 10mg/m3. OSHA PEL 5mg/m3.

SECTION 9 - Physical and chemical properties:

Appearance	: White Powder
Odour	: Typical Wax Odor
Odour threshold	: Not Applicable
pH	: Not Applicable
Melting point	: 257 F 125 C
Boiling point	: Not Applicable
Flash point	: > 450 F >232 C
Evaporation rate	: Not applicable
Flammability	: Combustible solid
Upper/lower flammability limits	: 450°F TOC
Vapor pressure	: NIL
Vapor density	: Heavier than air.
Relative density	: 0.96 g/cc
Solubility	: NIL
Partition coefficient	: Unknown
Auto-ignition temperature	: Unknown
Decomposition temperature	: Unknown
Viscosity	: Not Applicable
Volatiles as percentage	: ZERO

SECTION 10 - Stability and reactivity:

STABILITY: Stable at normal conditions.

CONDITIONS TO AVOID: Extreme heat, sparks and open flame.

INCOMPATABILITY (AVOID CONTACT WITH): Strong oxidizing agents and amines.

HAZARDOUS POLYMERIZATION: Should Not Occur

HAZARDOUS DECOMPOSITION PRODUCTS AND/OR BY PRODUCTS:
These products may emit: oxides of carbon and nitrogen.

SECTION 11 - Toxicological information:

Acute toxicity	: No data developed.
Skin corrosion/irritation	: No data developed. None expected.
Serious eye damage/irritation	: No data developed. Treat as nuisance dust.
Respiratory or skin sensitization	: No data developed. Treat as nuisance dust.
Germ cell mutagenicity	: No data developed.
Carcinogenicity	: N.T.P. CARCINOGEN: No I.A.R.C. CARCINOGEN: No
Reproductive toxicity	: No.
STOST-single exposure	: No data developed. Treat as nuisance dust.
STOST-repeated exposure	: No data developed. Treat as nuisance dust.
Aspiration hazard	: No data developed. Aspiration is possible.

OTHER DATA:

MEDICAL CONDITIONS GENERALLY AGGREVATED BY EXPOSURE: May irritate people with skin problems, asthma and lung diseases. Susceptible individuals may have an allergic reaction.

SECTION 12 - Ecological information:

ECOLOGICAL PROFILE:
No data have been developed on this subject. These polymeric products are not soluble in water. They are not considered biodegradable. Potential environmental impact in case of spill or release is considered to be minimal to NIL.

SECTION 13 - Disposal considerations:

WASTE DISPOSAL METHOD: Assume conformity with applicable disposal regulations. Preferred method of disposal is in closed containers of sufficient strength to eliminate leakage at approved incineration or chemical landfill waste disposal site in accordance with local regulations.

Sewage disposal is discouraged.

RCRA: Is the unused product a RCRA hazardous waste if discarded? No.

The information offered here is for the product as shipped. Use and/or alterations to the product such as mixing with other materials may significantly change the characteristics of the material and alter the RCRA classification and the proper disposal method.

SECTION 14 - Transport information:

UN Number	: Not classified as hazardous.
UN Proper shipping name	: N/A
Transport hazard class	: Not classified as hazardous.
Packing group	: N/A
Environmental hazards	: Not considered marine pollutant.
	: Not considered environmentally hazardous.
Special precautions	: Keep sealed and secure. Do not expose to heat.
DOT Classification	: Non-Hazardous.
INCO Terms	: EXW for Regulatory Purposes and Responsibilities

SECTION 15 - Regulatory information:

COMPLETE AND CURRENT REGULATORY INFORMATION IS AVAILABLE UPON REQUEST. (RSS FORM).

REACH: Registration and compliance pending.

T.S.C.A: This product or its components are listed on the TSCA Inventory. This product or its components do not contain any chemicals subject to any rules or orders under TSCA sections 4, 5, 6, 7, or 8(d).

CALIFORNIA PROP65 INFORMATION: Not Regulated.

WHMIS CLASSIFICATION (CANADA): Not subject to WHMIS regulations.

SARA TITLE III: This product is subject to SARA Title III reporting?
Section 311/312 - Immediate/Acute Health (irritant): YES
Section 302 - Contains an extremely hazardous substance: NO
Section 313 - This product does not contain any toxic chemical listed under Sec.313 of the Emergency Planning and Community Right-To-Know Act of 1986.

CLEAN WATER ACT - Priority Pollutants: Contains no known priority pollutants at concentrations greater than 0.1%.

SECTION 16 - Other information:

MICRO POWDERS, INC. QUALITY ASSURANCE PROGRAM CERTIFIED TO ISO-9001

Refer to Micro Powders, Inc. Regulatory Summary Sheet for further regulatory information.

Other useful guides to handling organic powders include:

NFPA 77	Recommended Practice on Static Electricity
NFPA 654	Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids
NFPA 499	Recommended Practice for the Classification of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas

DUST HAZARD - Notification given pursuant to Table 1.5.2 of the 3rd Revision of GHS (2009).

Information in this Safety Data Sheet has been provided by suppliers to Micro Powders as well as internally developed data and opinions.

REVISION NUMBER: 10.1.00

REASON FOR CHANGE: Format Change - GHS Compliance

THE DATA SET FORTH IN THIS SDS ARE TYPICAL VALUES (NOT SPECIFICATIONS) BASED ON INFORMATION PROVIDED BY THE SUPPLIERS OF THE RAW MATERIALS AND CHEMICALS USED IN THE MANUFACTURE OF THE AFOREMENTIONED PRODUCT. MICRO POWDERS, INC. MAKES NOWARRANTY WITH RESPECT TO THE ACCURACY OF THE INFORMATION PROVIDED BY THEIR SUPPLIERS AND DISCLAIMS ALL LIABILITY OF RELIANCE THEREOF. MICRO POWDERS, INC. WARRANTS ONLY THAT ITS PRODUCTS CONFORM WITH THEIR PUBLISHED SPECIFICATIONS AND NO OTHER EXPRESS WARRANTY IS MADE WITH REGARD THERETO. WE DONOT GUARANTEE FAVORABLE RESULTS AND WE ASSUME NO LIABILITY IN CONNECTION WITH THE USE OF THESE PRODUCTS. THEY ARE ALL INTENDED FOR USE BY PERSONS HAVING TECHNICAL SKILL AND KNOWLEDGE, AT THEIR OWN DISCRETION AND RISK.

SOLTEX
SYNTHETIC OILS & LUBRICANTS OF TEXAS, INC.

SOLTEX, INC.
3707 FM 1960 West, Suite 560
Houston, TX 77068
Phone: 281 587-0900 ▪ Fax: 281 587-1998
www.soltexinc.com

Material Safety Data Sheet

ACETYLENE BLACK

SECTION 1 PRODUCT AND COMPANY IDENTIFICATION

Product Number(s): 48PT, 54PT, 57PT, AB100%, AB100%-01, AB100%-03, AB50%-01, AB50%-03, AB50%- 04, AB75%-04, AB50%, AB50%, AB50P, AB50P, A50X, AB75%, AB75%-03, ABC55, ABC55ZPBAG, SS, 0001036931, 0001036933, ABALKA, 0001036932, 0001036934, 0001036939, 0001036940, 0001036941, 0001036943, 0001036944, 0001036949, 0001036950, 0001036951, 0001036952, 0001036953, 0001036954, 0001036955, 0001036956, 0001036957, 0001036958, 0001036959, 0001036960, 0001036961, 0001036962, 0001036963, 0001036964, 0001036965, 0001036966, 0001036967, 0001036968, 0001036969, 0001036970, 0001036971, 0001036972, 0001036973, 0001036974, 0001036975, 0001036976, 0001036977, 0001036978, 0001036979, 0001036936, 0001036936, 0001036935, 0001036937, 0001036945, 0001036946, 0001036947, 0001036948, 01036938, 001036980

Synonyms: SHAWINIGAN BLACK; Soltex ACE BLACK: CARBON BLACK

Emergency Phone Number: **CHEMTREC (800) 424-9300**

Other Safety Information: **(281) 587-0900**

SECTION 2 COMPOSITION/ INFORMATION ON INGREDIENTS

COMPONENT CAS NUMBER AMOUNT
CARBON BLACK 1333-86-4 100.00 % weight
Occupational Exposure Limits:
Component Limit TWA STEL Ceiling Notation CARBON BLACK ACGIH_TLV 3.5 mg/m3 NA NA NA CARBON BLACK OSHA_PEL 3.5 mg/m3 NA NA NA

SECTION 3 HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW:

Odorless black powder.
MAY CAUSE RESPIRATORY TRACT IRRITATION IF INHALED
****

IMMEDIATE HEALTH EFFECTS:

Eye: Not expected to cause prolonged or significant eye irritation.
Skin: Not expected to be harmful to internal organs if absorbed through the skin. Contact with the skin is not expected to cause prolonged or significant irritation.
Ingestion: Not expected to be harmful if swallowed.
Inhalation: The dust from this material may cause respiratory irritation. Symptoms of respiratory irritation may include coughing and difficulty breathing.

DELAYED OR OTHER HEALTH EFFECTS:

Cancer: May cause cancer in laboratory animals, but the available information is inadequate to determine if this material can cause cancer in humans. See Section 11 for additional information. Risk depends on duration and level of exposure.

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SECTION 4 FIRST AID MEASURES

Eye: No specific first aid measures are required because this material is not expected to cause eye irritation. As a precaution, remove contact lenses, if worn, and flush eyes with water.
Skin: To remove the material from skin, use soap and water. Discard contaminated clothing and shoes or thoroughly clean before reuse.
Ingestion: If swallowed, do not induce vomiting. Give the person a glass of water or milk to drink and get medical attention. Never give anything by mouth to an unconscious person.
Inhalation: Move the exposed person to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if breathing difficulties continue. .

SECTION 5 FIRE FIGHTING MEASURES

The ignition temperature of this material in air is approximately 900C. If ignited, flames may not be visible in the burning powder. Some heat and smoke may be noticeable. Soaking with water may spread the fire due to the burning powder floating on the water. High pressure fire extinguishing equipment may blow the burning powder into other areas resulting in more fires.
RECOMMENDED ACTION: If possible, isolate the burning powder into an open area (preferably outside), monitor, and allow the fire to burn itself out. Gently applying a fine water mist to the area of the fire may be helpful. Stop spraying if water starts to puddle. Eliminating the source of oxygen may also be helpful. DO NOT spray with high pressure fire extinguishers.
NFPA RATINGS: Health:1 Flammability: 1 Reactivity: 0
FLAMMABLE PROPERTIES: **Flashpoint**: NDA **Autoignition**: 900°C (1652°F) Flammability (Explosive) Limits (% by volume in air): Lower: NA Upper:
NA PROTECTION OF FIRE FIGHTERS:
Fire Fighting Instructions: For fires involving this material, do not enter any enclosed or confined fire space without proper protective equipment, including self-contained breathing apparatus. This material will burn although it is not easily ignited.
Combustion Products: Normal combustion forms carbon dioxide and water vapor; incomplete combustion can produce carbon monoxide.

SECTION 6 ACCIDENTAL RELEASE MEASURES

Spill Management: Clean up spills immediately, observing precautions in Exposure Controls/Personal Protection section. Sweep up material and place in a disposable container.
Reporting: Based on information available to Soltex, Inc., this product is neither listed as a hazardous waste nor does it exhibit any of the characteristics that would cause it to be classified or disposed of as a RCRA hazardous waste.

SECTION 7 HANDLING AND STORAGE

HANDLING	
Technical Measures /Precautions	Provide suitable exhaust in work areas if the product is handled in the open air. Avoid dust suspension in air.
STORAGE	
Technical Measures/Storage Conditions	Protect form damp conditions at normal ambient temperatures. Keep containers tightly sealed.
PACKAGING MATERIALS	
Recommended	Multi-ply paper sacks. Keep product in original containers or within sealed/waterproof hoppers.
OTHER INFORMATION	A cloud of acetylene black has an explosion index of 0.1 indicating that no explosion was obtained in the course of trials with flames or electric sparks.

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SECTION 8 EXPOSURE CONTROLS/PERSONAL PROTECTION

GENERAL CONSIDERATIONS:
Consider the potential hazards of this material (see Section 3), applicable exposure limits, job activities, and other substances in the work place when designing engineering controls and selecting personal protective equipment. If engineering controls or work practices are not adequate to prevent exposure to harmful levels of this material, the personal protective equipment listed below is recommended. The user should read and understand all instructions and limitations supplied with the equipment since protection is
usually provided for a limited time or under certain circumstances.
PERSONAL PROTECTIVE EQUIPMENT: Eye/Face Protection: No special eye protection is normally required. Where splashing is possible, wear safety glasses with side shields as a good safety practice. Skin Protection: Wear impervious protective clothing to prevent skin contact. Selection of protective clothing may include gloves, apron, boots, and complete facial protection depending on operations conducted. Users should determine acceptable performance characteristics of protective clothing. Consider physical requirements and other substances present when selecting protective clothing. Suggested materials for protective gloves include: No skin protection is ordinarily required under normal conditions of use.
Respiratory Protection: Wear a NIOSH approved respirator that provides protection when working with this material if exposure to harmful levels of airborne material may occur, such as: Air-Purifying Respirator for Dusts and Mists
Occupational Exposure Limits:
Component Limit TWA STEL Ceiling Notation CARBON
BLACK ACGIH_TLV 3.5 mg/m3 NA NA NA CARBON BLACK
OSHA_PEL 3.5 mg/m3 NA NA NA

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES APPEARANCE AND ODOR

Odorless black powder. **pH**: 6.5 - 7.5
VAPOR PRESSURE: NA
VAPOR DENSITY (AIR=1): NA
BOILING POINT: 3500°C (6332°F)
SOLUBILITY: NDA
DENSITY: 1.75 g/cm3

SECTION 10 STABILITY AND REACTIVITY

Chemical Stability: This material is considered stable under normal ambient and anticipated storage and handling conditions of temperature and pressure. Conditions to Avoid: No Data Available Incompatibility With Other Materials: No data available Hazardous Decomposition
Products: No Data Available Hazardous Polymerization: Hazardous polymerization will not occur.

SECTION 11 TOXICOLOGICAL INFORMATION IMMEDIATE HEALTH EFFECTS

Acute Oral Toxicity: The oral LD50 is undetermined.
Acute Dermal Toxicity: The dermal LD50 is undetermined.
Eye Irritation: This material is not expected to be irritating to the eyes.
Skin Irritation: This material is not expected to be irritating to the skin.
Respiratory Tract Irritation: This material is a mild irritant to the respiratory tract.

ADDITIONAL TOXICOLOGY INFORMATION:
The International Agency for Research on Cancer (IARC) has classified carbon black as a Group 2B carcinogen (possibly carcinogenic to humans) based on sufficient evidence in animals and inadequate evidence in humans. Carbon black has not been listed as a carcinogen by the National Toxicology Program the Occupational Safety and Health Administration. Acetylene black, a high purity carbon black, is made from the thermal decomposition of acetylene gas. It is a pure form of carbon containing less than 0.2 ppm polycyclic aromatic hydrocarbons (PAHs). Therefore, acetylene black is not expected to directly interact with DNA to present a cancer risk by skin exposure or by inhalation. However, chronic inflammation, lung

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fibrosis, and lung tumors have been observed in rats in studies in which rats inhaled carbon black for a lifetime at concentrations that overwhelmed the lung particle clearance mechanisms and caused the carbon black to accumulate in the lung. Results of these studies indicate that tumors were caused by the physical effect of overloading the lungs with particles and suggest that exposures below the exposure limit would not cause adverse health effects. Studies of workers in the carbon black industry indicate that elevated rates of lung cancer have not been associated with occupational exposures to carbon black. Studies in Eastern Europe of workers heavily exposed to carbon black reported respiratory diseases including bronchitis, fibrosis, pneumoconiosis, emphysema, and rhinitis, but not cancer; however, these studies are of questionable validity, due to inadequate study design and methodology, lack of appropriate controls for cigarette smoking, and confounding with concurrent exposures to other substances. Studies of workers in the carbon black production industries of North America and Western Europe show that pulmonary effects of exposure to carbon black are limited to slight radiological changes in the lung, chronic bronchitis, and slight reduction in lung function. Tumors induced in rat lungs by carbon black, as well as other biologically inert particles, under conditions of overload may be rat-specific effects as they are not seen in mice or hamsters tested under similar conditions or in studies of carbon black workers. We believe that the data presently available for carbon black do not support a significantly increased risk of cancer or other adverse health effects for workers when precautions outlined in this document are followed.

SECTION 12 ECOLOGICAL INFORMATION

ECOTOXICITY:

The toxicity of this material to aquatic organisms has not been evaluated. Consequently, this material should be kept out of sewage and drainage systems and all bodies of water.

ENVIRONMENTAL FATE:

This material is not expected to present an environmental problem.
physical properties and analysis for regulated components may be necessary to make a correct determination. If this material is classified as a hazardous waste, federal law requires disposal at a licensed hazardous waste disposal facility.

SECTION 13 DISPOSAL CONSIDERATIONS

Use material for its intended purpose or recycle if possible. This material, if it must be discarded, may meet the criteria of a hazardous waste as defined by US EPA under RCRA (40 CFR 261) or other State and local regulations. Measurement of certain physical properties and analysis for regulated components may be necessary to make a correct determination. If this material is classified as a hazardous waste, federal law requires disposal at a licensed hazardous waste disposal facility.

SECTION 14 TRANSPORT INFORMATION

The description shown may not apply to all shipping situations. Consult 49CFR, or appropriate Dangerous Goods Regulations, for additional description requirements (e.g., technical name) and mode-specific or quantity-specific shipping requirements.

US DOT

NOT REGULATED AS A HAZARDOUS MATERIAL OR DANGEROUS GOODS FOR TRANSPORTATION

ICAO / IATA

NOT REGULATED AS A HAZARDOUS MATERIAL OR DANGEROUS GOODS FOR TRANSPORTATION

IMO / IMDG

NOT REGULATED AS A HAZARDOUS MATERIAL OR DANGEROUS GOODS FOR TRANSPORTATION

RID / ADR

NOT REGULATED AS A HAZARDOUS MATERIAL OR DANGEROUS GOODS FOR TRANSPORTATION

SECTION 15 REGULATORY INFORMATION SARA 311/312 CATEGORIES: 1. Immediate (Acute) Health Effects: YES

1. 2. Delayed (Chronic) Health Effects: YES
2. 3. Fire Hazard: NO

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3. 4. Sudden Release of Pressure Hazard: NO
4. 5. Reactivity Hazard: NO

REGULATORY LISTS SEARCHED:
04A = IARC Group 1 12 = TSCA Section 8(a) PAIR 21 = TSCA Section 5(a) 04B = IARC Group 2A 13 = TSCA Section 8(d) 25 = CAA Section 112 HAPs 04C = IARC Group 2B 15 = SARA Section 313 26 = CWA Section 311 05 = NTP Carcinogen 16 = CA Proposition 65 28 = CWA Section 307 06 = OSHA Carcinogen 17 = MA RTK 30 = RCRA Waste P-List 09 = TSCA 12(b) 18 = NJ RTK 31 = RCRA Waste
U-List 10 = TSCA Section 4 19 = DOT Marine Pollutant 32 = RCRA Appendix VIII 11 = TSCA Section 8(a) CAIR 20 = PA RTK 33 = MN Hazardous Substance.The following components of this material are found on the regulatory lists indicated. CARBON BLACK 04C, 17, 18, 20, 33

CHEMICAL INVENTORY LISTINGS:
AUSTRALIA: All the components of this material are listed on the Australian Inventory of Chemical Substances (AICS). CANADA: All the components of this material are on the Canadian Domestic Substances List (DSL). PEOPLE'S REPUBLIC OF CHINA: All the components of this product are listed on the draft Inventory of Existing Chemical Substances in China. EUROPEAN UNION: All the components of this material are in compliance with the EU Seventh Amendment Directive 92/32/EEC.
JAPAN: All the components of this product are on the Existing & New Chemical Substances (ENCS) inventory in Japan, or have an exemption from listing. KOREA: All the components of this product are on the Existing Chemicals List (ECL) in Korea.
PHILIPPINES: All the components of this product are listed on the Philippine Inventory of Chemicals and Chemical Substances (PICCS). UNITED STATES: All of the components of this material are on the Toxic Substances Control Act (TSCA) Chemical Inventory.

SECTION 16 OTHER INFORMATION NFPA RATINGS
Health: 1 Flammability: 1 Reactivity: 0 (0-Least, 1-Slight, 2-Moderate, 3-High, 4-Extreme, PPE:- Personal Protection Equipment Index recommendation, *- Chronic Effect Indicator). These values are obtained using the guidelines or published evaluations prepared by the National Fire Protection Association (NFPA) or the

REVISION STATEMENT: This revision updates the transportation information, please review section 14.
ABBREVIATIONS THAT MAY HAVE BEEN USED IN THIS DOCUMENT: TLV -Threshold Limit Value TWA - Time Weighted Average STEL -Short-term Exposure Limit PEL - Permissible Exposure Limit ACGIH -American Conference of Government Industrial Hygienists OSHA - Occupational Safety &
Health NIOSH -National Institute of Safety & Health NFPA - National Fire Protection Agency WHMIS -Workplace Hazardous Materials Information System IRAC - Intl. Agency for Research on Cancer EINECS -European Inventory of existing Commercial Chemical Sales RCRA - Resource Conservation Recovery
Act SARA -Superfund Amendments and Reauthorization Act. TSCA - Toxic Substance Control Act EC50 - Effective Dose LC50 - Lethal Concentration LD50 -Lethal Dose CAS - Chemical Abstract Service
Number NDA -No Data Available NA - Not Applicable <= -Less Than or Equal To >= - Greater Than or Equal To CNS -Central Nervous System
Prepared according to the OSHA Hazard Communication Standard (29 CFR 1910.1200) and the ANSI MSDS Standard (Z400.1) by EHS Product Stewardship Group, Soltex, Inc., Houston, TX 77068

The above information is based on the data of which we are aware and is believed to be correct as of the date hereof. Since this information may be applied under conditions beyond our control and with which we may be unfamiliar and since data made available subsequent to the date hereof may suggest modifications of the information, we do not assume any responsibility for the results of its use. This information is furnished upon condition that the person receiving it shall make his own determination of the suitability of the material for his particular purpose.

REVISED 03/19/10

SAFETY DATA SHEET

Prepared in accordance with the United States Hazard Communication Standard: 29 CFR 1910.1200 (2012)

Revision date: 29-Jan-2018

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Product name: BLACK PEARLS® 2000 Carbon Black

Product code: BP2000

Synonyms: Carbon Black, Furnace Black

This SDS is valid for the following grades: Carbon Black grade series: BLACK PEARLS®, ELFTEX®, MOGUL®, MONARCH®, REGAL®, SPHERON®, STERLING®, VULCAN®, CSX™, CRX™, IRX™, FCX™, SHOBLACK™, DL™, PROPEL®, LITX®, and PBX® carbon black. Oxidized grades include: BLACK PEARLS® / MOGUL® L, BLACK PEARLS® / MOGUL® E, MOGUL® H, and REGAL® 400/400R carbon black. ***Excludes: BLACK PEARLS® / MONARCH® 1000, 1300, 1400, 1500; BLACK PEARLS® 1300B1; Monarch® 4750; and Black Pearls® 4350/4750 carbon black; and all oil pellet grades.**.

Recommended use: Additive/Filler for plastic and rubber, Pigment, Chemical reagent, Batteries, Refractories, Various

Restrictions on use: Not Applicable.

Supplier:

Cabot Corporation
800 Tashmoo Avenue
Sarnia,
Ontario N7T 7N4
CANADA
Tel: +1 519 336 2261
Fax: +1 519 339 8273

Cabot Corporation
157 Concord Road
Billerica, MA 01821
UNITED STATES
Tel: 1-978-663-3455
Fax: 1-978-670-6955

Emergency Telephone Number: US: CHEMTREC: 1-800-424-9300 or 1-703-527-3887
International CHEMTREC: +1 703-741-5970 or +1-703-527-3887

2. HAZARDS IDENTIFICATION

Classification

OSHA Regulatory Status: This chemical is considered hazardous by the United States 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200).

Combustible dust

Label Elements:

Pictogram:	None
Signal Word:	WARNING
Hazard statements:	May form combustible dust concentrations in air
Precautionary Statements - Prevention	• Keep away from all ignition sources including heat, sparks and flame • Prevent dust accumulations to minimize explosion hazard

Hazards not otherwise classified (HNOC)

Do not expose to temperatures above 300°C. Hazardous products of combustion can include carbon monoxide, carbon dioxide, oxides of sulfur, and organic products.

Potential health effects

Principle Routes of Exposure:	Inhalation, Eye contact, Skin Contact
Eye Contact:	May cause mechanical irritation. Avoid contact with eyes.
Skin Contact:	May cause mechanical irritation, soiling, and skin drying. Avoid contact with skin. No cases of sensitization in humans have been reported.
Inhalation:	Dust may be irritating to respiratory tract. Provide appropriate local exhaust ventilation at machinery and at places where dust can be generated. See also Section 8.
Ingestion:	Adverse health effects are not expected. See Section 11.
Carcinogenicity:	Carbon Black is listed as an IARC (International Agency for Research on Cancer) Group 2B substance (possibly carcinogenic to humans). See also Section 11.
Target Organ Effects:	Lungs, See Section 11
Medical Conditions Aggravated by Exposure:	Asthma, Respiratory disorder
Potential Environmental Effects:	None known. See Section 12.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Synonyms: Carbon Black, Furnace Black.

Chemical name	CAS No	weight-%	Trade secret
Carbon Black	1333-86-4	100	

4. FIRST AID MEASURES

FIRST AID MEASURES

Skin Contact Wash thoroughly with soap and water. Seek medical attention if symptoms develop.

Eye contact Flush eyes immediately with large amounts of water for 15 minutes. Seek medical attention if symptoms develop.

Inhalation If cough, shortness of breath or other breathing problems occur, move to fresh air. Seek medical attention if symptoms persist. If necessary, restore normal breathing through standard first aid measures.

Ingestion Do not induce vomiting. If conscious, give several glasses of water. Never give anything by mouth to an unconscious person.

Most important symptoms and effects, both acute and delayed

Symptoms: The most important known symptoms and effects are described in Section 2 and/or in Section 11.

Indication of any immediate medical attention and special treatment needed

Note to physicians: Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Suitable Extinguishing Media: Use foam, carbon dioxide (CO2), dry chemical or water spray. A fog is recommended if water is used.

Unsuitable Extinguishing Media: DO NOT USE a solid water stream as it may scatter and spread fire. DO NOT USE high pressure media which could cause formation of a potentially explosible dust-air mixture.

Specific hazards arising from the chemical: It may not be obvious that carbon black is burning unless the material is stirred and embers and/or sparks are apparent. Carbon black that has been on fire should be observed closely for at least 48 hours to ensure no smoldering material is present. Burning produces irritant fumes. The product is insoluble and floats on water. If possible, try to contain floating material.

Hazardous combustion products: Carbon monoxide (CO). Carbon dioxide (CO2). Sulphur oxides.

Protective equipment and precautions for firefighters: Wear suitable protective equipment. In the event of fire, wear self-contained breathing apparatus. Wet carbon black produces very slippery walking surfaces.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal precautions: CAUTION: Wet carbon black produces slippery walking surfaces. Avoid dust formation. Ensure adequate ventilation. Use personal protective equipment. See also Section 8.

Environmental Precautions:

Environmental Precautions: Contain spilled product on land, if possible. The product is insoluble and floats on water. Any product that reaches water should be contained. Local authorities should be advised if spillages cannot be contained.

Methods and material for containment and cleaning up

Methods for containment: Prevent further leakage or spillage if safe to do so.

Methods for cleaning up: If the spilled material contains dust or has the potential to create dust, use explosion-proof vacuums and/or cleaning systems suitable for combustible dusts. Use of a vacuum with high efficiency particulate air (HEPA) filtration is recommended. Do not create a dust cloud by using a brush or compressed air. Dry sweeping is not recommended. Water spray will produce very slippery walking surfaces and will not result in satisfactory removal of carbon black contamination. Pick up and transfer to properly labelled containers. See Section 13.

7. HANDLING AND STORAGE

Precautions for safe handling

Advice on safe handling: Avoid contact with skin and eyes. Avoid dust formation. Do not breathe dust. Provide appropriate local exhaust ventilation at machinery and at places where dust can be generated. Do not create a dust cloud by using a brush or compressed air. Dust may form explosible mixture in air.

Take precautionary measures against static discharges. All metal parts of the mixing and processing equipment must be earthed/grounded. Ensure all equipment is electrically earthed/grounded before beginning transfer operations. Fine dust is capable of penetrating electrical equipment and may cause electrical shorts. If hot work (welding, torch cutting, etc.) is required the immediate work area must be cleared of carbon black product and dust.

Conditions for safe storage, including any incompatibilities

Storage Conditions: Keep in a dry, cool and well-ventilated place. Keep away from heat and sources of ignition. Do not store together with strong oxidizing agents. Do not store together with volatile chemicals as they may be adsorbed onto product. Keep in properly labeled containers.

Carbon black is not classifiable as a Division 4.2 self-heating substance under the UN test criteria. However, the UN criteria for determining if a substance is self-heating is volume dependent, i.e., the auto-ignition temperature decreases with increasing volume. This classification may not be appropriate for large volume storage containers.

Before entering vessels and confined spaces containing carbon black, test for adequate oxygen, flammable gases and potential toxic air contaminants. Dust deposits should not be allowed to accumulate on surfaces, as these may form an explosible mixture if they

are released in the atmosphere in sufficient concentrations.

Incompatible materials: Strong oxidizing agents.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Exposure guidelines: The table below is a summary. Please see the specific legislation for complete information.

Carbon Black, CAS RN 1333-86-4:
Argentina: 3.5 mg/m³, TWA
Australia: 3.0 mg/m³, TWA inhalable
Belgium: 3.6 mg/m³, TWA
Brasil: 3.5 mg/m³, TWA
Canada (Ontario): 3.0 mg/m³, TWA inhalable
China: 4.0 mg/m³, TWA; 8.0 mg/m³, STEL
Colombia: 3.0 mg/m³, TWA inhalable
Czech Republic: 2.0 mg/m³, TWA
Finland: 3.5 mg/m³, TWA; 7.0 mg/m³, STEL
France - INRS: 3.5 mg/m³, TWA/VME inhalable
Hong Kong: 3.5 mg/m³, TWA
Indonesia: 3.5 mg/m³, TWA/NABs
Ireland: 3.5 mg/m³, TWA; 7.0 mg/m³, STEL
Italy: 3.0 mg/m³, TWA inhalable
Japan SOH: 4.0 mg/m³, TWA; 1.0 mg/m³, TWA respirable
Korea: 3.5 mg/m³, TWA
Malaysia: 3.5 mg/m³, TWA
Netherlands - MAC: 3.5 mg/m³, TWA inhalable
Mexico: 3.5 mg/m³, TWA
Norway: 3.5 mg/m³, TWA
Poland: 4.0 mg/m³ TWA (NDS) (applies to carbon black containing benzo(a)pyrene <35 mg in 1 kg of carbon black, total inhalable dust)
Sweden: 3.0 mg/m³, TWA
United Kingdom - WEL: 3.5 mg/m³, TWA inhalable; 7.0 mg/m³, STEL inhalable
US ACGIH - TLV: 3.0 mg/m³, TWA inhalable
US OSHA - PEL: 3.5 mg/m³, TWA

NOTE:

(1) Unless otherwise indicated as "respirable" or "inhalable", the exposure limit represents a "total" value. The inhalable exposure limit has been demonstrated to be more restrictive than the total exposure limit, by a factor of approximately 3.
(2) In its facilities globally, Cabot Corporation manages to the US ACGIH TLV of 3.0 mg/m³ TWA inhalable.

AGW: Arbeitsplatzgrenzwert
INRS: Institut National de Recherche et de Securite (National Institute of Research and Security)
MAC: Maximaal Aanvaarde Concentraties (Maximum allowed concentration)
MHLW: Ministry of Health, Labor and Welfare
NABS: Nilai Ambang Batas (threshold limit value)
NDS: Najwyzsze dopuszczalne stezenie (8-hour occupational exposure limit)
OEL: Occupational Exposure Limit
PEL: Permissible Exposure Limit
SOH: Society of Occupational Health
STEL: Short Term Exposure Limit
TLV: Threshold Limit Value
TRGS: Technische Regeln für Gefahrstoffe (Technical Rule for Hazardous Materials)

TWA: Time Weighted Average
US ACGIH: United States American Conference of Governmental Industrial Hygienists
US OSHA: United States Occupational Safety and Health Administration
VME: Valeur Moyenne d'Exposition (Average Level of Exposure)
WEL: Workplace Exposure Limit
VLA-ED: Valor límite ambiental de exposicíon diaria (environmental value of daily exposure limit)

Engineering Controls: Ensure adequate ventilation to maintain exposures below occupational limits. Provide appropriate local exhaust ventilation at machinery and at places where dust can be generated.

Personal protective equipment [PPE]

Respiratory Protection: An approved air-purifying respirator (APR) for particulates may be permissible where airborne concentrations are expected to exceed occupational exposure limits. Protection provided by air-purifying respirators is limited. Use a positive-pressure, air supplied respirator if there is any potential for uncontrolled release, exposure levels are not known, or any circumstances where air-purifying respirators may not provide adequate protection. Use of respirators must include a complete respiratory protection program in accordance with national standards and current best practices.

The following agencies/organizations approve respirators and/or criteria for respirator programs:

US: NIOSH approval under 42 CFR 84 required. OSHA (29 CFR 1910.134). ANSI Z88.2-1992 (Respiratory Protection).

EU: CR592 Guidelines for the Selection and Use of Respiratory Protection.

Germany: DIN/EN 143 Respiratory Protective Devices for Dusty Materials.

UK: BS 4275 Recommendations for the Selection, Use and Maintenance of Respiratory Protective Equipment. HSE Guidance Note HS (G)53 Respiratory Protective Equipment.

Hand Protection: Wear protective gloves to prevent soiling of hands. Use protective barrier cream before handling the product. Wash hands and other exposed skin with mild soap and water.

Eye/face Protection: Wear eye/face protection. Wear safety glasses with side shields (or goggles).

Skin and Body Protection: Wear suitable protective clothing. Wash clothing daily. Work clothing should not be allowed out of the workplace.

Other: Handle in accordance with good industrial hygiene and safety practice. Emergency eyewash and safety shower should be located nearby.

Environmental exposure controls: In accordance with all local legislation and permit requirements.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Solid	**Odor:**	None.
Appearance:	Black powder or pellets	**Odor threshold:**	Not Applicable
Color:	Black		

Property	Values		Remarks • Method
pH:	2-11		2-4 (oxidized carbon black) and 4-11 (non-oxidized carbon black), 50 g/l water, 68ºF (20ºC), ASTM 1512
Melting point/freezing point:			Not Applicable
Boiling point / boiling range:			Not Applicable
Evaporation Rate:			Not Applicable
Vapor pressure:			Not Applicable
Vapor Density:			Not Applicable
Density:	1.7-1.9 g/cm3		@ 20 °C
Bulk Density:	200-680 kg/m³		(Pellets)
	20-380 kg/m³		(powder)
Specific Gravity at 20°C:	1.7-1.9		
Water solubility:	Insoluble		
Solubility(ies):	Insoluble		
Partition Coefficient (n-octanol/water):			Not Applicable
Decomposition temperature:			Not Applicable
Viscosity:			Not Applicable
Kinematic viscosity:			Not Applicable
Dynamic viscosity:			Not Applicable
Oxidizing Properties:			Not Applicable
Softening point:			Not Applicable
VOC content (%):			No information available
% Volatile (by Volume):			No information available
% Volatile (by Weight):	< 2.5%		(950ºC) non-oxidized carbon black
	2 - 8%		(oxidized carbon black)
Surface Tension:			No information available
Explosive properties:			Dust may form explosible mixture in air
Flash Point:			Not Applicable
Flammability (solid, gas):			No information available
Flammability Limit in Air:			No information available
Explosion Limits in Air - Upper (g/m³):			No information available
Explosion Limits in Air - Lower (g/m³):		50 g/m³	dust
Autoignition Temperature:		> 140 °C	(transport) IMDG-Code
Minimum Ignition Temperature:		> 500 °C	(BAM Furnace) VDI 2263 (cloud)
		> 400 °C	VDI 2263 (layer)
Minimum Ignition Energy:		> 10,000 mJ	VDI 2263
Ignition Energy:			No information available
Maximum Absolute Explosion Pressure:		10 bar	VDI 2263 10 bar at an initial starting pressure of 1 bar. Higher starting initial pressures will yield higher explosion pressures
Maximum Rate of Pressure Rise:		30 - 400 bar/sec	VDI 2263 and ASTM E1226-88
Burn Velocity:		> 45 seconds	(not classifiable as "Highly Flammable", or "Easily Ignitable")
Kst Value:			No information available
Dust Explosion Classification:		ST1	

10. STABILITY AND REACTIVITY

Reactivity: May react exothermically upon contact with strong oxidizers.

Stability: Stable under recommended handling and storage conditions.

Possibility of hazardous reactions: None under normal processing.

Hazardous polymerization: Hazardous polymerization does not occur.

Conditions to avoid: Do not expose to temperatures above 300°C. Keep away from heat and sources of ignition. Avoid dust formation.

Incompatible materials: Strong oxidizing agents.

Explosion data See also Section 9.

Sensitivity to Mechanical Impact: Not sensitive to mechanical impact.

Sensitivity to Static Discharge: Dust may form explosible mixture in air. Avoid dust formation. Do not create a dust cloud by using a brush or compressed air. Take precautionary measures against static discharges. All metal parts of the mixing and processing equipment must be earthed/grounded. Ensure all equipment is electrically earthed/grounded before beginning transfer operations.

Hazardous decomposition products: Carbon monoxide (CO). Carbon dioxide (CO2). Sulfur oxides. Organic products of combustion.

11. TOXICOLOGICAL INFORMATION

Acute toxicity

Oral LD50: LD50/oral/rat = > 8000 mg/kg. (Equivalent to OECD TG 401).

Inhalation LC50: No data available

Dermal LD50: No data available.

Assessment: Non-toxic after ingestion.

Skin corrosion/irritation: Rabbit: not irritating. (Equivalent to OECD TG 404)
Edema = 0 (max. attainable irritation score: 4)
Erythema = 0 (max. attainable irritation score: 4)

Assessment: Not irritating to skin

Serious eye damage/eye irritation: Rabbit: not irritating. (OECD TG 405). Cornea: 0 (max. attainable irritation score: 4). Iris: 0 (max. attainable irritation score: 2). Conjunctivae: 0 (max. attainable irritation score: 3). Chemosis: 0 (max. attainable irritation score: 4).

Assessment: Not irritating to the eyes.

Sensitization: Guinea pig skin (Buehler Test): Not sensitizing (OECD TG 406).

Assessment: Not sensitizing in animals. No cases of sensitization in humans have been reported.

Germ Cell Mutagenicity *In Vitro*

Carbon black is not suitable to be tested in bacterial (Ames test) and other in vitro

systems because of its insolubility. However, when organic solvent extracts of carbon black have been tested, results showed no mutagenic effects. Organic solvent extracts of carbon black can contain traces of polycyclic aromatic hydrocarbons (PAHs). A study to examine the bioavailability of these PAHs showed that PAHs are very tightly bound to carbon black and not bioavailable. (Borm, 2005)

In Vivo

In an experimental investigation, mutational changes in the hprt gene were reported in alveolar epithelial cells in the rat following inhalation exposure to carbon black. This observation is believed to be rat specific and a consequence of "lung overload" (Driscoll, 1997) which led to chronic inflammation and release of reactive oxygen species. This is considered to be a secondary genotoxic effect and, thus, carbon black itself would not be considered to be mutagenic,

Assessment: In vivo mutagenicity in rats occurs by mechanisms secondary to a threshold effect and is a consequence of "lung overload," which leads to chronic inflammation and the release of genotoxic oxygen species. This mechanism is considered to be a secondary genotoxic effect and, thus, carbon black itself would not be considered to be mutagenic.

Carcinogenicity:

ANIMAL TOXICITY:

Rat, oral, duration 2 years.
Effect: no tumors.

Mouse, oral, duration 2 years.
Effect: no tumors.

Mouse, dermal, duration 18 months.
Effect: no skin tumors.

Rat, inhalation, duration 2 years.
Target organ: lungs.
Effect: inflammation, fibrosis, tumors.

Note: Tumors in the rat lung are considered to be related to the "lung overload" rather than to a specific chemical effect of carbon black itself in the lung. These effects in rats have been reported in many studies on other poorly soluble inorganic particles and appear to be rat specific (ILSI, 2000). Tumors have not been observed in other species (i.e., mouse and hamster) for carbon black or other poorly soluble particles under similar circumstances and study conditions.

MORTALITY STUDIES (HUMAN DATA):

A study on carbon black production workers in the UK (Sorahan, 2001) found an increased risk of lung cancer in two of the five plants studied; however, the increase was not related to the dose of carbon black. Thus, the authors did not consider the increased risk in lung cancer to be due to carbon black exposure. A German study of carbon black workers at one plant (Morfeld, 2006; Buechte, 2006) found a similar increase in lung cancer risk but, like the Sorahan, 2001 (UK study), found no association with carbon black exposure. A large US study of 18 plants showed a reduction in lung cancer risk in carbon

black production workers (Dell, 2006). Based upon these studies, the February 2006 Working Group at the International Agency for Research on Cancer (IARC) concluded that the human evidence for carcinogenicity was inadequate (IARC, 2010).

Since the IARC evaluation of carbon black, Sorahan and Harrington (2007) have re-analyzed the UK study data using an alternative exposure hypothesis and found a positive association with carbon black exposure in two of the five plants. The same exposure hypothesis was applied by Morfeld and McCunney (2009) to the German cohort; in contrast, they found no association between carbon black exposure and lung cancer risk and, thus, no support for the alternative exposure hypothesis used by Sorahan and Harrington.

Overall, as a result of these detailed investigations, no causative link between carbon black exposure and cancer risk in humans has been demonstrated.

IARC CANCER CLASSIFICATION:

In 2006 IARC re-affirmed its 1995 finding that there is "inadequate evidence" from human health studies to assess whether carbon black causes cancer in humans. IARC concluded that there is "sufficient evidence" in experimental animal studies for the carcinogenicity of carbon black. IARC's overall evaluation is that carbon black is "possibly carcinogenic to humans (Group 2B)". This conclusion was based on IARC's guidelines, which generally require such a classification if one species exhibits carcinogenicity in two or more animal studies (IARC, 2010).

Solvent extracts of carbon black were used in one study of rats in which skin tumors were found after dermal application and several studies of mice in which sarcomas were found following subcutaneous injection. IARC concluded that there was "sufficient evidence" that carbon black extracts can cause cancer in animals (Group 2B).

ACGIH CANCER CLASSIFICATION:

Confirmed Animal Carcinogen with Unknown Relevance to Humans (Category A3 Carcinogen).

ASSESSMENT:

Applying the guidelines of self-classification under the Globally Harmonized System of Classification and Labeling of Chemicals, carbon black is not classified as a carcinogen. Lung tumors are induced in rats as a result of repeated exposure to inert, poorly soluble particles like carbon black and other poorly soluble particles. Rat tumors are a result of a secondary non-genotoxic mechanism associated with the phenomenon of lung overload. This is a species-specific mechanism that has questionable relevance for classification in humans. In support of this opinion, the CLP Guidance for Specific Target Organ Toxicity – Repeated Exposure (STOT-RE), cites lung overload under mechanisms not relevant to humans. Human health studies show that exposure to carbon black does not increase the risk of carcinogenicity.

Reproductive and Developmental Toxicity: **ASSESSMENT:** No effects on reproductive organs or fetal development have been reported in long-term repeated dose toxicity studies in animals.

STOT - single exposure: **ASSESSMENT:** Based on available data, specific target organ toxicity is not expected after

single oral, single inhalation, or single dermal exposure.

STOT - repeated exposure:

ANIMAL TOXICITY:

Repeated dose toxicity: inhalation (rat), 90 days, No Observed Adverse Effect Concentration (NOAEC) = 1.1 mg/m^3 (respirable). Target organ effects at higher doses are lung inflammation, hyperplasia, and fibrosis.

Repeated dose toxicity: oral (mouse), 2 yrs, No Observed Effect Level (NOEL) = 137 mg/kg (body wt.)

Repeated dose toxicity: oral (rat), 2 yrs, NOEL = 52 mg/kg (body wt.)

Although carbon black produces pulmonary irritation, cellular proliferation, fibrosis, and lung tumors in the rat under conditions of "lung overload", there is evidence to demonstrate that this response is principally a species-specific response that is not relevant to humans.

MORBIDITY STUDIES (human data):

Results of epidemiological studies of carbon black production workers suggest that cumulative exposure to carbon black may result in small, non-clinical decrements in lung function. A U.S. respiratory morbidity study suggested a 27 ml decline in FEV1 from a 1 mg/m^3 8 hour TWA daily (inhalable fraction) exposure over a 40-year period (Harber, 2003). An earlier European investigation suggested that exposure to 1 mg/m^3 (inhalable fraction) of carbon black over a 40-year working lifetime would result in a 48 ml decline in FEV1 (Gardiner, 2001). However, the estimates from both studies were only of borderline statistical significance. Normal age-related decline over a similar period of time would be approximately 1200 ml.

In the U.S. study, 9% of the highest non-smokers exposure group (in contrast to 5% of the unexposed group) reported symptoms consistent with chronic bronchitis. In the European study, methodological limitations in the administration of the questionnaire limit the conclusions that can be drawn about reported symptoms. This study, however, indicated a link between carbon black and small opacities on chest films, with negligible effects on lung function.

INHALATION ASSESSMENT:

Applying the guidelines of self-classification under GHS, carbon black is not classified under STOT-RE for effects on the lung. Classification is not warranted on the basis of the unique response of rats resulting from the “lung overload” following exposure to poorly soluble particles such as carbon black. The pattern of pulmonary effects in the rat, such as inflammation and fibrotic responses, are not observed in other rodent species, non-human primates, or humans under similar exposure conditions. Lung overload does not appear to be relevant for human health. Overall, the epidemiological evidence from well-conducted investigations has shown no causative link between carbon black exposure and the risk of non-malignant respiratory disease in humans. A STOT-RE classification for carbon black after repeated inhalation exposure is not warranted.

ORAL ASSESSMENT:

Based on available data, specific target organ toxicity is not expected after repeated oral exposure.

DERMAL ASSESSMENT:

Based on available data and the chemical-physical properties (insolubility, low absorption potential), specific target organ toxicity is not expected after repeated dermal exposure.

Aspiration Hazard: ASSESSMENT: Based on industrial experience and the available data, no aspiration hazard is expected.

12. ECOLOGICAL INFORMATION

Aquatic Toxicity:
Fish (Brachydanio rerio): LC50 (96hr) > 1,000 mg/L. (Method: OECD 203).
Daphnia magna: EC50 (24hr) > 5,600 mg/L. (Method: OECD 202).
Algae (Scenedesmus subspicatus): EC50 (72hr) > 10,000 mg/L.
Algae (Scenedesmus subspicatus): NOEC >= 10,000 mg/L (Method: OECD 201).
Activated sludge: EC0 (3hr) >= 800 mg/L. (Method: DEV L3 TTC test).

ENVIRONMENTAL FATE

Persistence and degradability The methods for determining biodegradability are not applicable to inorganic substances

Bioaccumulation Not expected due to physicochemical properties of the substance.

Mobility: Not expected to migrate. Insoluble.

Distribution to Environmental Compartments: Insoluble. Expected to remain on soil surface. Expected to float on water.

PBT and vPvB Assessment: This substance does not fulfill the criteria for PBT or vPvB.

Other adverse effects: No information available.

13. DISPOSAL CONSIDERATIONS

Disclaimer: Information in this section pertains to the product as shipped in its intended composition as described in Section 3 of this SDS. Contamination or processing may change waste characteristics and requirements. Regulations may also apply to empty containers, liners or rinsate. State/provincial and local regulations may be different from federal regulations.

RCRA: Not a hazardous waste under U.S. RCRA, 40 CFR 261.

Canadian Waste Classification: Canada: Not a hazardous waste under provincial regulations.

Disposal considerations: Waste should not be released to sewers. Product, as supplied, can be burned in suitable incineration facilities or should be disposed of in accordance with the regulations issued by the appropriate federal, state and local authorities. Same consideration should be given to containers and packaging.

14. TRANSPORT INFORMATION

Seven (7) ASTM reference carbon blacks were tested according to the UN method, Self Heating Solids, and found to be “Not a self-heating substance of Division 4.2”; the same carbon blacks were tested according to the UN method, Readily Combustible Solids, and found to be “Not a readily combustible solid of Division 4.1”; under current UN Recommendations on the Transport of Dangerous Goods.

The following organizations do not classify carbon black as a "hazardous cargo" if it is "carbon, non-activated, mineral origin". Cabot carbon blacks meet this definition.

US Rail Regulations: Not regulated.

DOT

UN/ID no	Not regulated
Proper Shipping Name	Not regulated
Hazard Class	Not regulated
Packing group	Not regulated

ICAO (air)

UN/ID no	Not regulated
Proper Shipping Name	Not regulated
Hazard Class	Not regulated
Packing group	Not regulated

IATA

UN/ID no	Not regulated
Proper Shipping Name	Not regulated
Hazard Class	Not regulated
Packing group	Not regulated

IMDG

UN/ID no	Not regulated
Proper Shipping Name	Not regulated
Hazard Class	Not regulated
Packing group	Not regulated

RID

UN/ID no	Not regulated
Proper Shipping Name	Not regulated
Hazard Class	Not regulated
Packing group	Not regulated

ADR

UN/ID no	Not regulated
Proper Shipping Name	Not regulated

Hazard Class	Not regulated
Packing group	Not regulated

15. REGULATORY INFORMATION

Hazard Classification

United States - OSHA (29 CFR 1910.1200): Hazardous
Mexico - NOM-018-STPS-2000: Not hazardous
Mexico - NOM-018-STPS-2015: Not hazardous.
Canada - WHMIS Classification (CPR, SOR/88-66): Class D2A
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the M/SDS contains all the information required by the Controlled Products Regulations.

Canada - WHMIS Classification (HPR, SOR/2015-17) This product has been classified in accordance with the hazard criteria of the Hazardous Products Regulations (HPR) and the M/SDS contains all the information required by the Hazardous Products Regulations.

Chemical name	WHMIS - Ingredient Disclosure
Carbon Black 1333-86-4	1%

International Inventories

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

US Federal Regulations

SARA 311/312 Hazard Categories

Acute Health Hazard	NO
Chronic Health Hazard	YES
Fire hazard	YES
Sudden release of pressure hazard	NO
Reactive Hazard	NO

See GHS classification in section 2 for applicable SARA 311/312 hazard categories under the revised 40 CFR 370 (June 13, 2016)

SARA Section 313 (40 CFR 372) Toxics Release Inventory
Under EPA's Toxics Release Inventory (TRI) program, the reporting threshold for the polycyclic aromatic compounds (PAC) category is 100 pounds/year manufactured, processed, or otherwise used. The 100 pounds/year reporting threshold applies to the cumulative total of 25 specific PACs. In addition, the TRI reporting threshold for benzo(g,h,i)perylene is 10 pounds/year manufactured, processed, or otherwise used. Carbon black may contain certain PACs and/or benzo(g,h,i)perylene. The user is

advised to evaluate their own TRI reporting responsibilities.

Clean Air Act Amendments of 1990 (CAA, Section 112, 40 CFR 82):
This product does not contain any components listed as a Hazardous Air Pollutant, Flammable Substance, Toxic Substance, or Class 1 or 2 Ozone Depletor

CWA (Clean Water Act)
This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42).

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

Food and Drug Administration (FDA)

Carbon Black is permitted for food contact when used as a filler in rubber articles intended for repeated use under 21 CFR (code of Federal Regulations) 177.2600.

LIMITATIONS:

-Total carbon black (channel process and furnace process) in the rubber may not exceed 50% by weight of the rubber products. Cabot carbon blacks are furnace process blacks.

- Not for use in contact with infant formula and human milk (see TOR 2016-002).

Pharmaceutical Information
Not permitted.

US State Regulations

California Proposition 65
This product contains the following Proposition 65 chemicals.

• "carbon black (airborne, unbound particles of respirable size)" is a California Proposition 65 listed substance. Please note that all three listing qualifiers (airborne, unbound (not bound within a matrix), and respirable size (10 micrometers or less in diameter)) must be met for this substance to be considered a Proposition 65 substance. Please contact your sales representative for additional information.
• Certain polycyclic aromatic hydrocarbons (PAHs) that may be found adsorbed onto the surface of carbon black are California Proposition 65 listed substances.
• “Carbon-black extracts” is a California Proposition 65 listed substance.
• Certain metals, including arsenic, cadmium, lead, mercury, or nickel, may be present on and/or in carbon black and are California Proposition 65 listed substances.

U.S. State Right-to-Know Regulations

Chemical name	New Jersey	Massachusetts	Pennsylvania	Louisiana:
Carbon Black 1333-86-4	X	X	X	

16. OTHER INFORMATION

Carbon Black Extracts:
Manufactured carbon blacks generally contain less than 0.1% of solvent extractable polycyclic aromatic hydrocarbons (PAH). Solvent extractable PAH content depends on numerous factors including, but not limited to, the manufacturing process, desired product specifications, and the analytical procedure used to measure and identify solvent extractable materials. Questions concerning PAH content of carbon black and analytical procedures should be addressed to your carbon black supplier

Cosmetic Use:
Cabot Corporation does not support the use of this product in any cosmetic application.

References:

Borm, P.J.A., Cakmak, G., Jermann, E., Weishaupt C., Kempers, P., van Schooten,FJ., Oberdorster, G., Schins, RP. (2005) Formation of PAH-DNA adducts after in-vivo and vitro exposure of rats and lung cell to different commercial carbon blacks. Tox.Appl. Pharm. 1:205(2):157-67.

Buechte, S, Morfeld, P, Wellmann, J, Bolm-Audorff, U, McCunney, R, Piekarski, C. (2006) Lung cancer mortality and carbon black exposure – A nested case-control study at a German carbon black production plant. J.Occup. Env.Med. 12: 1242-1252.

Dell, L, Mundt, K, Luipold, R, Nunes, A, Cohen, L, Heidenreich, M, Bachand, A. (2006) A cohort mortality study of employees in the United States carbon black industry. J.Occup. Env. Med. 48(12): 1219-1229.

Driscoll KE, Deyo LC, Carter JM, Howard BW, Hassenbein DG and Bertram TA (1997) Effects of particle exposure and particle-elicited inflammatory cells on mutation in rat alveolar epithelial cells. Carcinogenesis 18(2) 423-430.

Gardiner K, van Tongeren M, Harrington M. (2001) Respiratory health effects from exposure to carbon black: Results of the phase 2 and 3 cross sectional studies in the European carbon black manufacturing industry. Occup. Env. Med. 58: 496-503.

Harber P, Muranko H, Solis S, Torossian A, Merz B. (2003) Effect of carbon black exposure on respiratory function and symptoms. J. Occup. Env. Med. 45: 144-55.

ILSI Risk Science Institute Workshop: The Relevance of the Rat Lung Response to Particle to Particle Overload for Human Risk Assessment. Inh. Toxicol. 12:1-17 (2000).

International Agency for Research on Cancer: IARC Monographs on the Evaluation of Carcinogenic Risks to Humans (2010), Vol. 93, February 1-14, 2006, Carbon Black, Titanium Dioxide, and Talc. Lyon, France.

Morfeld P, Büchte SF, Wellmann J, McCunney RJ, Piekarski C (2006). Lung cancer mortality and carbon black exposure: Cox regression analysis of a cohort from a German carbon black production plant. J. Occup.Env.Med.48(12):1230-1241.

Morfeld P and McCunney RJ, (2009). Carbon Black and lung cancer testing a novel exposure metric by multi-model inference. Am. J. Ind. Med. 52: 890-899.

Sorahan T, Hamilton L, van Tongeren M, Gardiner K, Harrington JM (2001). A cohort mortality study of U.K. carbon black workers, 1951-1996. Am. J. Ind. Med. 39(2):158-170.

Sorahan T, Harrington JM (2007) A ''Lugged'' Analysis of Lung Cancer Risks in UK Carbon Black Production Workers, 1951–2004. Am. J. Ind. Med. 50, 555–564.

In compliance with Mexican regulation NMX-R-019-SCFI-2011, the following is the Mexican supplier:

CABOT SPECIALTY CHEMICALS MEXICO, SAPI DE CV-Planta Altamira
Carretera Tampico-Mante Km. 13.5
Col. Laguna de la Puerta, CP 89603
Altamira, Tamps. México
Tel. (833) 229 05 63
Fax. (833) 229 03 53
RFC NHU920612M83
Web:www.nhumo.com.mx

Disclaimer:
The information set forth is based on information that Cabot Corporation believes to be accurate. No warranty, expressed or implied, is intended. The information is provided solely for your information and consideration and Cabot assumes no legal responsibility for use or reliance thereon. In the event of a discrepancy between the information on the non-English document and its English counterpart, the English version shall supersede.

Prepared by: Cabot Corporation - Safety, Health and Environmental Affairs
Revision date: 29-Jan-2018

End of Safety Data Sheet

1.) Identification of the substance/preparation and of the company/undertaking

Identification of the substance or preparation

Trade name

TIMREX Synthetic Graphite

Company/undertaking identification

Address

TIMCAL AG
-
CH-6743 Bodio (Switzerland)

Telephone no. +41 91 873 20 10

Fax no. +41 91 873 20 19

Information provided by / telephone

Technological Development

Emergency telephone

For Chemical Emergency ONLY (spill, leak, fire, exposure or accident), call CHEMTREC at +1 800 424 9300.
For ALL other inquiries about this product, call Timcal at
+41 91 873 20 10 (Monday - friday: 7.30 - 12.00, 13.15 - 17.15 h).

Supplier

Address

TIMCAL AMERICA INC.
Representative Office
29299 Clemens Road 1-L
Westlake, Ohio 44145 USA

Telephone no. +1-440-871-7504

Fax no. +1-440-871-6026

2.) Hazards identification

Potential Health Effects

Eye

May cause eye irritation.

Skin

May cause skin irritation.

Inhalation

May cause respiratory tract irritation.

Ingestion

No hazard in normal industrial use.

Cancer

None of the components present in this material at concentrations equal or greater than 0.1% is listed by IARC, NTP, OSHA or ACGIH as a carcinogen.

3.) Composition / information on ingredients

Chemical characterization

Synthetic graphite powder, free of crystalline silica (quartz)

Substance / product identification

CAS no.	7782-42-5
Molecular weight	12.01
Formula	C1

4.) First aid measures

General information

In case of persisting adverse effects, consult a physician. Remove contaminated clothing and shoes immediately, and launder thoroughly before reusing.

After inhalation

Remove from exposure. Remove to fresh air. If not breathing, give artificial respiration If breathing is difficult give Oxygen. Get medical attention.

After skin contact

Wash with soap and water.

After eye contact

Hold eyelids apart and flush eyes with plenty of water for at least 15 minutes.

After ingestion

Rinse mouth thoroughly with water. Seek medical advice immediately. Never give anything by mouth to an unconscious person.

5.) Firefighting measures

Suitable extinguishing media

Graphite is difficult to combust. Extinguishing measures to suit surroundings.

Special exposure hazards arising from the substance or preparation itself, its combustion products or from resulting gases

In the event of fire, the following can be released:
Carbon monoxide (CO)
Carbon dioxide (CO_2)

Special protective equipment for firefighting

As in any fire, wear self-contained breathing apparatus pressure - demand, MSHA/ NIOSH (approved or equivalent) and full protective gear.

6.) Accidental release measures

Personal precautions

Refer to protective measures listed in sections 7 and 8. Avoid contact with skin, eyes and clothing. Ensure adequate ventilation. Avoid dust formation. High risk of slipping due to leakage/spillage of product.

Environmental precautions

Do not discharge into the drains/surface waters/groundwater.

Methods for cleaning up/taking up

Pick up mechanically. Send in suitable containers for recovery or disposal.

7.) Handling and storage

Handling

Advice on safe handling

Provide good ventilation of working area (local exhaust ventilation if necessary). If workplace exposure limits are exceeded, respiratory protection approved for this particular job must be worn.

Advice on protection against fire and explosion

Dust can form an explosive mixture with air. Take precautionary measures against static charges. Keep away from sources of heat and ignition.

Storage

Requirements for storage rooms and vessels

Containers which are opened must be carefully resealed and kept upright to prevent leakage. Always keep in containers of same material as the original one.

Further information on storage conditions

Keep container tightly closed and dry.

8.) Exposure controls / personal protection

Exposure limit values

Graphite

CAS no.	7782-42-5
EC no.	231-955-3

ACGIH

Graphite (all forms except graphite fibers)

TWA	2	mg/m³

Personal protective equipment

Respiratory protection

A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements must be followed whenever workplace conditions warrant a respirator's use.

Hand protection

Wear appropriate gloves to prevent skin exposure. Before use, the protective glove should be tested in any case for its specific work-station suitability (i.e. mechanical resistance, product compatibility and antistatic properties). Adhere to the manufacturer's instructions and information relating to the use, storage, care and replacement of protective gloves. Protective gloves shall be replaced immediately when physically damaged or worn. Design operations thus to avoid permanent use of protective gloves. The glove(s) listed below may provide protection against permeation. Gloves of other chemically resistant materials may not provide adequate protection.

Appropriate Material	rubber

Eye protection

Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133.

Skin protection

Wear appropriate clothing to minimize contact with skin.

General protective and hygiene measures

Do not eat, drink or smoke during work time. Keep away from foodstuffs and beverages. Avoid contact with eyes and skin. Remove soiled or soaked clothing immediately. Wash hands before breaks and after work. Do not inhale dust. Hold eye wash fountain available.

9.) Physical and chemical properties

General information

Form	powder
Color	grey to black
Odor	odorless

Important health, safety and environmental information

Changes in physical state

Type	Melting point		
Value	appr.	3500	℃

Flash point

Remarks	not applicable

Ignition temperature

Value	>	570 -	740	℃
Reference substance	dispersed dust cloud			
Value	>		365	℃
Reference substance	deposited dust			

Vapor pressure

Value	<	0.01	mbar
Reference temperature	20	℃	

Density

Value	2.08	-	2.30	g/cm³
Reference temperature	25	℃		

Bulk density

Value	70	-	720	kg/m³

Solubility in water

Value	<	0.001	g/l

Other information

Flammability BZ1: not burning (100 ℃), source of i gnition: glowing platinium wire, 1000 ℃ approx.
Impact sensitivity: not impact sensitive

10.) Stability and reactivity

Materials to avoid

Fluorine; Chlorine trifluoride

Hazardous decomposition products

No hazardous decomposition products known.

11.) Toxicological information

Acute toxicity

Acute oral toxicity

LD50	>	2000	mg/kg
Species	rat		
Method	OECD 401		

Irritant/corrosive effects

Irritant effect on skin

Species	rabbit	
Duration of exposure	4	h
Evaluation	non-irritant	
Method	OECD 404	

Irritant effect on eyes

Species	rabbit
Evaluation	slightly irritant
Method	OECD 405

Experience in practice

Contact with skin and eyes may lead to mechanical irritation.
Inhalation of dusts may irritate the respiratory tract.

12.) Ecological information

Persistence and degradability

Biodegradability

Evaluation	not degradable

13.) Disposal considerations

Product

Dispose in accordance with federal, state and local regulations.

14.) Transport information

Other information

The product is not defined under USDOT, IMDG or ICAO/IATA regulations as a hazardous material.
Canada: The product is not defined under Transport Dangerous Goods Directorate regulations as a hazardous material.

15.) Regulatory information

Regulations

US Federal Regulations

TSCA (Toxic Substances Control Act)
Is listed on the TSCA inventory.
CAS-No. 7782-42-5

Clean Air Act:
None of the ingredients is listed.

Clean Water Act (CWA):
None of the ingredients is listed.

OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200)
This product is not classified as hazardous in accordance with US OSHA Hazard Communication Standard 29 CFR, Appendix A to § 1910.1200.

SARA Section 302 (RQ):
None of the ingredients is listed.

SARA HAZARD CATEGORY (Section 311/312)
This product is not classified as hazardous in accordance with US OSHA Hazard Communication Standard 29 CFR, Appendix A to § 1910.1200.

SARA Section 313 INFORMATION:
None of the ingredients is listed.

HAPS (Hazardous Air Pollutants):
None of the ingredients is listed.

IARC
None of the ingredients is listed.

State Regulations

New Jersey Worker and Community Right to Know Act.
None of the ingredients is listed.

California Proposition 65.
None of the ingredients is listed.

Pennsylvania HAZARDOUS SUBSTANCE LIST
Following ingredients are listed:
CAS-No. 7782-42-5

Canada Federal Regulations

DSL/NDSL (Canada)
Listed on DSL inventory.
CAS-No. 7782-42-5

Workplace Hazardous Materials Information System (WHMIS) - Canada
This product had 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.
WHMIS Classification: not classified as hazardous

National Pollutant Release Inventory - Appendix 1 - Canada.
None of the ingredients is listed.

National Pollutant Release Inventory - Appendix 2 - Canada.
None of the ingredients is listed.

National regulations

Other regulations, restrictions and prohibition regulations
The product is listed on the following inventories:
European Inventory of Existing Chemical Substances (EINECS)
Australian Inventory of Chemical Substances (AICS)
Korea (KECI, Nr. KE-18101)
Philippines Inventory of Chemicals and Chemical Substances (PICCS)
New Zealand: not subject to the provisions of the HSNO Act.
Inventory of Existing Chemical Substances Manufactured or Imported in China (IECSC)
MITI/ENCS (Japan)
Toxic Substances Control Act (TSCA)
Domestic Substance List, DSL (Canada)

16.) Other information

HMIS Classification

Health	1
Flammability :	0
Reactivity	0
PPE	C

Other information

Abbreviations:
ACGIH American Conference of Governmental Hygienics
CAS Chemical Abstracts Service
HAPS Hazardous Air Pollutants
HMIS Hazardous Material Identifikation System
IARC International Agency for Research on Cancer
IDLH Immediate Dangerous to Life and Health
LEL Lower Explosion Limit
NTP National Toxicology Program
OEL Occupational Exposure Limit
OSHA Occupational Safety and Health Administration
PEL Permissible Exposure Limit
PPE Personal Protection Equipment
SARA Superfund Amendments and Reauthorization Act
STEL Short-Term Exposure Level (15 minutes)
TWA Time-Weighted Average (8 hours)
UEL Upper Explosion Limit
VOC Volatile Organic Compounds
WEEL Workplace Environmental Exposure Level
Canadian Abbreviations:
DSL Domestic Substance List
NDSL Non-Domestic Substance List
NPRI National Pollutant Release Inventory
TDG Transport Dangerous Goods Directorate
WHMIS Workplace Hazardous Materials Information System

Department issuing safety data sheet

UMCO Umwelt Consult GmbH
Georg-Wilhelm-Str. 183 b, D-21107 Hamburg
Tel.: +49 40 / 41 92 13 00 Fax: +49 40 / 41 92 13 57 e-mail: umco@umco.de

This information is based on our present state of knowledge. However, it should not constitute a guarantee for any specific product properties and shall not establish a legally valid relationship.

SAFETY DATA SHEET

Prepared in accordance with the United States Hazard Communication Standard: 29 CFR 1910.1200 (2012)

Revision date: 29-Jan-2018

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Product name: VULCAN® XC72R Carbon Black

Product code: VXC72R

Synonyms: Carbon Black, Furnace Black

This SDS is valid for the following grades: Carbon Black grade series: BLACK PEARLS®, ELFTEX®, MOGUL®, MONARCH®, REGAL®, SPHERON®, STERLING®, VULCAN®, CSX™, CRX™, IRX™, FCX™, SHOBLACK™, DL™, PROPEL®, LITX®, and PBX® carbon black. Oxidized grades include: BLACK PEARLS® / MOGUL® L, BLACK PEARLS® / MOGUL® E, MOGUL® H, and REGAL® 400/400R carbon black. ***Excludes: BLACK PEARLS® / MONARCH® 1000, 1300, 1400, 1500; BLACK PEARLS® 1300B1; Monarch® 4750; and Black Pearls® 4350/4750 carbon black; and all oil pellet grades.**.

Recommended use: Additive/Filler for plastic and rubber, Pigment, Chemical reagent, Batteries, Refractories, Various

Restrictions on use: Not Applicable.

Supplier:

Cabot Corporation
800 Tashmoo Avenue
Sarnia,
Ontario N7T 7N4
CANADA
Tel: +1 519 336 2261
Fax: +1 519 339 8273

Cabot Corporation
157 Concord Road
Billerica, MA 01821
UNITED STATES
Tel: 1-978-663-3455
Fax: 1-978-670-6955

Emergency Telephone Number: US: CHEMTREC: 1-800-424-9300 or 1-703-527-3887
International CHEMTREC: +1 703-741-5970 or +1-703-527-3887

2. HAZARDS IDENTIFICATION

Classification

OSHA Regulatory Status: This chemical is considered hazardous by the United States 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200).

Combustible dust

Label Elements:

Pictogram:	None
Signal Word:	WARNING
Hazard statements:	May form combustible dust concentrations in air
Precautionary Statements - Prevention	• Keep away from all ignition sources including heat, sparks and flame • Prevent dust accumulations to minimize explosion hazard

Hazards not otherwise classified (HNOC)

Do not expose to temperatures above 300°C. Hazardous products of combustion can include carbon monoxide, carbon dioxide, oxides of sulfur, and organic products.

Potential health effects

Principle Routes of Exposure:	Inhalation, Eye contact, Skin Contact
Eye Contact:	May cause mechanical irritation. Avoid contact with eyes.
Skin Contact:	May cause mechanical irritation, soiling, and skin drying. Avoid contact with skin. No cases of sensitization in humans have been reported.
Inhalation:	Dust may be irritating to respiratory tract. Provide appropriate local exhaust ventilation at machinery and at places where dust can be generated. See also Section 8.
Ingestion:	Adverse health effects are not expected. See Section 11.
Carcinogenicity:	Carbon Black is listed as an IARC (International Agency for Research on Cancer) Group 2B substance (possibly carcinogenic to humans). See also Section 11.
Target Organ Effects:	Lungs, See Section 11
Medical Conditions Aggravated by Exposure:	Asthma, Respiratory disorder
Potential Environmental Effects:	None known. See Section 12.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Synonyms: Carbon Black, Furnace Black.

Chemical name	CAS No	weight-%	Trade secret
Carbon Black	1333-86-4	100	

4. FIRST AID MEASURES

FIRST AID MEASURES

Skin Contact Wash thoroughly with soap and water. Seek medical attention if symptoms develop.

Eye contact Flush eyes immediately with large amounts of water for 15 minutes. Seek medical attention if symptoms develop.

Inhalation If cough, shortness of breath or other breathing problems occur, move to fresh air. Seek medical attention if symptoms persist. If necessary, restore normal breathing through standard first aid measures.

Ingestion Do not induce vomiting. If conscious, give several glasses of water. Never give anything by mouth to an unconscious person.

Most important symptoms and effects, both acute and delayed

Symptoms: The most important known symptoms and effects are described in Section 2 and/or in Section 11.

Indication of any immediate medical attention and special treatment needed

Note to physicians: Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Suitable Extinguishing Media: Use foam, carbon dioxide (CO2), dry chemical or water spray. A fog is recommended if water is used.

Unsuitable Extinguishing Media: DO NOT USE a solid water stream as it may scatter and spread fire. DO NOT USE high pressure media which could cause formation of a potentially explosible dust-air mixture.

Specific hazards arising from the chemical: It may not be obvious that carbon black is burning unless the material is stirred and embers and/or sparks are apparent. Carbon black that has been on fire should be observed closely for at least 48 hours to ensure no smoldering material is present. Burning produces irritant fumes. The product is insoluble and floats on water. If possible, try to contain floating material.

Hazardous combustion products: Carbon monoxide (CO). Carbon dioxide (CO2). Sulphur oxides.

Protective equipment and precautions for firefighters: Wear suitable protective equipment. In the event of fire, wear self-contained breathing apparatus. Wet carbon black produces very slippery walking surfaces.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal precautions: CAUTION: Wet carbon black produces slippery walking surfaces. Avoid dust formation.

Ensure adequate ventilation. Use personal protective equipment. See also Section 8.

Environmental Precautions:

Environmental Precautions: Contain spilled product on land, if possible. The product is insoluble and floats on water. Any product that reaches water should be contained. Local authorities should be advised if spillages cannot be contained.

Methods and material for containment and cleaning up

Methods for containment: Prevent further leakage or spillage if safe to do so.

Methods for cleaning up: If the spilled material contains dust or has the potential to create dust, use explosion-proof vacuums and/or cleaning systems suitable for combustible dusts. Use of a vacuum with high efficiency particulate air (HEPA) filtration is recommended. Do not create a dust cloud by using a brush or compressed air. Dry sweeping is not recommended. Water spray will produce very slippery walking surfaces and will not result in satisfactory removal of carbon black contamination. Pick up and transfer to properly labelled containers. See Section 13.

7. HANDLING AND STORAGE

Precautions for safe handling

Advice on safe handling: Avoid contact with skin and eyes. Avoid dust formation. Do not breathe dust. Provide appropriate local exhaust ventilation at machinery and at places where dust can be generated. Do not create a dust cloud by using a brush or compressed air. Dust may form explosible mixture in air.

Take precautionary measures against static discharges. All metal parts of the mixing and processing equipment must be earthed/grounded. Ensure all equipment is electrically earthed/grounded before beginning transfer operations. Fine dust is capable of penetrating electrical equipment and may cause electrical shorts. If hot work (welding, torch cutting, etc.) is required the immediate work area must be cleared of carbon black product and dust.

Conditions for safe storage, including any incompatibilities

Storage Conditions: Keep in a dry, cool and well-ventilated place. Keep away from heat and sources of ignition. Do not store together with strong oxidizing agents. Do not store together with volatile chemicals as they may be adsorbed onto product. Keep in properly labeled containers.

Carbon black is not classifiable as a Division 4.2 self-heating substance under the UN test criteria. However, the UN criteria for determining if a substance is self-heating is volume dependent, i.e., the auto-ignition temperature decreases with increasing volume. This classification may not be appropriate for large volume storage containers.

Before entering vessels and confined spaces containing carbon black, test for adequate oxygen, flammable gases and potential toxic air contaminants. Dust deposits should not be allowed to accumulate on surfaces, as these may form an explosible mixture if they are released in the atmosphere in sufficient concentrations.

Incompatible materials: Strong oxidizing agents.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Exposure guidelines: The table below is a summary. Please see the specific legislation for complete information.

Carbon Black, CAS RN 1333-86-4:

Argentina: 3.5 mg/m³, TWA
Australia: 3.0 mg/m³, TWA inhalable
Belgium: 3.6 mg/m³, TWA
Brasil: 3.5 mg/m³, TWA
Canada (Ontario): 3.0 mg/m³, TWA inhalable
China: 4.0 mg/m³, TWA; 8.0 mg/m³, STEL
Colombia: 3.0 mg/m³, TWA inhalable
Czech Republic: 2.0 mg/m³, TWA
Finland: 3.5 mg/m³, TWA; 7.0 mg/m³, STEL
France - INRS: 3.5 mg/m³, TWA/VME inhalable
Hong Kong: 3.5 mg/m³, TWA
Indonesia: 3.5 mg/m³, TWA/NABs
Ireland: 3.5 mg/m³, TWA; 7.0 mg/m³, STEL
Italy: 3.0 mg/m³, TWA inhalable
Japan SOH: 4.0 mg/m³, TWA; 1.0 mg/m³, TWA respirable
Korea: 3.5 mg/m³, TWA
Malaysia: 3.5 mg/m³, TWA
Netherlands - MAC: 3.5 mg/m³, TWA inhalable
Mexico: 3.5 mg/m³, TWA
Norway: 3.5 mg/m³, TWA
Poland: 4.0 mg/m³ TWA (NDS) (applies to carbon black containing benzo(a)pyrene <35 mg in 1 kg of carbon black, total inhalable dust)
Sweden: 3.0 mg/m³, TWA
United Kingdom - WEL: 3.5 mg/m³, TWA inhalable; 7.0 mg/m³, STEL inhalable
US ACGIH - TLV: 3.0 mg/m³, TWA inhalable
US OSHA - PEL: 3.5 mg/m³, TWA

NOTE:

(1) Unless otherwise indicated as "respirable" or "inhalable", the exposure limit represents a "total" value. The inhalable exposure limit has been demonstrated to be more restrictive than the total exposure limit, by a factor of approximately 3.
(2) In its facilities globally, Cabot Corporation manages to the US ACGIH TLV of 3.0 mg/m³ TWA inhalable.

AGW: Arbeitsplatzgrenzwert
INRS: Institut National de Recherche et de Securite (National Institute of Research and Security)
MAC: Maximaal Aanvaarde Concentraties (Maximum allowed concentration)
MHLW: Ministry of Health, Labor and Welfare
NABS: Nilai Ambang Batas (threshold limit value)
NDS: Najwyzsze dopuszczalne stezenie (8-hour occupational exposure limit)
OEL: Occupational Exposure Limit
PEL: Permissible Exposure Limit
SOH: Society of Occupational Health
STEL: Short Term Exposure Limit
TLV: Threshold Limit Value
TRGS: Technische Regeln für Gefahrstoffe (Technical Rule for Hazardous Materials)
TWA: Time Weighted Average
US ACGIH: United States American Conference of Governmental Industrial Hygienists
US OSHA: United States Occupational Safety and Health Administration
VME: Valeur Moyenne d'Exposition (Average Level of Exposure)
WEL: Workplace Exposure Limit
VLA-ED: Valor límite ambiental de exposicíon diaria (environmental value of daily exposure limit)

Engineering Controls: Ensure adequate ventilation to maintain exposures below occupational limits. Provide appropriate local exhaust ventilation at machinery and at places where dust can be generated.

Personal protective equipment [PPE]

Respiratory Protection: An approved air-purifying respirator (APR) for particulates may be permissible where airborne concentrations are expected to exceed occupational exposure limits. Protection provided by air-purifying respirators is limited. Use a positive-pressure, air supplied respirator if there is any potential for uncontrolled release, exposure levels are not known, or any circumstances where air-purifying respirators may not provide adequate protection. Use of respirators must include a complete respiratory protection program in accordance with national standards and current best practices.

The following agencies/organizations approve respirators and/or criteria for respirator programs:

US: NIOSH approval under 42 CFR 84 required. OSHA (29 CFR 1910.134). ANSI Z88.2-1992 (Respiratory Protection).

EU: CR592 Guidelines for the Selection and Use of Respiratory Protection.

Germany: DIN/EN 143 Respiratory Protective Devices for Dusty Materials.

UK: BS 4275 Recommendations for the Selection, Use and Maintenance of Respiratory Protective Equipment. HSE Guidance Note HS (G)53 Respiratory Protective Equipment.

Hand Protection: Wear protective gloves to prevent soiling of hands. Use protective barrier cream before handling the product. Wash hands and other exposed skin with mild soap and water.

Eye/face Protection: Wear eye/face protection. Wear safety glasses with side shields (or goggles).

Skin and Body Protection: Wear suitable protective clothing. Wash clothing daily. Work clothing should not be allowed out of the workplace.

Other: Handle in accordance with good industrial hygiene and safety practice. Emergency eyewash and safety shower should be located nearby.

Environmental exposure controls: In accordance with all local legislation and permit requirements.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Solid	**Odor:**	None.
Appearance:	Black powder or pellets	**Odor threshold:**	Not Applicable
Color:	Black		

Property	**Values**	**Remarks • Method**
pH:	2-11	2-4 (oxidized carbon black) and 4-11 (non-oxidized carbon black), 50 g/l water, 68ºF (20ºC), ASTM 1512
Melting point/freezing point:		Not Applicable
Boiling point / boiling range:		Not Applicable
Evaporation Rate:		Not Applicable

Vapor pressure:		Not Applicable
Vapor Density:		Not Applicable
Density:	1.7-1.9 g/cm3	@ 20 °C
Bulk Density:	200-680 kg/m³	(Pellets)
	20-380 kg/m³	(powder)
Specific Gravity at 20°C:	1.7-1.9	
Water solubility:	Insoluble	
Solubility(ies):	Insoluble	
Partition Coefficient (n-octanol/water):		Not Applicable
Decomposition temperature:		Not Applicable
Viscosity:		Not Applicable
Kinematic viscosity:		Not Applicable
Dynamic viscosity:		Not Applicable
Oxidizing Properties:		Not Applicable
Softening point:		Not Applicable
VOC content (%):		No information available
% Volatile (by Volume):		No information available
% Volatile (by Weight):	< 2.5%	(950ºC) non-oxidized carbon black
	2 - 8%	(oxidized carbon black)
Surface Tension:		No information available
Explosive properties:		Dust may form explosible mixture in air

Flash Point:		Not Applicable
Flammability (solid, gas):		No information available
Flammability Limit in Air:		No information available
Explosion Limits in Air - Upper (g/m³):		No information available
Explosion Limits in Air - Lower (g/m³):	50 g/m³	dust
Autoignition Temperature:	> 140 °C	(transport) IMDG-Code
Minimum Ignition Temperature:	> 500 °C	(BAM Furnace) VDI 2263 (cloud)
	> 400 °C	VDI 2263 (layer)
Minimum Ignition Energy:	> 10,000 mJ	VDI 2263
Ignition Energy:		No information available
Maximum Absolute Explosion Pressure:	10 bar	VDI 2263 10 bar at an initial starting pressure of 1 bar. Higher starting initial pressures will yield higher explosion pressures
Maximum Rate of Pressure Rise:	30 - 400 bar/sec	VDI 2263 and ASTM E1226-88
Burn Velocity:	> 45 seconds	(not classifiable as "Highly Flammable", or "Easily Ignitable")
Kst Value:		No information available
Dust Explosion Classification:	ST1	

10. STABILITY AND REACTIVITY

Reactivity: May react exothermically upon contact with strong oxidizers.

Stability: Stable under recommended handling and storage conditions.

Possibility of hazardous reactions: None under normal processing.

Hazardous polymerization: Hazardous polymerization does not occur.

Conditions to avoid: Do not expose to temperatures above 300°C. Keep away from heat and sources of ignition. Avoid dust formation.

Incompatible materials: Strong oxidizing agents.

Explosion data See also Section 9.

Sensitivity to Mechanical Impact: Not sensitive to mechanical impact.

Sensitivity to Static Discharge: Dust may form explosible mixture in air. Avoid dust formation. Do not create a dust cloud by using a brush or compressed air. Take precautionary measures against static discharges. All metal parts of the mixing and processing equipment must be earthed/grounded. Ensure all equipment is electrically earthed/grounded before beginning transfer operations.

Hazardous decomposition products: Carbon monoxide (CO). Carbon dioxide (CO_2). Sulfur oxides. Organic products of combustion.

11. TOXICOLOGICAL INFORMATION

Acute toxicity

Oral LD50: LD50/oral/rat = > 8000 mg/kg. (Equivalent to OECD TG 401).

Inhalation LC50: No data available

Dermal LD50: No data available.

Assessment: Non-toxic after ingestion.

Skin corrosion/irritation: Rabbit: not irritating. (Equivalent to OECD TG 404)
Edema = 0 (max. attainable irritation score: 4)
Erythema = 0 (max. attainable irritation score: 4)

Assessment: Not irritating to skin

Serious eye damage/eye irritation: Rabbit: not irritating. (OECD TG 405). Cornea: 0 (max. attainable irritation score: 4). Iris: 0 (max. attainable irritation score: 2). Conjunctivae: 0 (max. attainable irritation score: 3). Chemosis: 0 (max. attainable irritation score: 4).

Assessment: Not irritating to the eyes.

Sensitization: Guinea pig skin (Buehler Test): Not sensitizing (OECD TG 406).

Assessment: Not sensitizing in animals. No cases of sensitization in humans have been reported.

Germ Cell Mutagenicity *In Vitro*

Carbon black is not suitable to be tested in bacterial (Ames test) and other in vitro systems because of its insolubility. However, when organic solvent extracts of carbon black have been tested, results showed no mutagenic effects. Organic solvent extracts of carbon black can contain traces of polycyclic aromatic hydrocarbons (PAHs). A study to examine the bioavailability of these PAHs showed that PAHs are very tightly bound to carbon black and not bioavailable. (Borm, 2005)

In Vivo

In an experimental investigation, mutational changes in the hprt gene were reported in alveolar epithelial cells in the rat following inhalation exposure to carbon black. This observation is believed to be rat specific and a consequence of "lung overload" (Driscoll, 1997) which led to chronic inflammation and release of reactive oxygen species. This is considered to be a secondary genotoxic effect and, thus, carbon black itself would not be considered to be mutagenic,

Assessment: In vivo mutagenicity in rats occurs by mechanisms secondary to a threshold effect and is a consequence of "lung overload," which leads to chronic inflammation and the release of genotoxic oxygen species. This mechanism is considered to be a secondary genotoxic effect and, thus, carbon black itself would not be considered to be mutagenic.

Carcinogenicity:

ANIMAL TOXICITY:

Rat, oral, duration 2 years.
Effect: no tumors.

Mouse, oral, duration 2 years.
Effect: no tumors.

Mouse, dermal, duration 18 months.
Effect: no skin tumors.

Rat, inhalation, duration 2 years.
Target organ: lungs.
Effect: inflammation, fibrosis, tumors.

Note: Tumors in the rat lung are considered to be related to the "lung overload" rather than to a specific chemical effect of carbon black itself in the lung. These effects in rats have been reported in many studies on other poorly soluble inorganic particles and appear to be rat specific (ILSI, 2000). Tumors have not been observed in other species (i.e., mouse and hamster) for carbon black or other poorly soluble particles under similar circumstances and study conditions.

MORTALITY STUDIES (HUMAN DATA):

A study on carbon black production workers in the UK (Sorahan, 2001) found an increased risk of lung cancer in two of the five plants studied; however, the increase was not related to the dose of carbon black. Thus, the authors did not consider the increased risk in lung cancer to be due to carbon black exposure. A German study of carbon black workers at one plant (Morfeld, 2006; Buechte, 2006) found a similar increase in lung cancer risk but, like the Sorahan, 2001 (UK study), found no association with carbon black exposure. A large US study of 18 plants showed a reduction in lung cancer risk in carbon black production workers (Dell, 2006). Based upon these studies, the February 2006 Working Group at the International Agency for Research on Cancer (IARC) concluded that the human evidence for carcinogenicity was inadequate (IARC, 2010).

Since the IARC evaluation of carbon black, Sorahan and Harrington (2007) have re-analyzed the UK study data using an alternative exposure hypothesis and found a positive association with carbon black exposure in two of the five plants. The same exposure hypothesis was applied by Morfeld and McCunney (2009) to the German

cohort; in contrast, they found no association between carbon black exposure and lung cancer risk and, thus, no support for the alternative exposure hypothesis used by Sorahan and Harrington.

Overall, as a result of these detailed investigations, no causative link between carbon black exposure and cancer risk in humans has been demonstrated.

IARC CANCER CLASSIFICATION:

In 2006 IARC re-affirmed its 1995 finding that there is "inadequate evidence" from human health studies to assess whether carbon black causes cancer in humans. IARC concluded that there is "sufficient evidence" in experimental animal studies for the carcinogenicity of carbon black. IARC's overall evaluation is that carbon black is "possibly carcinogenic to humans (Group 2B)". This conclusion was based on IARC's guidelines, which generally require such a classification if one species exhibits carcinogenicity in two or more animal studies (IARC, 2010).

Solvent extracts of carbon black were used in one study of rats in which skin tumors were found after dermal application and several studies of mice in which sarcomas were found following subcutaneous injection. IARC concluded that there was "sufficient evidence" that carbon black extracts can cause cancer in animals (Group 2B).

ACGIH CANCER CLASSIFICATION:

Confirmed Animal Carcinogen with Unknown Relevance to Humans (Category A3 Carcinogen).

ASSESSMENT:

Applying the guidelines of self-classification under the Globally Harmonized System of Classification and Labeling of Chemicals, carbon black is not classified as a carcinogen. Lung tumors are induced in rats as a result of repeated exposure to inert, poorly soluble particles like carbon black and other poorly soluble particles. Rat tumors are a result of a secondary non-genotoxic mechanism associated with the phenomenon of lung overload. This is a species-specific mechanism that has questionable relevance for classification in humans. In support of this opinion, the CLP Guidance for Specific Target Organ Toxicity – Repeated Exposure (STOT-RE), cites lung overload under mechanisms not relevant to humans. Human health studies show that exposure to carbon black does not increase the risk of carcinogenicity.

Reproductive and Developmental Toxicity:

ASSESSMENT: No effects on reproductive organs or fetal development have been reported in long-term repeated dose toxicity studies in animals.

STOT - single exposure:

ASSESSMENT: Based on available data, specific target organ toxicity is not expected after single oral, single inhalation, or single dermal exposure.

STOT - repeated exposure:

ANIMAL TOXICITY:

Repeated dose toxicity: inhalation (rat), 90 days, No Observed Adverse Effect Concentration (NOAEC) = 1.1 mg/m^3 (respirable). Target organ effects at higher doses are lung inflammation, hyperplasia, and fibrosis.

Repeated dose toxicity: oral (mouse), 2 yrs, No Observed Effect Level (NOEL) = 137 mg/kg

(body wt.)

Repeated dose toxicity: oral (rat), 2 yrs, NOEL = 52 mg/kg (body wt.)

Although carbon black produces pulmonary irritation, cellular proliferation, fibrosis, and lung tumors in the rat under conditions of "lung overload", there is evidence to demonstrate that this response is principally a species-specific response that is not relevant to humans.

MORBIDITY STUDIES (human data):

Results of epidemiological studies of carbon black production workers suggest that cumulative exposure to carbon black may result in small, non-clinical decrements in lung function. A U.S. respiratory morbidity study suggested a 27 ml decline in FEV1 from a 1 mg/m^3 8 hour TWA daily (inhalable fraction) exposure over a 40-year period (Harber, 2003). An earlier European investigation suggested that exposure to 1 mg/m^3 (inhalable fraction) of carbon black over a 40-year working lifetime would result in a 48 ml decline in FEV1 (Gardiner, 2001). However, the estimates from both studies were only of borderline statistical significance. Normal age-related decline over a similar period of time would be approximately 1200 ml.

In the U.S. study, 9% of the highest non-smokers exposure group (in contrast to 5% of the unexposed group) reported symptoms consistent with chronic bronchitis. In the European study, methodological limitations in the administration of the questionnaire limit the conclusions that can be drawn about reported symptoms. This study, however, indicated a link between carbon black and small opacities on chest films, with negligible effects on lung function.

INHALATION ASSESSMENT:

Applying the guidelines of self-classification under GHS, carbon black is not classified under STOT-RE for effects on the lung. Classification is not warranted on the basis of the unique response of rats resulting from the “lung overload” following exposure to poorly soluble particles such as carbon black. The pattern of pulmonary effects in the rat, such as inflammation and fibrotic responses, are not observed in other rodent species, non-human primates, or humans under similar exposure conditions. Lung overload does not appear to be relevant for human health. Overall, the epidemiological evidence from well-conducted investigations has shown no causative link between carbon black exposure and the risk of non-malignant respiratory disease in humans. A STOT-RE classification for carbon black after repeated inhalation exposure is not warranted.

ORAL ASSESSMENT:

Based on available data, specific target organ toxicity is not expected after repeated oral exposure.

DERMAL ASSESSMENT:

Based on available data and the chemical-physical properties (insolubility, low absorption potential), specific target organ toxicity is not expected after repeated dermal exposure.

Aspiration Hazard: ASSESSMENT: Based on industrial experience and the available data, no aspiration hazard is expected.

12. ECOLOGICAL INFORMATION

Aquatic Toxicity:

Fish (Brachydanio rerio): LC50 (96hr) > 1,000 mg/L. (Method: OECD 203).
Daphnia magna: EC50 (24hr) > 5,600 mg/L. (Method: OECD 202).
Algae (Scenedesmus subspicatus): EC50 (72hr) > 10,000 mg/L.
Algae (Scenedesmus subspicatus): NOEC >= 10,000 mg/L (Method: OECD 201).
Activated sludge: EC0 (3hr) >= 800 mg/L. (Method: DEV L3 TTC test).

ENVIRONMENTAL FATE

Persistence and degradability The methods for determining biodegradability are not applicable to inorganic substances

Bioaccumulation Not expected due to physicochemical properties of the substance.

Mobility: Not expected to migrate. Insoluble.

Distribution to Environmental Compartments: Insoluble. Expected to remain on soil surface. Expected to float on water.

PBT and vPvB Assessment: This substance does not fulfill the criteria for PBT or vPvB.

Other adverse effects: No information available.

13. DISPOSAL CONSIDERATIONS

Disclaimer: Information in this section pertains to the product as shipped in its intended composition as described in Section 3 of this SDS. Contamination or processing may change waste characteristics and requirements. Regulations may also apply to empty containers, liners or rinsate. State/provincial and local regulations may be different from federal regulations.

RCRA: Not a hazardous waste under U.S. RCRA, 40 CFR 261.

Canadian Waste Classification: Canada: Not a hazardous waste under provincial regulations.

Disposal considerations: Waste should not be released to sewers. Product, as supplied, can be burned in suitable incineration facilities or should be disposed of in accordance with the regulations issued by the appropriate federal, state and local authorities. Same consideration should be given to containers and packaging.

14. TRANSPORT INFORMATION

Seven (7) ASTM reference carbon blacks were tested according to the UN method, Self Heating Solids, and found to be “Not a self-heating substance of Division 4.2”; the same carbon blacks were tested according to the UN method, Readily Combustible Solids, and found to be “Not a readily combustible solid of Division 4.1”; under current UN Recommendations on the Transport of Dangerous Goods.

The following organizations do not classify carbon black as a "hazardous cargo" if it is "carbon, non-activated, mineral origin". Cabot carbon blacks meet this definition.

US Rail Regulations: Not regulated.

DOT

UN/ID no	Not regulated
Proper Shipping Name	Not regulated
Hazard Class	Not regulated
Packing group	Not regulated

ICAO (air)

UN/ID no	Not regulated
Proper Shipping Name	Not regulated
Hazard Class	Not regulated
Packing group	Not regulated

IATA

UN/ID no	Not regulated
Proper Shipping Name	Not regulated
Hazard Class	Not regulated
Packing group	Not regulated

IMDG

UN/ID no	Not regulated
Proper Shipping Name	Not regulated
Hazard Class	Not regulated
Packing group	Not regulated

RID

UN/ID no	Not regulated
Proper Shipping Name	Not regulated
Hazard Class	Not regulated
Packing group	Not regulated

ADR

UN/ID no	Not regulated
Proper Shipping Name	Not regulated
Hazard Class	Not regulated
Packing group	Not regulated

15. REGULATORY INFORMATION

Hazard Classification

United States - OSHA (29 CFR 1910.1200): Hazardous
Mexico - NOM-018-STPS-2000: Not hazardous
Mexico - NOM-018-STPS-2015: Not hazardous.
Canada - WHMIS Classification (CPR, SOR/88-66): Class D2A
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the M/SDS

contains all the information required by the Controlled Products Regulations.

Canada - WHMIS Classification (HPR, SOR/2015-17) This product has been classified in accordance with the hazard criteria of the Hazardous Products Regulations (HPR) and the M/SDS contains all the information required by the Hazardous Products Regulations.

Chemical name	WHMIS - Ingredient Disclosure
Carbon Black 1333-86-4	1%

International Inventories

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

US Federal Regulations

SARA 311/312 Hazard Categories

Acute Health Hazard	NO
Chronic Health Hazard	YES
Fire hazard	YES
Sudden release of pressure hazard	NO
Reactive Hazard	NO

See GHS classification in section 2 for applicable SARA 311/312 hazard categories under the revised 40 CFR 370 (June 13, 2016)

SARA Section 313 (40 CFR 372) Toxics Release Inventory

Under EPA's Toxics Release Inventory (TRI) program, the reporting threshold for the polycyclic aromatic compounds (PAC) category is 100 pounds/year manufactured, processed, or otherwise used. The 100 pounds/year reporting threshold applies to the cumulative total of 25 specific PACs. In addition, the TRI reporting threshold for benzo(g,h,i)perylene is 10 pounds/year manufactured, processed, or otherwise used. Carbon black may contain certain PACs and/or benzo(g,h,i)perylene. The user is advised to evaluate their own TRI reporting responsibilities.

Clean Air Act Amendments of 1990 (CAA, Section 112, 40 CFR 82):

This product does not contain any components listed as a Hazardous Air Pollutant, Flammable Substance, Toxic Substance, or Class 1 or 2 Ozone Depletor

CWA (Clean Water Act)

This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42).

CERCLA

This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive

Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material.

Food and Drug Administration (FDA)

Carbon Black is permitted for food contact when used as a filler in rubber articles intended for repeated use under 21 CFR (code of Federal Regulations) 177.2600.

LIMITATIONS:

-Total carbon black (channel process and furnace process) in the rubber may not exceed 50% by weight of the rubber products. Cabot carbon blacks are furnace process blacks.

- Not for use in contact with infant formula and human milk (see TOR 2016-002).

Pharmaceutical Information
Not permitted.

US State Regulations

California Proposition 65
This product contains the following Proposition 65 chemicals.

• "carbon black (airborne, unbound particles of respirable size)" is a California Proposition 65 listed substance. Please note that all three listing qualifiers (airborne, unbound (not bound within a matrix), and respirable size (10 micrometers or less in diameter)) must be met for this substance to be considered a Proposition 65 substance. Please contact your sales representative for additional information.
• Certain polycyclic aromatic hydrocarbons (PAHs) that may be found adsorbed onto the surface of carbon black are California Proposition 65 listed substances.
• “Carbon-black extracts” is a California Proposition 65 listed substance.
• Certain metals, including arsenic, cadmium, lead, mercury, or nickel, may be present on and/or in carbon black and are California Proposition 65 listed substances.

U.S. State Right-to-Know Regulations

Chemical name	New Jersey	Massachusetts	Pennsylvania	Louisiana:
Carbon Black 1333-86-4	X	X	X	

16. OTHER INFORMATION

Carbon Black Extracts:
Manufactured carbon blacks generally contain less than 0.1% of solvent extractable polycyclic aromatic hydrocarbons (PAH). Solvent extractable PAH content depends on numerous factors including, but not limited to, the manufacturing process, desired product specifications, and the analytical procedure used to measure and identify solvent extractable materials. Questions concerning PAH content of carbon black and analytical procedures should be addressed to your carbon black supplier

Cosmetic Use:
Cabot Corporation does not support the use of this product in any cosmetic application.

References:

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Dell, L, Mundt, K, Luipold, R, Nunes, A, Cohen, L, Heidenreich, M, Bachand, A. (2006) A cohort mortality study of employees in the United States carbon black industry. J.Occup. Env. Med. 48(12): 1219-1229.

Driscoll KE, Deyo LC, Carter JM, Howard BW, Hassenbein DG and Bertram TA (1997) Effects of particle exposure and particle-elicited inflammatory cells on mutation in rat alveolar epithelial cells. Carcinogenesis 18(2) 423-430.

Gardiner K, van Tongeren M, Harrington M. (2001) Respiratory health effects from exposure to carbon black: Results of the phase 2 and 3 cross sectional studies in the European carbon black manufacturing industry. Occup. Env. Med. 58: 496-503.

Harber P, Muranko H, Solis S, Torossian A, Merz B. (2003) Effect of carbon black exposure on respiratory function and symptoms. J. Occup. Env. Med. 45: 144-55.

ILSI Risk Science Institute Workshop: The Relevance of the Rat Lung Response to Particle to Particle Overload for Human Risk Assessment. Inh. Toxicol. 12:1-17 (2000).

International Agency for Research on Cancer: IARC Monographs on the Evaluation of Carcinogenic Risks to Humans (2010), Vol. 93, February 1-14, 2006, Carbon Black, Titanium Dioxide, and Talc. Lyon, France.

Morfeld P, Büchte SF, Wellmann J, McCunney RJ, Piekarski C (2006). Lung cancer mortality and carbon black exposure: Cox regression analysis of a cohort from a German carbon black production plant. J. Occup.Env.Med.48(12):1230-1241.

Morfeld P and McCunney RJ, (2009). Carbon Black and lung cancer testing a novel exposure metric by multi-model inference. Am. J. Ind. Med. 52: 890-899.

Sorahan T, Hamilton L, van Tongeren M, Gardiner K, Harrington JM (2001). A cohort mortality study of U.K. carbon black workers, 1951-1996. Am. J. Ind. Med. 39(2):158-170.

Sorahan T, Harrington JM (2007) A ‘‘Lugged’’ Analysis of Lung Cancer Risks in UK Carbon Black Production Workers, 1951–2004. Am. J. Ind. Med. 50, 555–564.

In compliance with Mexican regulation NMX-R-019-SCFI-2011, the following is the Mexican supplier:

CABOT SPECIALTY CHEMICALS MEXICO, SAPI DE CV-Planta Altamira
Carretera Tampico-Mante Km. 13.5
Col. Laguna de la Puerta, CP 89603
Altamira, Tamps. México
Tel. (833) 229 05 63
Fax. (833) 229 03 53
RFC NHU920612M83
Web:www.nhumo.com.mx

Disclaimer:

The information set forth is based on information that Cabot Corporation believes to be accurate. No warranty, expressed or implied, is intended. The information is provided solely for your information and consideration and Cabot assumes no legal responsibility for use or reliance thereon. In the event of a discrepancy between the information on the non-English document and its English counterpart, the English version shall supersede.

Prepared by: Cabot Corporation - Safety, Health and Environmental Affairs
Revision date: 29-Jan-2018

End of Safety Data Sheet

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[redacted]

Version No:**1.0**
Safety Data Sheet according to OSHA HazCom Standard (2012) requirements

Issue Date:**05/09/2016**
Initial Date: **05/09/2016**
S.GHS.USA.EN

SECTION 1 IDENTIFICATION

Product Identifier

Product name	[redacted]
Synonyms	
CAS number	

Recommended use of the chemical and restrictions on use

Relevant identified uses	Laboratory chemicals and manufacture of substances

Name, address, and telephone number of the chemical manufacturer, importer, or other responsible party

Registered company name	Nexceris, LLC
Address	404 Enterprise Dr., Lewis Center, OH 43035 United States
Telephone	614-842-6606
Fax	614-842-6607
Website	www.nexceris.com
Email	info@nexceris.com

Emergency phone number

Association / Organisation	Infotrac
Emergency telephone numbers	1-800-535-5053
Other emergency telephone numbers	Not Available

SECTION 2 HAZARD(S) IDENTIFICATION

Classification of the substance or mixture

Classification	Skin Corrosion/Irritation Category 2, Eye Irritation Category 2A, Specific target organ toxicity - single exposure Category 3 (respiratory tract irritation)

Label elements

GHS label elements	
SIGNAL WORD	**WARNING**

Hazard statement(s)

H315	Causes skin irritation.
H319	Causes serious eye irritation.
H335	May cause respiratory irritation.

Hazard(s) not otherwise specified

Not Applicable

Supplementary statement(s)

Not Applicable

Precautionary statement(s) Prevention

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

Continued...

Precautionary statement(s) Response

P362	Take off contaminated clothing and wash before reuse.

Precautionary statement(s) Storage

P405	Store locked up.

Precautionary statement(s) Disposal

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

SECTION 3 COMPOSITION / INFORMATION ON INGREDIENTS

Substances

CAS No	%[weight]	Name
[redacted]	1-69	[redacted]
	1-59	
	30-45	

Mixtures

See section above for composition of Substances

SECTION 4 FIRST-AID MEASURES

Description of first aid measures

Eye Contact	If this product comes in contact with the eyes: ▸ Immediately hold eyelids apart and flush the eye continuously with running water. ▸ Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids. ▸ Continue flushing until advised to stop by the Poisons Information Centre or a doctor, or for at least 15 minutes. ▸ Transport to hospital or doctor without delay. ▸ Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.
Skin Contact	If skin or hair contact occurs: ▸ Immediately flush body and clothes with large amounts of water, using safety shower if available. ▸ Quickly remove all contaminated clothing, including footwear. ▸ Wash skin and hair with running water. Continue flushing with water until advised to stop by the Poisons Information Centre. ▸ Transport to hospital, or doctor.
Inhalation	▸ If fumes or combustion products are inhaled remove from contaminated area. ▸ Lay patient down. Keep warm and rested. ▸ Prostheses such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures. ▸ Apply artificial respiration if not breathing, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary. ▸ Transport to hospital, or doctor, without delay.
Ingestion	▸ For advice, contact a Poisons Information Centre or a doctor at once. ▸ Urgent hospital treatment is likely to be needed. ▸ If swallowed do **NOT** induce vomiting. ▸ If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration. ▸ Observe the patient carefully. ▸ Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious. ▸ Give water to rinse out mouth, then provide liquid slowly and as much as casualty can comfortably drink. ▸ Transport to hospital or doctor without delay.

Most important symptoms and effects, both acute and delayed

See Section 11

Indication of any immediate medical attention and special treatment needed

Treat symptomatically.
For acute or short-term repeated exposures to highly alkaline materials:
- Respiratory stress is uncommon but present occasionally because of soft tissue edema.
- Unless endotracheal intubation can be accomplished under direct vision, cricothyroidotomy or tracheotomy may be necessary.
- Oxygen is given as indicated.
- The presence of shock suggests perforation and mandates an intravenous line and fluid administration.
- Damage due to alkaline corrosives occurs by liquefaction necrosis whereby the saponification of fats and solubilisation of proteins allow deep penetration into the tissue.

Alkalis continue to cause damage after exposure.
INGESTION:
- Milk and water are the preferred diluents

No more than 2 glasses of water should be given to an adult.
- Neutralising agents should never be given since exothermic heat reaction may compound injury.

* Catharsis and emesis are absolutely contra-indicated.
* Activated charcoal does not absorb alkali.
* Gastric lavage should not be used.

Supportive care involves the following:
- Withhold oral feedings initially.
- If endoscopy confirms transmucosal injury start steroids only within the first 48 hours.
- Carefully evaluate the amount of tissue necrosis before assessing the need for surgical intervention.
- Patients should be instructed to seek medical attention whenever they develop difficulty in swallowing (dysphagia).

Continued...

SKIN AND EYE:

- Injury should be irrigated for 20-30 minutes.

Eye injuries require saline. [Ellenhorn & Barceloux: Medical Toxicology]

Both dermal and oral toxicity of manganese salts is low because of limited solubility of manganese. No known permanent pulmonary sequelae develop after acute manganese exposure. Treatment is supportive.

[Ellenhorn and Barceloux: Medical Toxicology]

In clinical trials with miners exposed to manganese-containing dusts, L-dopa relieved extrapyramidal symptoms of both hypo kinetic and dystonic patients. For short periods of time symptoms could also be controlled with scopolamine and amphetamine. BAL and calcium EDTA prove ineffective.

[Gosselin et al: Clinical Toxicology of Commercial Products.]

SECTION 5 FIRE-FIGHTING MEASURES

Extinguishing media

- There is no restriction on the type of extinguisher which may be used.
- Use extinguishing media suitable for surrounding area.

Special hazards arising from the substrate or mixture

Fire Incompatibility	None known.

Special protective equipment and precautions for fire-fighters

Fire Fighting	- Alert Fire Brigade and tell them location and nature of hazard.
Fire/Explosion Hazard	- Non combustible. May emit poisonous fumes.May emit corrosive fumes.

SECTION 6 ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Minor Spills	- Clean up all spills immediately.
Major Spills	Moderate hazard.

Personal Protective Equipment advice is contained in Section 8 of the SDS.

SECTION 7 HANDLING AND STORAGE

Precautions for safe handling

Safe handling	- Avoid all personal contact, including inhalation.
Other information	- Store in original containers.

Conditions for safe storage, including any incompatibilities

Suitable container	- Glass container is suitable for laboratory quantities - Polyethylene or polypropylene container.
Storage incompatibility	- WARNING: Avoid or control reaction with peroxides. - Segregate from alcohol, water. - Avoid strong acids, acid chlorides, acid anhydrides and chloroformates. - Avoid contact with copper, aluminium and their alloys.

SECTION 8 EXPOSURE CONTROLS / PERSONAL PROTECTION

Control parameters

OCCUPATIONAL EXPOSURE LIMITS (OEL)

INGREDIENT DATA

Source	Ingredient	Material name	TWA	STEL	Peak	Notes
US OSHA Permissible Exposure Levels (PELs) - Table Z1	[redacted]		Not Available	Not Available	5 mg/m3	(as Mn)
US ACGIH Threshold Limit Values (TLV)			0.02 mg/m3 / 0.1 mg/m3	Not Available	Not Available	TLV® Basis: CNS impair
US NIOSH Recommended Exposure Limits (RELs)			Not Available	Not Available	Not Available	See Appendix D

EMERGENCY LIMITS

Ingredient	Material name	TEEL-1	TEEL-2	TEEL-3
[redacted]	[redacted]	4 mg/m3	44 mg/m3	270 mg/m3
		4.2 mg/m3	6.9 mg/m3	6.9 mg/m3

Continued...

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Ingredient	Original IDLH	Revised IDLH
[redacted]	Not Available	Not Available
	Not Available	Not Available
	N.E. / N.E.	500 mg/m3

Exposure controls

Appropriate engineering controls	Engineering controls are used to remove a hazard or place a barrier between the worker and the hazard.
Personal protection	
Eye and face protection	▸ Chemical goggles.
Skin protection	See Hand protection below
Hands/feet protection	The selection of suitable gloves does not only depend on the material, but also on further marks of quality which vary from manufacturer to manufacturer. Experience indicates that the following polymers are suitable as glove materials for protection against undissolved, dry solids, where abrasive particles are not present.
Body protection	See Other protection below
Other protection	▸ Overalls.
Thermal hazards	Not Available

Respiratory protection

Particulate.

Where the concentration of gas/particulates in the breathing zone,approaches or exceeds the 'Exposure Standard' (or ES), respiratoryprotection is required.
Degree of protection varies with both face-piece and Class offilter; the nature of protection varies with Type of filter.

Required Minimum Protection Factor	Half-Face Respirator	Full-Face Respirator	Powered Air Respirator
up to 10 x ES	-AUS P2	-	-PAPR-AUS / Class 1 P2
up to 50 x ES	-	-AUS / Class 1 P2	-
up to 100 x ES	-	-2 P2	-PAPR-2 P2 ^

^ - Full-face
A(All classes) = Organic vapours, B AUS or B1 = Acid gasses, B2 =Acid gas or hydrogen cyanide(HCN), B3 = Acid gas or hydrogen cyanide(HCN), E =Sulfur dioxide(SO2), G = Agricultural chemicals, K = Ammonia(NH3), Hg =Mercury, NO = Oxides of nitrogen, MB = Methyl bromide, AX = Low boiling pointorganic compounds(below 65 degC)

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Appearance	Black/Gray

Physical state	Divided Solid Powder	**Relative density (Water = 1)**	Not Available
Odour	Not Available	**Partition coefficient n-octanol / water**	Not Available
Odour threshold	Not Available	**Auto-ignition temperature (°C)**	Not Available
pH (as supplied)	Not Available	**Decomposition temperature**	Not Available
Melting point / freezing point (°C)	> 1650	**Viscosity (cSt)**	Not Available
Initial boiling point and boiling range (°C)	Not Available	**Molecular weight (g/mol)**	Not Available
Flash point (°C)	Not Available	**Taste**	Not Available
Evaporation rate	Not Available	**Explosive properties**	Not Available
Flammability	Not Available	**Oxidising properties**	Not Available
Upper Explosive Limit (%)	Not Available	**Surface Tension (dyn/cm or mN/m)**	Not Applicable
Lower Explosive Limit (%)	Not Available	**Volatile Component (%vol)**	Not Available
Vapour pressure (kPa)	Not Available	**Gas group**	Not Available
Solubility in water (g/L)	Immiscible	**pH as a solution (1%)**	Not Available
Vapour density (Air = 1)	Not Available	**VOC g/L**	Not Available

SECTION 10 STABILITY AND REACTIVITY

Reactivity	See section 7
Chemical stability	▸ Unstable in the presence of incompatible materials.

Continued...

Possibility of hazardous reactions	See section 7
Conditions to avoid	See section 7
Incompatible materials	See section 7
Hazardous decomposition products	See section 5

SECTION 11 TOXICOLOGICAL INFORMATION

Information on toxicological effects

Inhaled	The material can cause respiratory irritation in some persons. Persons with impaired respiratory function, airway diseases and conditions such as emphysema or chronic bronchitis, may incur further disability if excessive concentrations of particulate are inhaled. Exposure to vapours of some rare earth salts can cause sensitivity to heat, itching, and increased sensitivity of smell and taste.
Ingestion	The material can produce chemical burns within the oral cavity and gastrointestinal tract following ingestion. The material has **NOT** been classified by EC Directives or other classification systems as 'harmful by ingestion'. Strontium salts induce vomiting and diarrhoea when swallowed in large quantity. Poisonings rarely occur after oral administration of manganese salts because they are poorly absorbed from the gut.
Skin Contact	The material can produce chemical burns following direct contact with the skin. Skin contact is not thought to have harmful health effects (as classified under EC Directives); the material may still produce health damage following entry through wounds, lesions or abrasions. Open cuts, abraded or irritated skin should not be exposed to this material Entry into the blood-stream, through, for example, cuts, abrasions or lesions, may produce systemic injury with harmful effects.
Eye	The material can produce chemical burns to the eye following direct contact. If applied to the eyes, this material causes severe eye damage.
Chronic	Repeated or prolonged exposure to corrosives may result in the erosion of teeth, inflammatory and ulcerative changes in the mouth and necrosis (rarely) of the jaw. Long-term exposure to respiratory irritants may result in disease of the airways involving difficult breathing and related systemic problems. Substance accumulation, in the human body, may occur and may cause some concern following repeated or long-term occupational exposure. Strontium accumulates in teeth and bone, especially in the growth plates of rapidly growing bone. Long term exposure to high dust concentrations may cause changes in lung function i.e. pneumoconiosis, caused by particles less than 0.5 micron penetrating and remaining in the lung. Manganese is an essential trace element. Lanthanum is one of the rare earth metals - light type (cerium family).

[redacted]	TOXICITY	IRRITATION
	Not Available	Not Available

[redacted]	TOXICITY	IRRITATION
	Dermal (rabbit) LD50: >1087 mg/kg[1]	Not Available
	Oral (rat) LD50: >8500 mg[2]	

[redacted]	TOXICITY	IRRITATION
	Not Available	Not Available

[redacted]	TOXICITY	IRRITATION
	Oral (rat) LD50: >2000 mg/kg[1]	Not Available

Legend:	*1. Value obtained from Europe ECHA Registered Substances - Acute toxicity 2.* Value obtained from manufacturer's SDS. Unless otherwise specified data extracted from RTECS - Register of Toxic Effect of chemical Substances*

[redacted]	Asthma-like symptoms may continue for months or even years after exposure to the material ceases. Lanthanide poisoning causes immediate defaecation, writhing, inco-ordination, laboured breathing, and inactivity. for typical lanthanides: The symptoms of toxicity of the rare earth elements include writhing, ataxia, labored respiration, walking on the toes with arched back and sedation.
[redacted]	Asthma-like symptoms may continue for months or even years after exposure to the material ceases. Lanthanide poisoning causes immediate defaecation, writhing, inco-ordination, laboured breathing, and inactivity. The material may be irritating to the eye, with prolonged contact causing inflammation. No significant acute toxicological data identified in literature search.
[redacted]	Asthma-like symptoms may continue for months or even years after exposure to the material ceases. The material may be irritating to the eye, with prolonged contact causing inflammation. The material may produce respiratory tract irritation, and result in damage to the lung including reduced lung function. The material may cause skin irritation after prolonged or repeated exposure and may produce on contact skin redness, swelling, the production of vesicles, scaling and thickening of the skin. No significant acute toxicological data identified in literature search.

Continued...

[redacted]	Asthma-like symptoms may continue for months or even years after exposure to the material ceases. No significant acute toxicological data identified in literature search.

Acute Toxicity	⊘	**Carcinogenicity**	⊘
Skin Irritation/Corrosion	✔	**Reproductivity**	⊘
Serious Eye Damage/Irritation	✔	**STOT - Single Exposure**	⊘
Respiratory or Skin sensitisation	⊘	**STOT - Repeated Exposure**	⊘
Mutagenicity	⊘	**Aspiration Hazard**	⊘

Legend: ✘ *– Data available but does not fill the criteria for classification*
✔ *– Data required to make classification available*
⊘ *– Data Not Available to make classification*

SECTION 12 ECOLOGICAL INFORMATION

Toxicity

Ingredient	Endpoint	Test Duration (hr)	Species	Value	Source
[redacted]	EC50	72	Algae or other aquatic plants	13mg/L	2
	EC50	72	Algae or other aquatic plants	15.2mg/L	2
	NOEC	196	Algae or other aquatic plants	>=0.00001mg/L	2
	EC50	48	Crustacea	>0.0219mg/L	2
	NOEC	48	Crustacea	0.0219mg/L	2
Legend:	*Extracted from 1. IUCLID Toxicity Data 2. Europe ECHA Registered Substances - Ecotoxicological Information - Aquatic Toxicity 3. EPIWIN Suite V3.12 - Aquatic Toxicity Data (Estimated) 4. US EPA, Ecotox database - Aquatic Toxicity Data 5. ECETOC Aquatic Hazard Assessment Data 6. NITE (Japan) - Bioconcentration Data 7. METI (Japan) - Bioconcentration Data 8. Vendor Data*				

For Metal:
Atmospheric Fate -Metal-containing inorganic substances generally have negligible vapour pressureand are not expected to partition to air.
For Manganese and its Compounds:
Environmental Fate: Manganese is a naturally occurring element in the environment occurring as a result of weathering of geological material.
For Lanthanoids (Formerly Lanthanides: Synonym Rare Earth Metals and their Salts):
Environmental Fate: Rare earths, such as the lanthanoids, are relatively abundant in the crust of the Earth.
For strontium:
Environmental Fate: Strontiumpresent in the atmosphere is in the form of wet or dry aerosols.
DO NOT discharge into sewer or waterways.

Persistence and degradability

Ingredient	Persistence: Water/Soil	Persistence: Air
	No Data available for all ingredients	No Data available for all ingredients

Bioaccumulative potential

Ingredient	Bioaccumulation
	No Data available for all ingredients

Mobility in soil

Ingredient	Mobility
	No Data available for all ingredients

SECTION 13 DISPOSAL CONSIDERATIONS

Waste treatment methods

Product / Packaging disposal	Legislation addressing waste disposal requirements may differ by country, state and/ or territory. ▸ **DO NOT** allow wash water from cleaning or process equipment to enter drains. ▸ Recycle wherever possible or consult manufacturer for recycling options.

SECTION 14 TRANSPORT INFORMATION

Labels Required

Marine Pollutant	NO

Land transport (DOT): NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS

Air transport (ICAO-IATA / DGR): NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS

Sea transport (IMDG-Code / GGVSee): NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS

Continued...

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Transport in bulk according to Annex II of MARPOL and the IBC code

Not Applicable

SECTION 15 REGULATORY INFORMATION

Safety, health and environmental regulations / legislation specific for the substance or mixture

[redacted]S FOUND ON THE FOLLOWING REGULATORY LISTS

US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory

[redacted]S FOUND ON THE FOLLOWING REGULATORY LISTS

US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory

[redacted]S FOUND ON THE FOLLOWING REGULATORY LISTS

US - Alaska Limits for Air Contaminants
US - California OEHHA/ARB - Chronic Reference Exposure Levels and Target Organs (CRELs)
US - California Permissible Exposure Limits for Chemical Contaminants
US - Hawaii Air Contaminant Limits
US - Idaho - Limits for Air Contaminants
US - Michigan Exposure Limits for Air Contaminants
US - Minnesota Permissible Exposure Limits (PELs)
US - Oregon Permissible Exposure Limits (Z-1)
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants
US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants
US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants
US - Washington Permissible exposure limits of air contaminants
US - Washington Toxic air pollutants and their ASIL, SQER and de minimis emission values
US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants
US ACGIH Threshold Limit Values (TLV)
US ACGIH Threshold Limit Values (TLV) - Carcinogens
US EPCRA Section 313 Chemical List
US NIOSH Recommended Exposure Limits (RELs)
US OSHA Permissible Exposure Levels (PELs) - Table Z1
US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory

Federal Regulations

Superfund Amendments and Reauthorization Act of 1986 (SARA)

SECTION 311/312 HAZARD CATEGORIES

Immediate (acute) health hazard	YES
Delayed (chronic) health hazard	NO
Fire hazard	NO
Pressure hazard	NO
Reactivity hazard	NO

US. EPA CERCLA HAZARDOUS SUBSTANCES AND REPORTABLE QUANTITIES (40 CFR 302.4)

None Reported

State Regulations

US. CALIFORNIA PROPOSITION 65

None Reported

National Inventory	Status
Australia - AICS	Y
Canada - DSL	Y
Canada - NDSL	N (strontium oxide; lanthanum oxide; manganese tetroxide)
China - IECSC	Y
Europe - EINEC / ELINCS / NLP	Y
Japan - ENCS	Y
Korea - KECI	Y
New Zealand - NZIoC	Y
Philippines - PICCS	N (strontium oxide)
USA - TSCA	Y
Legend:	*Y = All ingredients are on the inventory* *N = Not determined or one or more ingredients are not on the inventory and are not exempt from listing(see specific ingredients in brackets)*

SECTION 16 OTHER INFORMATION

Other information

Definitions and abbreviations

PC—TWA: Permissible Concentration-Time Weighted Average
PC—STEL: Permissible Concentration-Short Term Exposure Limit
IARC: International Agency for Research on Cancer
ACGIH: American Conference of Governmental Industrial Hygienists
STEL: Short Term Exposure Limit
TEEL: Temporary Emergency Exposure Limit。
IDLH: Immediately Dangerous to Life or Health Concentrations

Continued...

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OSF: Odour Safety Factor
NOAEL :No Observed Adverse Effect Level
LOAEL: Lowest Observed Adverse Effect Level
TLV: Threshold Limit Value
LOD: Limit Of Detection
OTV: Odour Threshold Value
BCF: BioConcentration Factors
BEI: Biological Exposure Index

end of SDS

MATERIAL SAFETY DATA SHEET

The MSDS format adheres to the standards and regulatory requirements of the United States and may not meet regulatory requirements in other countries.

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SECTION 1: PRODUCT / COMPANY IDENTIFICATION

PRODUCT NAME: [redacted]
MSDS # DU006977

DATE OF PREPARATION OR REVISION: Revised 04/15/2010

TRADE NAMES AND SYNONYMS:
[redacted]

MANUFACTURER/DISTRIBUTOR:
TORAY Fluorofibers (America), Inc.
2032 Highway 20
Decatur, AL 35601

PHONE NUMBERS (ALTERNATES):
TECHNICAL: 256-260-5909 (256-345-2753)
EMERGENCY: 256-260-5912 (256-260-5927)
AFTER HOURS: 256-318-3860 (256-654-1232)

SECTION 2: HAZARDS IDENTIFICATION

POTENTIAL HEALTH EFFECTS:

Based on toxicological testing and more than 20 years experience in commercial use, [redacted] fiber products present minimal risk to human health and the environment. Breathing decomposition products from [redacted] above 330 deg. C can produce flu-like symptoms (polymer fume fever) that usually last ~24 hours. The symptoms may occur several hours after the exposure.

Smoking tobacco and cigarettes contaminated with [redacted] particles may produce polymer fume fever. Gases that can be fatal at low concentrations may be emitted when [redacted] is heated above 400 deg. C.

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

SECTION 3: COMPOSITION / INFORMATION ON INGREDIENTS

[redacted]

Components/Material	CAS Number	%
[redacted]	[redacted]	92-97
Water	7732-18-5	0.1-0.3
Carbonaceous Residues	7440-44-0	3-8

[redacted]

Components/Material	CAS Number	%
[redacted]	[redacted]	>99
Water	7732-18-5	0.1-0.3

Components (Remarks):
[redacted] is principally a solid polymer composed of carbon and fluorine.

SECTION 4: FIRST AID MEASURES

EYE CONTACT: In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Call a physician.

INGESTION: Not a probable route. However, in case of gastro-intestinal distress following accidental ingestion, call a physician.

INHALATION: If exposed to excess levels of fiber dust or fly, remove to fresh air and get medical attention if cough or other symptoms persist.

SKIN: Wash with soap and water. Get medical attention if irritation develops or persists.

SECTION 5: FIRE FIGHTING MEASURES

FLAMMABLE PROPERTIES / FLASH POINT: Not applicable. The lower explosive limit is not applicable. The upper explosive limit is not applicable. Auto-ignition Temperature is not available. This product is inherently flame retardant.

HAZARDOUS COMBUSTION PRODUCTS: Hydrogen fluoride forms during combustion. Hydrogen fluoride is highly corrosive and toxic. Other combustion gases are mostly carbon dioxide, water and oxides of nitrogen. However, carbon monoxide and various other toxic gases may be produced depending on the conditions of burning.

UNUSUAL FIRE AND EXPLOSION HAZARDS: [redacted] thermal decomposition begins at 330 degrees C. Up to 400 deg. C, the decomposition products are mainly monomer and a waxy sublimate. Breathing these decomposition products can result in flu-like symptoms, (polymer fume fever) which normally last ~24 hours with no cumulative effect. Above 400 deg. C, gases such as hydrogen fluoride and perfluoroisobutylene, which can be fatal at low concentrations, are evolved.

EXTINGUISHING MEDIA: Use any available extinguishing media.

FIRE FIGHTING INSTRUCTIONS: As in any fire, wear self contained breathing apparatus pressure demand, MSHA/NIOSH approved (or equivalent) and full protective gear.

SECTION 6: ACCIDENTAL RELEASE MEASURES

SAFEGUARDS (PERSONNEL): Review **FIRE FIGHTING MEASURES** sections before proceeding with clean-up. Use appropriate **PERSONAL PROTECTIVE EQUIPMENT** during clean-up.

SPILL CLEAN UP: Use appropriate **PERSONAL PROTECTIVE EQUIPMENT** during clean up. Clean up dusts and fibers with vacuum equipment. Sweep up spilled solids, place in clean container and seal for later disposal or reclamation.

SECTION 7: HANDLING AND STORAGE

No special handling or storage required.

SECTION 8: EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS

VENTILATION: Breathing decomposition products from PTFE Fluoropolymer at 330 to 400 deg. C can produce flu-like symptoms (polymer fume fever) that usually last ~24 hours. The symptoms may occur several hours after the exposure. Smoking tobacco and cigarettes contaminated with PTFE Fluoropolymer particles may produce polymer fume fever. Gases that can be fatal at low concentrations may be emitted when PTFE Fluoropolymer is heated above 400 deg. C. Practice good industrial hygiene when handling PTFE Fluoropolymer products and avoid breathing fumes from when PTFE Fluoropolymer is heated above 330 deg. C. Provide adequate exhaust ventilation to completely capture and remove vapors and fumes from operations that involve heating PTFE Fluoropolymer products above 330 deg. C.

PERSONAL PROTECTIVE EQUIPMENT

INHALATION: When these products are used at elevated temperature or in a way that creates airborne decomposition products, wear NIOSH/MSHA approved combination organic vapor/acid gas/dust-mist respirators. Get medical attention, if cough or other symptoms develop.

SKIN: Observe good industrial hygiene practices while handling these products and provide adequate exhaust ventilation to maintain exposures below the applicable dust and fibers limits. Gloves and long sleeved loose

fitting clothing may be useful in some cases. Wash with mild soap and water after handling these products. Get medical attention if irritation develops or persists

EYES: Wear safety glasses with side shield for general eye protection. Get medical attention if irritation persists.

INGESTION: Not a probable route. However, in case of gastro-intestinal distress following accidental ingestion, call a physician.

APPLICABLE EXPOSURE LIMITS

[redacted](Particulates (Not Otherwise Regulated))

PEL (OSHA):	15 mg/m^3, 8 Hr. TWA, total dust 5 mg/m^3, 8 Hr. TWA, respirable dust
TLV (ACGIH):	10 mg/m^3, 8 Hr. TWA, total dust 5 mg/m^3, 8 Hr. TWA, respirable dust
AEL*:	10 mg/m^3, 8 Hr. TWA, total dust 5 mg/m^3, 8 Hr. TWA, respirable dust

* AEL is Toray's Acceptable Exposure Limit. Where governmentally imposed occupational exposure limits which are lower than the Acceptable Exposure Limit are in effect, such limits shall take precedence.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical Data	
Form :	Solid.
Color :	Brown/White.
Melting Point :	327 degrees C for PTFE Fluoropolymer
Solubility in Water :	Insoluble
Odor :	Burnt Suger/None.

All physical and chemical properties are same except for color and odor. The natural fiber is brown in color and burnt sugar in odor. The bleached fiber is white in color and none in odor.

SECTION 10: STABILITY AND REACTIVITY

CHEMICAL STABILITY: Stable at normal temperatures and storage conditions.

CONDITIONS TO AVOID: This product's polymer begins to thermally degrade rapidly above 400 deg. C (800 deg. F). The thermal degradation rate increases with temperature.

Avoid contaminating tobacco products with PTFE Fluoropolymers.

INCOMPATIBLE MATERIALS:
None known.

DECOMPOSITION: PTFE Fluoropolymer thermal decomposition begins at 330 deg. C. Up to 400 deg. C, the decomposition products are mainly monomer and a waxy sublimate. Breathing these decomposition products can result in flu-like symptoms (polymer fume fever) which normally lasts ~24 hours with no cumulative effect. Above 400 deg C, gases such as hydrogen fluoride and perfluoroisobutylene, which can be fatal at low concentrations, are evolved.

POLYMERIZATION:
Polymerization will not occur.

SECTION 11: TOXICOLOGY INFORMATION

HUMAN/ANIMAL DATA:

These products present minimal risk to human health and the environment. Human skin irritation or animal testing has not been conducted.

SECTION 12: ECOLOGICAL INFORMATION

ECOTOXICOLOGICAL INFORMATION:

These products are essentially inert in the environment. They do not decompose in landfills and other natural environments, and therefore, do not release toxic degradation materials into the ecosystems. This material is not toxic to aquatic life.

SECTION 13: DISPOSAL CONSIDERATIONS

WASTE DISPOSAL

Treatment, storage, transportation, and disposal must be in accordance with applicable Federal, State/Provincial, and Local regulations. These products are not hazardous waste as defined by regulations implementing the Resource Conservation and Recovery Act (RCRA). In general, waste materials may be discarded in accordance with State and Local regulations governing the disposal of other common or non-RCRA regulated waste materials.

INCINERATION INFORMATION:

Due to the inherent thermal resistance of these products and their components, they are not usually incinerated. However, should it be necessary to incinerate [redacted] products, these precautions should be exercised.

- The hydrogen fluoride that forms during incineration must be neutralized or otherwise treated. Hydrogen fluoride is highly corrosive to materials of construction that may be in incinerators including refractory brick.
- Toxic gases are emitted during the thermal decomposition of [redacted] and provision to prevent their release must be implemented.

- The incinerator must be equipped with off-gas treatment facilities and adequate monitoring to assure that no toxic releases occur.
- Incinerator Temperatures - 1800 deg. F (1000 deg.C) minimum.

SECTION 14: TRANSPORT INFORMATION

SHIPPING INFORMATION – DOT
Not Regulated.
International Civil Aviation Organization (ICAO) classification not required.
International Maritime Dangerous Goods (IMDG) classification not required.

SHIPPING INFORMATION – CANADA

TDG Class : This material is Not Regulated.

SECTION 15: REGULATORY INFORMATION

U.S. FEDERAL REGULATIONS

SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 (SARA) TITLE III: These products are not regulated as hazardous substances under CERCLA and are not subject to reporting requirements.

STATE REGULATIONS (U.S.): California Safe Drinking Water and Toxic Enforcement Act of 1986 (proposition 65): This product contains none of the substances known to the State of California to cause cancer or reproductive toxicity.

State Right-To-Know Regulations. The information in this MSDS complies with the requirements of those Laws.

SECTION 16: OTHER INFORMATION

NFPA, NPCA-HMIS

NFPA Rating	
Health	: 1
Flammability	: 0
Reactivity	: 0
NPCA-HMIS Rating	
Health	: 1
Flammability	: 0
Reactivity	: 0

ADDITIONAL INFORMATION

MEDICAL USE: CAUTION:
Do not use in medical applications involving permanent or temporary implantation in the human body or contact with body fluids.

OZONE DEPLETERS:
This product does not contain any of the ozone depleting substances listed in either Class I (chlorofluorocarbons, halon, carbon tetrachloride, and methyl chloroform) or Class II (hydrochlorofluorocarbons) of the Clean Air Act Amendments of 1990. Nor do any of these chemicals come in contact with these products during their manufacture.

The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.

Responsibility for MSDS : Jamie Foote, P.E.

Address : Toray Fluorofibers (America), Inc.
2032 HWY 20
Decatur, Alabama 35601

Telephone : (256) 260-5927 FAX (256) 260-5910

This information is based upon technical information believed to be reliable. It is subject to revision as additional knowledge and experience is gained.

End of MSDS

BRENNTAG

SAFETY DATA SHEET

1. Identification

Other means of identification None known.

Product identifier **ISOPROPYL ALCOHOL 99%**

Recommended use ALL PROPER AND LEGAL PURPOSES

Recommended restrictions None known.

Manufacturer/Importer/Supplier/Distributor information

Manufacturer

Company name Brenntag Northeast, LLC

Address 81 West Huller Lane
Reading, PA 19605

Telephone 610-926-4151

E-mail Not available.

Emergency phone number 800-424-9300 Chemtrec

2. Hazard(s) identification

Physical hazards	Flammable liquids	Category 2
Health hazards	Serious eye damage/eye irritation	Category 2A
	Specific target organ toxicity, single exposure	Category 3 narcotic effects

Environmental hazards Not classified.

OSHA defined hazards Not classified.

Label elements

Signal word Danger

Hazard statement Highly flammable liquid and vapor. Causes serious eye irritation. May cause drowsiness or dizziness.

Precautionary statement

Prevention Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Keep container tightly closed. Ground/bond container and receiving equipment. Use explosion-proof electrical/ventilating/lighting equipment. Use only non-sparking tools. Take precautionary measures against static discharge. Wash thoroughly after handling. Use only outdoors or in a well-ventilated area. Wear protective gloves/eye protection/face protection.

Response If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower. If inhaled: Remove person to fresh air and keep comfortable for breathing. If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Call a poison center/doctor if you feel unwell. If eye irritation persists: Get medical advice/attention. In case of fire: Use appropriate media to extinguish.

Storage Keep cool. Store in a well-ventilated place. Keep container tightly closed. Store locked up.

Disposal Dispose of contents/container in accordance with local/regional/national/international regulations.

Hazard(s) not otherwise classified (HNOC) Static accumulating flammable liquid can become electrostatically charged even in bonded and grounded equipment. Sparks may ignite liquid and vapor. May cause flash fire or explosion.

Supplemental information 100% of the mixture consists of component(s) of unknown acute inhalation toxicity.

3. Composition/information on ingredients

Mixtures

Chemical name	Common name and synonyms	CAS number	%
2-PROPANOL		67-63-0	99
Other components below reportable levels			1

4. First-aid measures

Inhalation	Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a poison center or doctor/physician if you feel unwell.
Skin contact	Take off immediately all contaminated clothing. Rinse skin with water/shower. Get medical attention if irritation develops and persists.
Eye contact	Immediately flush eyes with plenty of water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Get medical attention if irritation develops and persists.
Ingestion	Rinse mouth. Get medical attention if symptoms occur.
Most important symptoms/effects, acute and delayed	May cause drowsiness and dizziness. Headache. Nausea, vomiting. Severe eye irritation. Symptoms may include stinging, tearing, redness, swelling, and blurred vision.
Indication of immediate medical attention and special treatment needed	Provide general supportive measures and treat symptomatically. Thermal burns: Flush with water immediately. While flushing, remove clothes which do not adhere to affected area. Call an ambulance. Continue flushing during transport to hospital. Keep victim under observation. Symptoms may be delayed.
General information	Take off all contaminated clothing immediately. Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves. Wash contaminated clothing before reuse.

5. Fire-fighting measures

Suitable extinguishing media	Water fog. Alcohol resistant foam. Carbon dioxide (CO2). Dry chemical powder, carbon dioxide, sand or earth may be used for small fires only.
Unsuitable extinguishing media	Do not use water jet as an extinguisher, as this will spread the fire.
Specific hazards arising from the chemical	Vapors may form explosive mixtures with air. Vapors may travel considerable distance to a source of ignition and flash back. This product is a poor conductor of electricity and can become electrostatically charged. If sufficient charge is accumulated, ignition of flammable mixtures can occur. To reduce potential for static discharge, use proper bonding and grounding procedures. This liquid may accumulate static electricity when filling properly grounded containers. Static electricity accumulation may be significantly increased by the presence of small quantities of water or other contaminants. Material will float and may ignite on surface of water. During fire, gases hazardous to health may be formed.
Special protective equipment and precautions for firefighters	Self-contained breathing apparatus and full protective clothing must be worn in case of fire.
Fire fighting equipment/instructions	In case of fire and/or explosion do not breathe fumes. Move containers from fire area if you can do so without risk.
Specific methods	Use standard firefighting procedures and consider the hazards of other involved materials.
General fire hazards	Highly flammable liquid and vapor.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures	Keep unnecessary personnel away. Keep people away from and upwind of spill/leak. Eliminate all ignition sources (no smoking, flares, sparks, or flames in immediate area). Wear appropriate protective equipment and clothing during clean-up. Avoid breathing mist/vapors. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Ventilate closed spaces before entering them. Use appropriate containment to avoid environmental contamination. Transfer by mechanical means such as vacuum truck to a salvage tank or other suitable container for recovery or safe disposal. Local authorities should be advised if significant spillages cannot be contained. For personal protection, see section 8 of the SDS.
Methods and materials for containment and cleaning up	Eliminate all ignition sources (no smoking, flares, sparks, or flames in immediate area). Keep combustibles (wood, paper, oil, etc.) away from spilled material. Take precautionary measures against static discharge. Use only non-sparking tools. Large Spills: Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible. Use a non-combustible material like vermiculite, sand or earth to soak up the product and place into a container for later disposal. Following product recovery, flush area with water. Small Spills: Absorb with earth, sand or other non-combustible material and transfer to containers for later disposal. Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to remove residual contamination. Never return spills to original containers for re-use. For waste disposal, see section 13 of the SDS.
Environmental precautions	Avoid discharge into drains, water courses or onto the ground. Use appropriate containment to avoid environmental contamination.

7. Handling and storage

Precautions for safe handling

Do not handle, store or open near an open flame, sources of heat or sources of ignition. Protect material from direct sunlight. When using do not smoke. Explosion-proof general and local exhaust ventilation. Minimize fire risks from flammable and combustible materials (including combustible dust and static accumulating liquids) or dangerous reactions with incompatible materials. Handling operations that can promote accumulation of static charges include but are not limited to: mixing, filtering, pumping at high flow rates, splash filling, creating mists or sprays, tank and container filling, tank cleaning, sampling, gauging, switch loading, vacuum truck operations. Take precautionary measures against static discharges. All equipment used when handling the product must be grounded. Use non-sparking tools and explosion-proof equipment. Avoid breathing mist/vapors. Avoid contact with eyes. Avoid prolonged exposure. Wear appropriate personal protective equipment. Observe good industrial hygiene practices.

For additional information on equipment bonding and grounding, refer to the Canadian Electrical Code in Canada, (CSA C22.1), or the American Petroleum Institute (API) Recommended Practice 2003, "Protection Against Ignitions Arising out of Static, Lightning, and Stray Currents" or National Fire Protection Association (NFPA) 77, "Recommended Practice on Static Electricity" or National Fire Protection Association (NFPA) 70, "National Electrical Code".

Conditions for safe storage, including any incompatibilities

Store locked up. Keep away from heat, sparks and open flame. Prevent electrostatic charge build-up by using common bonding and grounding techniques. Eliminate sources of ignition. Avoid spark promoters. Ground/bond container and equipment. These alone may be insufficient to remove static electricity. Store in a cool, dry place out of direct sunlight. Store in tightly closed container. Store in a well-ventilated place. Keep in an area equipped with sprinklers. Store away from incompatible materials (see Section 10 of the SDS).

8. Exposure controls/personal protection

Occupational exposure limits

US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)

Components	Type	Value
2-PROPANOL (CAS 67-63-0)	PEL	980 mg/m3
		400 ppm

US. ACGIH Threshold Limit Values

Components	Type	Value
2-PROPANOL (CAS 67-63-0)	STEL	400 ppm
	TWA	200 ppm

US. NIOSH: Pocket Guide to Chemical Hazards

Components	Type	Value
2-PROPANOL (CAS 67-63-0)	STEL	1225 mg/m3
		500 ppm
	TWA	980 mg/m3
		400 ppm

Biological limit values

ACGIH Biological Exposure Indices

Components	Value	Determinant	Specimen	Sampling Time
2-PROPANOL (CAS 67-63-0)	40 mg/l	Acetone	Urine	*

* - For sampling details, please see the source document.

Appropriate engineering controls

Explosion-proof general and local exhaust ventilation. Good general ventilation should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. Provide eyewash station and safety shower.

Individual protection measures, such as personal protective equipment

The following are recommendations for Personnel Protective Equipment (PPE). The employer/user of this product must perform a Hazard Assessment of the workplace according to OSHA regulations 29 CFR 1910.132 to determine the appropriate PPE for use while performing any task involving potential exposure to this product.

Eye/face protection	Chemical respirator with organic vapor cartridge and full facepiece.
Skin protection	
Hand protection	Wear appropriate chemical resistant gloves.
Other	Wear appropriate chemical resistant clothing.
Respiratory protection	Chemical respirator with organic vapor cartridge and full facepiece.
Thermal hazards	Wear appropriate thermal protective clothing, when necessary.
General hygiene considerations	When using do not smoke. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

9. Physical and chemical properties

Appearance	
Physical state	Liquid.
Form	Liquid.
Color	COLORLESS
Odor	ALCOHOL
Odor threshold	Not available.
pH	Not available.
Melting point/freezing point	-128 °F (-88.89 °C)
Initial boiling point and boiling range	180.82 °F (82.68 °C) estimated
Flash point	54.0 °F (12.2 °C)
Evaporation rate	Not available.
Flammability (solid, gas)	Not applicable.
Upper/lower flammability or explosive limits	
Flammability limit - lower (%)	Not available.
Flammability limit - upper (%)	Not available.
Explosive limit - lower (%)	Not available.
Explosive limit - upper (%)	Not available.
Vapor pressure	Not available.
Vapor density	Not available.
Relative density	Not available.
Solubility(ies)	
Solubility (water)	Not available.
Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	Not available.
Decomposition temperature	Not available.
Viscosity	Not available.
Other information	
Density	6.55 lbs/gal 0.79 g/ml
Explosive properties	Not explosive.
Flammability class	Flammable IB estimated
Oxidizing properties	Not oxidizing.
Percent volatile	100 % estimated

Specific gravity	0.79
VOC	99 % estimated

10. Stability and reactivity

Reactivity	The product is stable and non-reactive under normal conditions of use, storage and transport.
Chemical stability	Material is stable under normal conditions.
Possibility of hazardous reactions	Hazardous polymerization does not occur.
Conditions to avoid	Avoid heat, sparks, open flames and other ignition sources. Avoid temperatures exceeding the flash point. Contact with incompatible materials.
Incompatible materials	Acids. Strong oxidizing agents. Chlorine. Isocyanates.
Hazardous decomposition products	No hazardous decomposition products are known.

11. Toxicological information

Information on likely routes of exposure

Inhalation	May cause drowsiness and dizziness. Headache. Nausea, vomiting. Prolonged inhalation may be harmful.
Skin contact	No adverse effects due to skin contact are expected.
Eye contact	Causes serious eye irritation.
Ingestion	Expected to be a low ingestion hazard.
Symptoms related to the physical, chemical and toxicological characteristics	May cause drowsiness and dizziness. Headache. Nausea, vomiting. Severe eye irritation. Symptoms may include stinging, tearing, redness, swelling, and blurred vision.

Information on toxicological effects

Acute toxicity Not known.

Product	Species	Test Results
ISOPROPYL ALCOHOL 99%		
Acute		
Oral		
ATEmix		2525 mg/kg

Components	Species	Test Results
2-PROPANOL (CAS 67-63-0)		
Acute		
Dermal		
LD50	Rabbit	12800 mg/kg
Oral		
LD50	Rat	4.7 g/kg

Skin corrosion/irritation	Due to partial or complete lack of data the classification is not possible.
Serious eye damage/eye irritation	Causes serious eye irritation.

Respiratory or skin sensitization

Respiratory sensitization	Due to partial or complete lack of data the classification is not possible.
Skin sensitization	Due to partial or complete lack of data the classification is not possible.
Germ cell mutagenicity	Due to partial or complete lack of data the classification is not possible.
Carcinogenicity	Due to partial or complete lack of data the classification is not possible.

IARC Monographs. Overall Evaluation of Carcinogenicity

Not listed.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1053)

Not listed.

US. National Toxicology Program (NTP) Report on Carcinogens

Not listed.

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

Specific target organ toxicity - single exposure May cause drowsiness and dizziness.

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

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

Chronic effects Prolonged inhalation may be harmful.

12. Ecological information

Ecotoxicity The product is not classified as environmentally hazardous. However, this does not exclude the possibility that large or frequent spills can have a harmful or damaging effect on the environment.

Components		Species	Test Results
2-PROPANOL (CAS 67-63-0)			
Aquatic			
Fish	LC50	Bluegill (Lepomis macrochirus)	> 1400 mg/l, 96 hours

Persistence and degradability No data is available on the degradability of any ingredients in the mixture.

Bioaccumulative potential

Partition coefficient n-octanol / water (log Kow)

2-PROPANOL	0.05

Mobility in soil No data available.

Other adverse effects The product contains volatile organic compounds which have a photochemical ozone creation potential.

13. Disposal considerations

Disposal instructions Collect and reclaim or dispose in sealed containers at licensed waste disposal site. Incinerate the material under controlled conditions in an approved incinerator. Do not incinerate sealed containers. If discarded, this product is considered a RCRA ignitable waste, D001. Dispose of contents/container in accordance with local/regional/national/international regulations.

Local disposal regulations Dispose in accordance with all applicable regulations.

Hazardous waste code D001: Waste Flammable material with a flash point <140 F
The waste code should be assigned in discussion between the user, the producer and the waste disposal company.

Waste from residues / unused products Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions).

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

14. Transport information

DOT

UN number UN1219
UN proper shipping name ISOPROPANOL
Transport hazard class(es)
Class 3
Subsidiary risk -
Packing group II
Special precautions for user Read safety instructions, SDS and emergency procedures before handling.
Transportation information on packaging may be different from that listed.

IATA

UN number UN1219
UN proper shipping name ISOPROPANOL
Transport hazard class(es)
Class 3
Subsidiary risk -
Packing group II
Environmental hazards No.
Special precautions for user Read safety instructions, SDS and emergency procedures before handling.

IMDG

UN number UN1219

UN proper shipping name	ISOPROPANOL (ISOPROPYL ALCOHOL) SOLUTION (2-PROPANOL)
Transport hazard class(es)	
Class	3
Subsidiary risk	-
Packing group	II
Environmental hazards	
Marine pollutant	No.
EmS	F-E, S-D
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.

DOT

IATA; IMDG

15. Regulatory information

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

Toxic Substances Control Act (TSCA)

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

CERCLA Hazardous Substance List (40 CFR 302.4)

Not listed.

SARA 304 Emergency release notification

Not regulated.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1053)

Not listed.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

SARA 302 Extremely hazardous substance

Not listed.

SARA 311/312 Hazardous chemical	Yes
Classified hazard categories	Flammable (gases, aerosols, liquids, or solids) Serious eye damage or eye irritation Specific target organ toxicity (single or repeated exposure) Hazard not otherwise classified (HNOC)

SARA 313 (TRI reporting)

Not regulated.

Other federal regulations

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

Not regulated.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

Not regulated.

Safe Drinking Water Act (SDWA) Not regulated.

FEMA Priority Substances Respiratory Health and Safety in the Flavor Manufacturing Workplace

2-PROPANOL (CAS 67-63-0) Low priority

US state regulations

California Proposition 65

California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65): This material is not known to contain any chemicals currently listed as carcinogens or reproductive toxins. For more information go to www.P65Warnings.ca.gov.

US. California. Candidate Chemicals List. Safer Consumer Products Regulations (Cal. Code Regs, tit. 22, 69502.3, subd. (a))

2-PROPANOL (CAS 67-63-0)

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	Yes
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
Taiwan	Taiwan Chemical Substance Inventory (TCSI)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

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

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

Issue date	03-30-2015
Revision date	01-06-2022
Version #	45
HMIS® ratings	Health: 2 Flammability: 3 Physical hazard: 0
NFPA ratings	Health: 2 Flammability: 3 Instability: 0
Disclaimer	While Brenntag believes the information contained herein to be accurate, Brenntag makes no representation or warranty, express or implied, regarding, and assumes no liability for, the accuracy or completeness of the information. The Buyer assumes all responsibility for handling, using and/or reselling the Product in accordance with applicable federal, state, and local law. This SDS shall not in any way limit or preclude the operation and effect of any of the provisions of Brenntag's terms and conditions of sale.

CLAIMED CONFIDENTIAL

North American Höganäs

SAFETY DATA SHEET

Revision Date 13-Oct-2021 **Version** 1

1. IDENTIFICATION

1.1. Product identifier

Product Name
Item number [redacted]

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

Relevant identified uses Powder metallurgical use.

1.3. Details of the supplier of the safety data sheet

Höganäs Sweden AB
Bruksgatan
S-263 83 Höganäs
SWEDEN
Telephone: +46 42 338000

Contact Information E-Mail
MSDS-info@hoganas.com

Fax Number
+46 42 338330

1.4. Emergency telephone number

Emergency telephone at the company
+46 42 33 80 00 (Only available during office hours - Central European Time Zone, CET)

2. HAZARDS IDENTIFICATION

2.1. Classification of the substance or mixture

This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Combustible dust Classified

2.2. Label elements

Signal word
Warning

Hazard Statements

May form combustible dust concentrations in air

Precautionary Statements

Not applicable

Hazards not otherwise classified (HNOC)
Not applicable

2.3 Other hazards

Not classified as PBT or vPvB

The product contains no substances which at their given concentration, are considered to be hazardous to health

Physical state Powder **Appearance** Light grey to Grey metal Powder. **Odor** Odorless

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances/Mixtures

Chemical name	CAS No	Weight-%	Trade Secret
[redacted]	[redacted]	>99	*

4. FIRST AID MEASURES

4.1. Description of first aid measures

Inhalation Move to fresh air. If symptoms persist, call a physician.

Skin contact Take off contaminated clothing. Wash skin with soap and water.

Eye contact Rinse thoroughly with plenty of water, also under the eyelids. If symptoms appear, seek medical advice.

Ingestion. Drink 1 or 2 glasses of water. Get medical attention. If possible drink milk afterwards.

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

Inhalation Main symptoms: Cough and shortness of breath. May cause irritation of respiratory tract

Skin contact Long term contact can cause irritation.

Eye contact May cause mechanical irritation.

Ingestion Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhea.

4.3. Indication of any immediate medical attention and special treatment needed

Treat symptomatically.

5. FIRE-FIGHTING MEASURES

5.1. Extinguishing media

Suitable Extinguishing Media
Use extinguishing measures that are appropriate to local circumstances and the surrounding environment. Keep containers and surroundings cool with water spray. Confining and smothering metal fires is preferable rather than applying water. Use: Dry powder, dry chemical.

Extinguishing media which shall not be used for safety reasons
Do not use a solid water stream as it may scatter and spread fire.

5.2. Special hazards arising from the substance or mixture

Special Hazard
Avoid generating dust; fine dust dispersed in air in sufficient concentrations, and in the presence of an ignition source is a potential dust explosion hazard.

5.3. Advice for firefighters

As in any fire, wear self-contained breathing apparatus and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

6.1. Personal precautions, protective equipment and emergency procedures

Avoid dust formation. Remove all sources of ignition. Use personal protection recommended in Section 8.

6.2. Environmental precautions

Try to prevent the material from entering drains or water sources.

6.3. Methods and material for containment and cleaning up

Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

6.4 Reference to other sections

Refer to protective measures listed in section 8 and 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Protective measures

Keep workplace clean from dust. Accumulated dust dispersed in air may cause dust explosion if ignited. Use sufficient dust extraction.

Advice on general occupational hygiene

Avoid inhalation, ingestion and contact with skin and eyes. General occupational hygiene measures are required to ensure safe handling of the substance. The measures involve good personal and housekeeping practices (i.e. regular cleaning with suitable cleaning devices), no drinking, eating and smoking at the workplace. Shower and change clothes at end of work shift.

7.2. Conditions for safe storage, including any incompatibilities

Keep container tightly closed in dry place to avoid oxidation of material. Make sure the product does not come in contact with acids or strong oxidizers.

7.3. Specific end use(s)

No information available.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1. Control parameters

Exposure limits

Chemical name	ACGIH TLV	OSHA PEL	NIOSH IDLH
[redacted]	Nuisance dust: 15 mg/m³	Nuisance Dust: 15 mg/m³	-

8.2. Exposure controls

Engineering Measures Ensure adequate ventilation, especially in confined areas.

Protective measures

Eye/Face Protection ANSI approved safety glasses or protective goggles.
Skin protection Long sleeved clothing.
Hand protection Use of canvas gloves is advisable.
Respiratory protection If exposure limits are exceeded or irritation is experienced, NIOSH/MSHA approved respiratory protection should be worn. Respiratory protection must be provided in accordance with current local regulations. minimum N95.

Thermal hazards The substance does not represent a thermal hazard, thus special consideration is not required. .

Environmental Exposure Controls Dust from exhaust ventilation should be separated out in order to avoid release to the natural environment.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

Physical state Powder
Appearance Light grey to Grey metal Powder.
Odor Odorless
Odor Threshold Not applicable
Particle size No information available

Property	Values	Remarks
pH	Not applicable	Insoluble in water.
Melting point / freezing point	1538°C @ 1013hPa	
Boiling point / boiling range	2861°C @ 1013hPa	
Flash Point	Not applicable	Not relevant for inorganic substances
Evaporation rate		Solid with a melting point >300°C
Flammability (solid, gas)	Not flammable.	According to Method A10, EU- Regulation 440/2008
Flammability Limit in Air		
Upper flammability or explosive limit	No information available	
Lower flammability or explosive limit	No information available	
Vapor pressure	Not applicable	Solid with a melting point >300°C
Vapor density	No information available	Solid with a melting point >300°C
Relative density	7,87g/cm3 @ 20°C	
Water Solubility	0,015 mg/l @ 22°C	
Solubility(ies)	Insoluble in organic solvents.	
Partition coefficient	Not applicable	Not relevant for inorganic substances
Autoignition temperature	Not classified.	UN test N.4
Decomposition temperature	Not applicable	Not relevant for inorganic substances
Viscosity	Not applicable	Solid with a melting point >300°C
Explosive properties	Not an explosive	The substance contains no chemical groups associated with explosive properties.
Oxidizing Properties	Not oxidizing	The substance is incapable of reacting exothermically with combustible materials on the basis of the chemical structure.

9.2. Other information

VOC Content (%)	Not applicable
Bulk density	2,0-4,0 g/cm^3
Fines fraction	>=95% -1000µm
Dust explosion class	St 1

10. STABILITY AND REACTIVITY

10.1. Reactivity

Stable under normal conditions.

10.2. Chemical stability

Stable under normal handling and storage conditions.

10.3. Possibility of hazardous reactions

None under normal processing.

10.4. Conditions to avoid

Heat, flames and sparks.

10.5. Incompatible materials

Strong oxidizing agents and strong acids.

10.6. Hazardous decomposition products

None under normal use conditions.

11. TOXICOLOGICAL INFORMATION

11.1. Information on toxicological effects

Information on likely routes of exposure

General	The principal risk to human health presented by "iron" dust is related to the concentration of dust in the air acting as a nuisance dust. The higher the concentration of dust the greater the risk of irritation to the repiratory system and mechanical irritation to the eyes.
Acute Toxicity	The substance is not toxic for skin, inhalation or ingestion.
Skin corrosion/irritation	Not irritating.
Serious Eye Damage/Eye Irritation	OECD 405: Not irritating.
Respiratory or skin sensitization	Not sensitizing.
Germ Cell Mutagenicity	Ames test OECD 471 negative
Reproductive Toxicity	Testing of metallic iron for reproductive toxicity is not appropriate due to a lack of systemic exposure.
STOT-single exposure	Not classified according to the criterias of the Globally Harmonized System (GHS).
STOT-repeated exposure	Not classified according to the criterias of the Globally Harmonized System (GHS).
Aspiration hazard	Not classified according to the criterias of the Globally Harmonized System (GHS).

Chemical name	Oral LD50	Dermal LD50	Inhalation LC50
[redacted]	7500 mg/kg bw (Rat)	-	-

Carcinogenicity Not classified according to the criterias of the Globally Harmonized System (GHS).

Legend:

ACGIH: (American Conference of Governmental Industrial Hygienists)
A1 - Known Human Carcinogen
A2 - Suspected Human Carcinogen
A3 - Animal Carcinogen
A4 - Not Classifiable as a Human Carcinogen
IARC: (International Agency for Research on Cancer)
Group 1 - Carcinogenic to Humans
Group 2A - Probably Carcinogenic to Humans
Group 2B - Possibly Carcinogenic to Humans
Group 3 - Not Classifiable as to Carcinogenicity in Humans
NTP: (National Toxicity Program)
Known - Known Carcinogen
Reasonably Anticipated - Reasonably Anticipated to be a Human Carcinogen

OSHA: (Occupational Safety & Health Administration)
X - Present

12. ECOLOGICAL INFORMATION

12.1. Toxicity

Ecotoxicity effects
Contains forms of iron which are highly insoluble and non-hazardous.

Chemical name	Algae/aquatic plants	Fish	Toxicity to microorganisms	Crustacea
[redacted]	-	LC50 96 h = 13.6 mg/L (Morone saxatilis - static)	-	-

12.2. Persistence and degradability

The methods for determining the biological degradability are not applicable to inorganic substances.

12.3. Bioaccumulative potential

Iron and its compounds are essential compounds. Iron is an essential trace element, well regulated in all living organisms. The availible evidence shows the absence of iron biomagnification across the trophic chain both in the aquatic and terrestrial food chains. The existing information suggests not only that iron does not biomagnify, but rather that it tends to exhibit biodilution.

12.4. Mobility in soil

Iron and its compounds are found in the form of hydroxides in the environment. They are stabilized in the form of oxides in the long term.

12.5. Results of PBT and vPvB assessment

As iron is not bio-available, owing to its extreme insolubility in water, it is not systematically available or bio-accumulative, and hence it does not fulfil either of the PBT or vPvB criteria for classification.

12.6. Other adverse effects

None anticipated.

13. DISPOSAL CONSIDERATIONS

13.1. Waste treatment methods

Product disposal

Recycle where possible. Dispose of in accordance with local regulations.

Packaging disposal

Dispose of in accordance with local regulations.

14. TRANSPORT INFORMATION

DOT

UN/ID no	Not applicable
Proper shipping name	Not applicable
Transport hazard class(es)	Not applicable
Packaging group	Not applicable

IATA

UN/ID no	Not applicable
Proper shipping name	Not applicable
Transport hazard class(es)	Not applicable
Packing Group	Not applicable

IMDG:

UN number	Not regulated
UN proper shipping name	Not applicable
Transport hazard class(es)	Not applicable
Packing Group	Not applicable
Marine pollutant	Not applicable

15. REGULATORY INFORMATION

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

International Inventories

All of the components in the product are on the following Inventory lists:

TSCA	Complies
EINECS/ELINCS	Complies
DSL/NDSL	Complies
ENCS	Complies
IECSC	Complies
KECL	Complies
PICCS	Complies
AICS	Complies

Legend:

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

U.S. Federal Regulations

SARA 313

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

SARA 311/312 Hazard Categories

Acute Health Hazard	No
Chronic Health Hazard	No
Fire Hazard	No
Sudden Release of Pressure Hazard	No
Reactive Hazard	No

Clean Water Act

This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42)

CERCLA

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

U.S. State Regulations

California Proposition 65

This product does not contain any Proposition 65 chemicals

EPA Pesticide Registration Number -

16. OTHER INFORMATION INCLUDING DATE OF PREPARATION OR LAST REVISION

NFPA	**Health Hazard**	0	**Flammability**	1	**Instability** 0	**Physical and chemical hazards**	-
HMIS	**Health Hazard**	0	**Flammability**	1	**Physical Hazard** 0	**Personal protection**	E

Abbreviations

EC50: median effective concentration
LC50: median lethal concentration.
LD50: median lethal dose
NIOSH: The National Institute for Occupational Safety and Health
NOEC: No Observable Effect Concentration
OEL: Occupational Exposure Limit
OSHA Occupational Safety & Health Administration
PBT: Persistent, bioaccumulative, and toxic chemicals
PNEC: Predicted No Effect Concentration (PNEC)
STEL: Short-Term Exposure Limit
TLV: Substance with TLV-values
TWA: Time Weighted Average
vPvB: very persistent, very bioaccumulative chemical

Revision Date 13-Oct-2021

Revision Note No information available.

Disclaimer

The information provided on this SDS is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information

relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

end

SAFETY DATA SHEET

SECTION 1 PRODUCT AND COMPANY IDENTIFICATION

PRODUCT

Product Name: **ISOPAR™ L FLUID**
Product Description: Isoparaffinic Hydrocarbon

Intended Use: Solvent

COMPANY IDENTIFICATION

Supplier: **EXXONMOBIL CHEMICAL COMPANY**
SDS – LOC. 106
22777 Springwoods Village Parkway
Spring, TX 77389-1425 USA

24 Hour Health Emergency	(800) 726-2015
Transportation Emergency Phone	(800) 424-9300 or (703) 527-3887 CHEMTREC
Product Technical Information	(832) 624-8500
Supplier General Contact	(832) 624-8500

SECTION 2 HAZARDS IDENTIFICATION

This material is hazardous according to regulatory guidelines (see (M)SDS Section 15).

CLASSIFICATION:

Flammable liquid: Category 4.
Aspiration toxicant: Category 1.

LABEL:
Pictogram:

Signal Word: Danger

Hazard Statements:
H227: Combustible liquid. H304: May be fatal if swallowed and enters airways.

Precautionary Statements:
P210: Keep away from flames and hot surfaces. -- No smoking. P280: Wear protective gloves and eye / face protection.P301 + P310: IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician. P331: Do NOT induce vomiting. P370 + P378: In case of fire: Use water fog, foam, dry chemical or carbon dioxide (CO2) to

extinguish.P403 + P235: Store in a well-ventilated place. Keep cool. P405: Store locked up.P501: Dispose of contents and container in accordance with local regulations.

Contains: NAPHTHA (PETROLEUM), HYDROTREATED HEAVY

Other hazard information:

HAZARD NOT OTHERWISE CLASSIFIED (HNOC): None as defined under 29 CFR 1910.1200.

PHYSICAL / CHEMICAL HAZARDS

Material can accumulate static charges which may cause an ignition. Material can release vapors that readily form flammable mixtures. Vapor accumulation could flash and/or explode if ignited. Combustible.

HEALTH HAZARDS

Repeated exposure may cause skin dryness or cracking. May be irritating to the eyes, nose, throat, and lungs.

ENVIRONMENTAL HAZARDS

No significant hazards.

NFPA Hazard ID:	Health:	1	Flammability:	2	Reactivity:	0
HMIS Hazard ID:	Health:	1*	Flammability:	2	Reactivity:	0

NOTE: This material should not be used for any other purpose than the intended use in Section 1 without expert advice. Health studies have shown that chemical exposure may cause potential human health risks which may vary from person to person.

SECTION 3 COMPOSITION / INFORMATION ON INGREDIENTS

This material is defined as a complex substance.

Hazardous Substance(s) or Complex Substance(s) required for disclosure

Name	CAS#	Concentration*	GHS Hazard Codes
NAPHTHA (PETROLEUM), HYDROTREATED HEAVY	64742-48-9	100 %	H227, H304

* All concentrations are percent by weight unless material is a gas. Gas concentrations are in percent by volume. Concentration values may vary.

As per paragraph (i) of 29 CFR 1910.1200, formulation is considered a trade secret and specific chemical identity and exact percentage (concentration) of composition may have been withheld. Specific chemical identity and exact percentage composition will be provided to health professionals, employees, or designated representatives in accordance with applicable provisions of paragraph (i).

SECTION 4 FIRST AID MEASURES

INHALATION

Remove from further exposure. For those providing assistance, avoid exposure to yourself or others. Use adequate respiratory protection. If respiratory irritation, dizziness, nausea, or unconsciousness occurs, seek

immediate medical assistance. If breathing has stopped, assist ventilation with a mechanical device or use mouth-to-mouth resuscitation.

SKIN CONTACT

Wash contact areas with soap and water. Remove contaminated clothing. Launder contaminated clothing before reuse.

EYE CONTACT

Flush thoroughly with water. If irritation occurs, get medical assistance.

INGESTION

Seek immediate medical attention. Do not induce vomiting.

NOTE TO PHYSICIAN

If ingested, material may be aspirated into the lungs and cause chemical pneumonitis. Treat appropriately.

SECTION 5 FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA

Appropriate Extinguishing Media: Use water fog, foam, dry chemical or carbon dioxide (CO2) to extinguish flames.

Inappropriate Extinguishing Media: Straight Streams of Water

FIRE FIGHTING

Fire Fighting Instructions: Evacuate area. Prevent runoff from fire control or dilution from entering streams, sewers, or drinking water supply. Firefighters should use standard protective equipment and in enclosed spaces, self-contained breathing apparatus (SCBA). Use water spray to cool fire exposed surfaces and to protect personnel.

Unusual Fire Hazards: Combustible.

Hazardous Combustion Products: Incomplete combustion products, Oxides of carbon, Smoke, Fume

FLAMMABILITY PROPERTIES

Flash Point [Method]: 62°C (144°F) [ASTM D-93]
Flammable Limits (Approximate volume % in air): LEL: 0.7 UEL: 6.0
Autoignition Temperature: 332°C (630°F) [ASTM E659]

SECTION 6 ACCIDENTAL RELEASE MEASURES

NOTIFICATION PROCEDURES

In the event of a spill or accidental release, notify relevant authorities in accordance with all applicable regulations. US regulations require reporting releases of this material to the environment which exceed the applicable reportable quantity or oil spills which could reach any waterway including intermittent dry creeks. The National Response Center can be reached at (800)424-8802.

PROTECTIVE MEASURES

Avoid contact with spilled material. Warn or evacuate occupants in surrounding and downwind areas if

required due to toxicity or flammability of the material. See Section 5 for fire fighting information. See the Hazard Identification Section for Significant Hazards. See Section 4 for First Aid Advice. See Section 8 for advice on the minimum requirements for personal protective equipment. Additional protective measures may be necessary, depending on the specific circumstances and/or the expert judgment of the emergency responders.

For emergency responders: Respiratory protection: half-face or full-face respirator with filter(s) for organic vapor and, when applicable, H2S, or Self Contained Breathing Apparatus (SCBA) can be used depending on the size of spill and potential level of exposure. If the exposure cannot be completely characterized or an oxygen deficient atmosphere is possible or anticipated, SCBA is recommended. Work gloves that are resistant to aromatic hydrocarbons are recommended. Note: gloves made of polyvinyl acetate (PVA) are not water-resistant and are not suitable for emergency use. Chemical goggles are recommended if splashes or contact with eyes is possible. Small spills: normal antistatic work clothes are usually adequate. Large spills: full body suit of chemical resistant, antistatic material is recommended.

SPILL MANAGEMENT

Land Spill: Eliminate all ignition sources (no smoking, flares, sparks or flames in immediate area). Stop leak if you can do it without risk. All equipment used when handling the product must be grounded. Do not touch or walk through spilled material. Prevent entry into waterways, sewer, basements or confined areas. A vapor suppressing foam may be used to reduce vapors. Use clean non-sparking tools to collect absorbed material. Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. Large Spills: Water spray may reduce vapor; but may not prevent ignition in closed spaces. Recover by pumping or with suitable absorbent.

Water Spill: Stop leak if you can do it without risk. Confine the spill immediately with booms. Warn other shipping. Remove from the surface by skimming or with suitable absorbents. Seek the advice of a specialist before using dispersants.

Water spill and land spill recommendations are based on the most likely spill scenario for this material; however, geographic conditions, wind, temperature, (and in the case of a water spill) wave and current direction and speed may greatly influence the appropriate action to be taken. For this reason, local experts should be consulted. Note: Local regulations may prescribe or limit action to be taken.

ENVIRONMENTAL PRECAUTIONS

Large Spills: Dike far ahead of liquid spill for later recovery and disposal. Prevent entry into waterways, sewers, basements or confined areas.

SECTION 7 HANDLING AND STORAGE

HANDLING

Avoid contact with skin. Small metal particles from machining may cause abrasion of the skin and may predispose to dermatitis. Prevent small spills and leakage to avoid slip hazard. Material can accumulate static charges which may cause an electrical spark (ignition source). When the material is handled in bulk, an electrical spark could ignite any flammable vapors from liquids or residues that may be present (e.g., during switch-loading operations). Use proper bonding and/or ground procedures. However, bonding and grounds may not eliminate the hazard from static accumulation. Consult local applicable standards for guidance. Additional references include American Petroleum Institute 2003 (Protection Against Ignitions Arising out of Static, Lightning and Stray Currents) or National Fire Protection Agency 77 (Recommended Practice on Static Electricity) or CENELEC CLC/TR 50404 (Electrostatics - Code of practice for the avoidance of hazards due to static electricity).

Loading/Unloading Temperature: [Ambient]

Transport Temperature: [Ambient]
Transport Pressure: [Ambient]

Static Accumulator: This material is a static accumulator. A liquid is typically considered a nonconductive, static accumulator if its conductivity is below 100 pS/m (100x10E-12 Siemens per meter) and is considered a semiconductive, static accumulator if its conductivity is below 10,000 pS/m. Whether a liquid is nonconductive or semiconductive, the precautions are the same. A number of factors, for example liquid temperature, presence of contaminants, anti-static additives and filtration can greatly influence the conductivity of a liquid.

STORAGE

The type of container used to store the material may affect static accumulation and dissipation. Keep container closed. Handle containers with care. Open slowly in order to control possible pressure release. Store in a cool, well-ventilated area. Storage containers should be grounded and bonded. Fixed storage containers, transfer containers and associated equipment should be grounded and bonded to prevent accumulation of static charge.
Storage Temperature: [Ambient]
Storage Pressure: [Ambient]

Suitable Containers/Packing: Tankers; Tank Trucks; Drums; Barges; Railcars
Suitable Materials and Coatings (Chemical Compatibility): Carbon Steel; Stainless Steel; Teflon; Neoprene; Epoxy Phenolics; Inorganic Zinc Coatings
Unsuitable Materials and Coatings: Butyl Rubber; Natural Rubber; Ethylene-proplyene-diene monomer (EPDM); Vinyl Coatings

SECTION 8 EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE LIMIT VALUES

Exposure limits/standards (Note: Exposure limits are not additive)

Substance Name	Form	Limit / Standard			NOTE	Source
NAPHTHA (PETROLEUM), HYDROTREATED HEAVY	Vapor.	RCP - TWA	1200 mg/m3	171 ppm	Total Hydrocarbons	ExxonMobil

NOTE: Limits/standards shown for guidance only. Follow applicable regulations.

No biological limits allocated.

ENGINEERING CONTROLS

The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Control measures to consider:
Adequate ventilation should be provided so that exposure limits are not exceeded. Use explosion-proof ventilation equipment.

PERSONAL PROTECTION

Personal protective equipment selections vary based on potential exposure conditions such as applications, handling practices, concentration and ventilation. Information on the selection of protective equipment for use with this material, as provided below, is based upon intended, normal usage.

Respiratory Protection: If engineering controls do not maintain airborne contaminant concentrations at a level which is adequate to protect worker health, an approved respirator may be appropriate. Respirator selection, use, and maintenance must be in accordance with regulatory requirements, if applicable. Types of respirators to be considered for this material include:

Half-face filter respirator

For high airborne concentrations, use an approved supplied-air respirator, operated in positive pressure mode. Supplied air respirators with an escape bottle may be appropriate when oxygen levels are inadequate, gas/vapor warning properties are poor, or if air purifying filter capacity/rating may be exceeded.

Hand Protection: Any specific glove information provided is based on published literature and glove manufacturer data. Glove suitability and breakthrough time will differ depending on the specific use conditions. Contact the glove manufacturer for specific advice on glove selection and breakthrough times for your use conditions. Inspect and replace worn or damaged gloves. The types of gloves to be considered for this material include:

If prolonged or repeated contact is likely, chemical resistant gloves are recommended. If contact with forearms is likely, wear gauntlet style gloves.

Eye Protection: If contact is likely, safety glasses with side shields are recommended.

Skin and Body Protection: Any specific clothing information provided is based on published literature or manufacturer data. The types of clothing to be considered for this material include:

If prolonged or repeated contact is likely, chemical, and oil resistant clothing is recommended.

Specific Hygiene Measures: Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Discard contaminated clothing and footwear that cannot be cleaned. Practice good housekeeping.

ENVIRONMENTAL CONTROLS

Comply with applicable environmental regulations limiting discharge to air, water and soil. Protect the environment by applying appropriate control measures to prevent or limit emissions.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Note: Physical and chemical properties are provided for safety, health and environmental considerations only and may not fully represent product specifications. Contact the Supplier for additional information.

GENERAL INFORMATION

Physical State: Liquid
Form: Clear
Color: Colorless
Odor: Faint
Odor Threshold: N/D

IMPORTANT HEALTH, SAFETY, AND ENVIRONMENTAL INFORMATION

Relative Density (at 15.6 °C): 0.77 [With respect to water] [Calculated]
Density (at 15.6 ºC): 760 kg/m³ (6.34 lbs/gal, 0.76 kg/dm³) [ASTM D4052]
Flammability (Solid, Gas): N/A
Flash Point [Method]: 62°C (144°F) [ASTM D-93]
Flammable Limits (Approximate volume % in air): LEL: 0.7 UEL: 6.0
Autoignition Temperature: 332°C (630°F) [ASTM E659]
Boiling Point / Range: 190°C (374°F) - 208°C (406°F) [ASTM D86]
Decomposition Temperature: N/D
Vapor Density (Air = 1): 5.6 at 101 kPa [Calculated]
Vapor Pressure: 0.04 kPa (0.3 mm Hg) at 20 °C [Calculated]
Evaporation Rate (n-butyl acetate = 1): 0.03 [Calculated]
pH: N/A
Log Pow (n-Octanol/Water Partition Coefficient): > 4 [Estimated]
Solubility in Water: Negligible
Viscosity: 1.6 cSt (1.6 mm2/sec) at 40 °C | 2.3 cSt (2.3 mm2/sec) at 20°C [Calculated]
Oxidizing Properties: See Hazards Identification Section.

OTHER INFORMATION

Freezing Point: N/D
Melting Point: N/A
Pour Point: -69°C (-92°F) [ASTM D5950]
Molecular Weight: 162 g/mol [Calculated]
Hygroscopic: No
Coefficient of Thermal Expansion: 0.00078 per Deg C [Calculated]

SECTION 10 STABILITY AND REACTIVITY

REACTIVITY: See sub-sections below.

STABILITY: Material is stable under normal conditions.

CONDITIONS TO AVOID: Avoid heat, sparks, open flames and other ignition sources.

MATERIALS TO AVOID: Strong oxidizers

HAZARDOUS DECOMPOSITION PRODUCTS: Material does not decompose at ambient temperatures.

POSSIBILITY OF HAZARDOUS REACTIONS: Hazardous polymerization will not occur.

SECTION 11 TOXICOLOGICAL INFORMATION

INFORMATION ON TOXICOLOGICAL EFFECTS

Hazard Class	Conclusion / Remarks
Inhalation	
Acute Toxicity: (Rat) 4 hour(s) LC50 > 5000 mg/m3 (Vapor)	Minimally Toxic. Based on test data for structurally similar materials. Test(s) equivalent or similar to OECD Guideline 403
Irritation: No end point data for material.	Negligible hazard at ambient/normal handling temperatures.
Ingestion	
Acute Toxicity (Rat): LD50 > 5000 mg/kg	Minimally Toxic. Based on test data for structurally similar

	materials. Test(s) equivalent or similar to OECD Guideline 401
Skin	
Acute Toxicity (Rabbit): LD50 > 5000 mg/kg	Minimally Toxic. Based on test data for structurally similar materials. Test(s) equivalent or similar to OECD Guideline 402
Skin Corrosion/Irritation: Data available.	May dry the skin leading to discomfort and dermatitis. Based on test data for structurally similar materials. Test(s) equivalent or similar to OECD Guideline 404
Eye	
Serious Eye Damage/Irritation: Data available.	May cause mild, short-lasting discomfort to eyes. Based on test data for structurally similar materials. Test(s) equivalent or similar to OECD Guideline 405
Sensitization	
Respiratory Sensitization: No end point data for material.	Not expected to be a respiratory sensitizer.
Skin Sensitization: Data available.	Not expected to be a skin sensitizer. Based on test data for structurally similar materials. Test(s) equivalent or similar to OECD Guideline 406
Aspiration: Data available.	May be fatal if swallowed and enters airways. Based on physico-chemical properties of the material.
Germ Cell Mutagenicity: Data available.	Not expected to be a germ cell mutagen. Based on test data for structurally similar materials. Test(s) equivalent or similar to OECD Guideline 471 473 474 476 478 479
Carcinogenicity: Data available.	Not expected to cause cancer. Based on test data for structurally similar materials. Test(s) equivalent or similar to OECD Guideline 453
Reproductive Toxicity: Data available.	Not expected to be a reproductive toxicant. Based on test data for structurally similar materials. Test(s) equivalent or similar to OECD Guideline 413 414 415
Lactation: No end point data for material.	Not expected to cause harm to breast-fed children.
Specific Target Organ Toxicity (STOT)	
Single Exposure: No end point data for material.	Not expected to cause organ damage from a single exposure.
Repeated Exposure: Data available.	Not expected to cause organ damage from prolonged or repeated exposure. Based on test data for structurally similar materials. Test(s) equivalent or similar to OECD Guideline 408 413

OTHER INFORMATION

For the product itself:

Vapor concentrations above recommended exposure levels are irritating to the eyes and the respiratory tract, may cause headaches and dizziness, are anesthetic and may have other central nervous system effects.

Prolonged and/or repeated skin contact with low viscosity materials may defat the skin resulting in possible irritation and dermatitis.

Small amounts of liquid aspirated into the lungs during ingestion or from vomiting may cause chemical pneumonitis or pulmonary edema.

The following ingredients are cited on the lists below: None.

--REGULATORY LISTS SEARCHED--

1 = NTP CARC	3 = IARC 1	5 = IARC 2B
2 = NTP SUS	4 = IARC 2A	6 = OSHA CARC

SECTION 12 ECOLOGICAL INFORMATION

The information given is based on data for the material, components of the material, or for similar materials, through the application of bridging principals.

ECOTOXICITY

Material -- Not expected to be harmful to aquatic organisms.
Material -- Not expected to demonstrate chronic toxicity to aquatic organisms.

MOBILITY

Material -- Highly volatile, will partition rapidly to air. Not expected to partition to sediment and wastewater solids.

PERSISTENCE AND DEGRADABILITY

Biodegradation:

Material -- Expected to be inherently biodegradable

Hydrolysis:

Material -- Transformation due to hydrolysis not expected to be significant.

Photolysis:

Material -- Transformation due to photolysis not expected to be significant.

Atmospheric Oxidation:

Material -- Expected to degrade rapidly in air

ECOLOGICAL DATA

Ecotoxicity

Test	Duration	Organism Type	Test Results
Aquatic - Acute Toxicity	48 hour(s)	Daphnia magna	EL0 1000 mg/l: data for similar materials
Aquatic - Acute Toxicity	96 hour(s)	Oncorhynchus mykiss	LL0 1000 mg/l: data for similar materials
Aquatic - Acute Toxicity	72 hour(s)	Pseudokirchneriella subcapitata	EL0 1000 mg/l: data for similar materials
Aquatic - Acute Toxicity	72 hour(s)	Pseudokirchneriella subcapitata	NOELR 1000 mg/l: data for similar materials
Aquatic - Chronic Toxicity	21 day(s)	Daphnia magna	NOELR 1 mg/l: data for the material

Persistence, Degradability and Bioaccumulation Potential

Media	Test Type	Duration	Test Results
Water	Ready Biodegradability	28 day(s)	Percent Degraded 31.3 : similar material

SECTION 13 DISPOSAL CONSIDERATIONS

Disposal recommendations based on material as supplied. Disposal must be in accordance with current applicable laws and regulations, and material characteristics at time of disposal.

DISPOSAL RECOMMENDATIONS

Product is suitable for burning in an enclosed controlled burner for fuel value or disposal by supervised incineration at very high temperatures to prevent formation of undesirable combustion products.

REGULATORY DISPOSAL INFORMATION

RCRA Information: The unused product, in our opinion, is not specifically listed by the EPA as a hazardous waste (40 CFR, Part 261D), nor is it formulated to contain materials which are listed as hazardous wastes. It does not exhibit the hazardous characteristics of ignitability, corrositivity or reactivity and is not formulated with contaminants as determined by the Toxicity Characteristic Leaching Procedure (TCLP). However, used product may be regulated.

Empty Container Warning Empty Container Warning (where applicable): Empty containers may contain residue and can be dangerous. Do not attempt to refill or clean containers without proper instructions. Empty drums should be completely drained and safely stored until appropriately reconditioned or disposed. Empty containers should be taken for recycling, recovery, or disposal through suitably qualified or licensed contractor and in accordance with governmental regulations. DO NOT PRESSURISE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND, OR EXPOSE SUCH CONTAINERS TO HEAT, FLAME, SPARKS, STATIC ELECTRICITY, OR OTHER SOURCES OF IGNITION. THEY MAY EXPLODE AND CAUSE INJURY OR DEATH.

SECTION 14 TRANSPORT INFORMATION

LAND (DOT)

Proper Shipping Name: PETROLEUM DISTILLATES, N.O.S.
Hazard Class & Division: COMBUSTIBLE LIQUID
ID Number: 1268
Packing Group: III
ERG Number: 128
Label(s): NONE
Transport Document Name: UN1268, PETROLEUM DISTILLATES, N.O.S., COMBUSTIBLE LIQUID, PG III

Footnote: This material is not regulated under 49 CFR in a container of 119 gallon capacity or less when transported solely by land, as long as the material is not a hazardous waste, a marine pollutant, or specifically listed as a hazardous substance.

LAND (TDG): Not Regulated for Land Transport

SEA (IMDG): Not Regulated for Sea Transport according to IMDG-Code

Marine Pollutant: No

AIR (IATA): Not Regulated for Air Transport

SECTION 15 REGULATORY INFORMATION

OSHA HAZARD COMMUNICATION STANDARD: This material is considered hazardous in accordance with OSHA HazCom 2012, 29 CFR 1910.1200.

Listed or exempt from listing/notification on the following chemical inventories: AICS, DSL, ENCS, IECSC, KECI, PICCS, TCSI, TSCA

The national inventory listings are based on the CAS number or numbers listed below.

CAS
64742-48-9
90622-58-5

SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302

CERCLA: This material is not subject to any special reporting under the requirements of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). CERCLA petroleum exclusion applies for this product. Contact local authorities to determine if other reporting requirements apply.

CWA / OPA: This product is classified as an oil under Section 311 of the Clean Water Act (40 CFR 110) and the Oil Pollution Act of 1990. Discharge or spills which produce a visible sheen on either surface water, or in waterways/sewers which lead to surface water, must be reported to the National Response Center at 800-424-8802.

SARA (311/312) REPORTABLE GHS HAZARD CLASSES: Aspiration Hazard, Flammable (gases, aerosols, liquids, or solids)

SARA (313) TOXIC RELEASE INVENTORY: This material contains no chemicals subject to the supplier notification requirements of the SARA 313 Toxic Release Program.

The following ingredients are cited on the lists below:

Chemical Name	CAS Number	List Citations
NAPHTHA (PETROLEUM), HYDROTREATED HEAVY	64742-48-9	16, 17, 18

--REGULATORY LISTS SEARCHED--

1 = ACGIH ALL	6 = TSCA 5a2	11 = CA P65 REPRO	16 = MN RTK
2 = ACGIH A1	7 = TSCA 5e	12 = CA RTK	17 = NJ RTK
3 = ACGIH A2	8 = TSCA 6	13 = IL RTK	18 = PA RTK
4 = OSHA Z	9 = TSCA 12b	14 = LA RTK	19 = RI RTK
5 = TSCA 4	10 = CA P65 CARC	15 = MI 293	

Code key: CARC=Carcinogen; REPRO=Reproductive

SECTION 16 OTHER INFORMATION

N/D = Not determined, N/A = Not applicable

KEY TO THE H-CODES CONTAINED IN SECTION 3 OF THIS DOCUMENT (for information only):
H227: Combustible liquid; Flammable Liquid, Cat 4
H304: May be fatal if swallowed and enters airways; Aspiration, Cat 1

THIS SAFETY DATA SHEET CONTAINS THE FOLLOWING REVISIONS:
Section 08: Exposure Limits Table information was modified.
Section 09: Molecular Weight information was modified.
Section 12: information was modified.
Section 15: CWA information was added.
Section 15: List Citations Table information was modified.

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Internal Use Only
MHC: 1A, 0, 0, 0, 1, 0

DGN: 4400160HUS (1011196)

Rhino Linings

SAFETY DATA SHEET

Part No.: 3155

DATE: 3/26/2015
SUPERCEDES: 01/08/2014

PRODUCT NAME: Rhino® 3155 Hardener

CHEMICAL FAMILY: Polyetherdiamines

SECTION 1 – IDENTIFICATION

MANUFACTURER'S NAME: Rhino Linings Corporation

ADDRESS: 9747 Businesspark Avenue, San Diego, CA, 92131

INFORMATION PHONE: 858-450-0441

EMERGENCY CONTACT: (CHEMTREC): 800-424-9300

SECTION 2 – HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW: Corrosive epoxy hardener. Certain individuals may have pre-existing skin or respiratory conditions causing a sensitivity or allergy which manifests as various reactions. Heating or spraying this product or the mixed parts increases potential health hazards. Health and Safety personnel should examine the handling procedures and remedy any existing or potential health and safety hazards.

POTENTIAL HEALTH EFFECTS:

EYE:
- Can cause irritation. Significant, prolonged, or repeated contact can damage the cornea.

SKIN:
- Can cause irritation. Significant, prolonged, or repeated exposure can cause severe irritation.

INGESTION:
- Can inflame or damage the G.I. tract. Ingestion can be harmful.

INHALATION:
- Can cause irritation. Significant, prolonged, or repeated exposure to mist or vapor can damage the respiratory system.

CHRONIC EFFECTS:
- Repeated exposure can cause irritation and sensitization.

SIGNS & SYMPTOMS:
- Skin rash, irritation, reddening, or eczema; Breathing irritation or difficulty.

SECTION 3 – COMPOSITION/INFORMATION ON INGREDIENTS

INGREDIENT	%	CAS #	EXPOSURE LIMITS
Isophoronediamine	<40	2855-13-2	N/E
Polyoxypropylenediamine	<40	9046-10-0	N/E
Proprietary ingredients	>20	Trade secret	N/E

SECTION 4 – FIRST-AID MEASURES

♦USE APPROPRIATE BLOOD-BORNE PATHOGENS PROTECTIONS♦

EYE:
- Hold eyelids apart and flood with copious amounts of water. Seek medical attention.

SKIN:
- Remove excess product. Wash thoroughly with soap and water. If irritation persists, seek medical attention.

INGESTION:
- Do not induce vomiting unless directed by medical personnel. Seek medical attention.

INHALATION:
- Remove to fresh air. Seek medical attention.

PRODUCT NAME: Rhino® 3155 Hardener

CHEMICAL FAMILY: Polyetherdiamines

SECTION 5 – FIRE-FIGHTING MEASURES

FLASH POINT: 205°C 400°F UEL: N.D.A.% LEL: N.D.A. VAPOR DENSITY: N.D.A.
NFPA FLAMMABILITY RATING: 1 AUTOIGNITION: N.D.A.
COMBUSTION PRODUCTS: CO, CO_2, NO_x, & misc. hydrocarbons
SPECIAL HAZARDS: Firefighters should wear butyl rubber boots, gloves, and body suit with SCBA. May generate toxic and irritating combustion products. Use DOT Response Guide #153.
EXTINGUISHING MEDIA: Use foam, CO_2, dry chemical, water fog.
FIRE FIGHTER INSTRUCTIONS: Stay upwind. Wear at least full bunker gear and SCBA.

SECTION 6 – ACCIDENTAL RELEASE MEASURES

Isolate spill area. Keep out of sewer and storm drains. Stop the leak and contain the spill. Vacuum, scoop, or absorb spill with non-combustible materials. Clean up spill residues with soap and water.

SECTION 7 – HANDLING AND STORAGE

Avoid skin and eye contact and breathing vapors by appropriate measures. Do not eat or smoke while handling this product. Wash thoroughly with soap and water after handling or exposure to this product.

Store in original sealed container at ambient temperatures (65°-80°F) in dry, well-ventilated areas.

SECTION 8 – EXPOSURE CONTROLS/PERSONAL PROTECTION

For Personal exposure Limits (PEL), Threshold Limit Values (TLV), or other exposure limits, see Sec.2.
GENERAL: Provide adequate ventilation that will keep airborne concentration at a minimum.
EYE/FACE: Safety glasses or splash goggles with face shield.
SKIN: Chemical resistant gloves. Don chemical resistant clothing where exposure may occur.
RESPIRATORY: NIOSH approved respirator with organic vapor/HEPA filter cartridges.
OTHER: Decontaminate or discard clothing and materials that have come in contact with this product.

SECTION 9 – PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE: clear liquid ODOR: faint amine PHYSICAL STATE: liquid
pH: alkaline VAPOR PRESS: N.D.A. VAPOR DENSITY: N.D.A. SPECIFIC GRAVITY: 0.98
BOILING PT: N.D.A. MELT PT: N/A SOLUBILITY IN H_2O: slightly

SECTION 10 – STABILITY AND REACTIVITY

CHEMICAL STABILITY: Stable.
INCOMPATIBILITY: Strong oxidizers, acids, epoxy resins in uncontrolled conditions; contact with other unpolymerized monomers or polymers.
HAZARDOUS POLYMERIZATION: Will not occur.
HAZARDOUS DECOMPOSITION: None known, other than Sec. 5's Combustion Products.

SECTION 11 – TOXICOLOGICAL INFORMATION

Oral: N.D.A.
Dermal: N.D.A.
Inhalation: N.D.A.
Carcinogens under OSHA, ACGIH, NTP, IARC, or Other: None ≥ 0.1%.

PRODUCT NAME: Rhino® 3155 Hardener

CHEMICAL FAMILY: Polyetherdiamines

SECTION 12 – ECOLOGICAL INFORMATION

N.D.A.

SECTION 13 – DISPOSAL CONSIDERATIONS

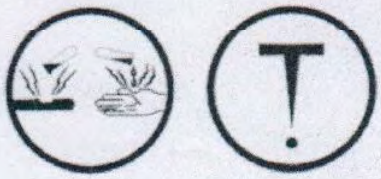
Dispose of in accordance with applicable federal, state, and local laws and regulations.

SECTION 14 – TRANSPORT INFORMATION

DOT: ISOPHORONEDIAMINE, 8, UN 2289, PGIII.
IATA: Regulated.
IMO: UN 2289 Isophoronediamine, class 8, PG III

SECTION 15 – REGULATORY INFORMATION

OSHA: 1910.1200 Hazardous Chemical "Corrosive", "Sensitizer".
TSCA: Contains listed ingredients.
SARA III: Sec311 & 312 Immediate Health Hazard; Sec313 Chemicals above de minimus level: None.
CA PROP. 65 NOTICE: Not listed.
VOLATILE ORGANIC COMPOUND (VOC) %: Zero.
NFPA: HEALTH 3 FIRE 1 REACTIVITY 0 OTHER N/A



WHMIS: Hazard Classification: Class D Division 2A, Class D Division 2B, Class E Corrosive.
WHMIS Symbols: Stylized T.
Trade Secrets: N/A.
Hazardous Products Act Information: This product SDS contains ingredients which are Controlled and/or on the Ingredient Disclosure List (HPA sections 13 and 14).

SECTION 16 – OTHER INFORMATION

03/26/2015 Change to SDS format. Supercedes 01/08/2014.

ABBREVIATIONS: N/A = not applicable; N.D.A. = no data available; NE = not established

Disclaimer: The data set forth in this sheet are based on information provided by the suppliers of the raw materials and chemicals used in the manufacture of the aforementioned product. Rhino Linings Corporation makes no warranty with respect to the accuracy of the information provided by their suppliers, and disclaims all liability of reliance thereof.

Rhino Linings

SAFETY DATA SHEET

Part No.: 1320

DATE: 3/30/2015
SUPERCEDES: 01/04/2012

PRODUCT NAME: Rhino® 1320 Epoxy Resin

CHEMICAL FAMILY: Epoxy Resin Mixture

SECTION 1 – IDENTIFICATION

MANUFACTURER'S NAME: Rhino Linings Corporation

ADDRESS: 9747 Businesspark Avenue, San Diego, CA, 92131

INFORMATION PHONE: 858-450-0441

EMERGENCY CONTACT: (CHEMTREC): 800-424-9300

SECTION 2 – HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW: Epoxy resin solution. Certain individuals may have pre-existing skin or respiratory conditions causing a sensitivity or allergy which manifests as various reactions. Heating or spraying this product or the mixed parts increases potential health hazards. Health and Safety personnel should examine the handling procedures and remedy any existing or potential health and safety hazards.

POTENTIAL HEALTH EFFECTS:

EYE:
- May cause irritation.

SKIN:
- May cause irritation. Low dermal absorption hazard.

INGESTION:
- May inflame or damage the G.I. tract. Large quantities may be harmful.

INHALATION:
- May cause irritation.

CHRONIC EFFECTS:
- Repeated exposure may cause irritation and sensitization.

SIGNS & SYMPTOMS:
- Skin rash, irritation, reddening, or eczema; breathing irritation or difficulty.

SECTION 3 – COMPOSITION/INFORMATION ON INGREDIENTS

INGREDIENT	%	CAS #	EXPOSURE LIMITS
Bisphenol A Reaction Product	>75	25085-99-8	N/E
O-Cresyl Glycidyl Ether	<10	2210-79-9	N/E
Proprietary ingredients	<10	Trade secret	N/E

SECTION 4 – FIRST-AID MEASURES

♦USE APPROPRIATE BLOOD-BORNE PATHOGENS PROTECTIONS♦

EYE:
- Hold eyelids apart and flood with copious amounts of water. Seek medical attention.

SKIN:
- Remove excess product. Wash thoroughly with soap and water. If irritation persists, seek medical attention.

INGESTION:
- Do not induce vomiting unless directed by medical personnel. Seek medical attention.

INHALATION:
- Remove to fresh air. Seek medical attention.

PRODUCT NAME: Rhino® 1320 Epoxy Resin

CHEMICAL FAMILY: Epoxy Resin Mixture

SECTION 5 – FIRE-FIGHTING MEASURES

FLASH POINT: 177°C 350°F UEL: N/A LEL: N/A VAPOR DENSITY: N/A
NFPA FLAMMABILITY RATING: 1 AUTOIGNITION: 300°C 570°F
COMBUSTION PRODUCTS: CO, CO_2, NO_x, & misc. hydrocarbons.
SPECIAL HAZARDS: Pre-sensitization to epoxy.
EXTINGUISHING MEDIA: Use foam, CO_2, dry chemical, water fog.
FIRE FIGHTER INSTRUCTIONS: Stay upwind. Wear at least full bunker gear and SCBA.

SECTION 6 – ACCIDENTAL RELEASE MEASURES

Isolate spill area. Keep out of sewer and storm drains. Stop the leak and contain the spill. Vacuum, scoop, or absorb spill with non-combustible materials. Clean up spill residues with soap and water.

SECTION 7 – HANDLING AND STORAGE

Avoid skin and eye contact and breathing vapors or mists by appropriate measures. Do not eat or smoke while handling this product. Wash thoroughly after handling or exposure to this product.

Store in original sealed container at ambient temperatures (65°-80°F) in dry, well-ventilated areas.

SECTION 8 – EXPOSURE CONTROLS/PERSONAL PROTECTION

For Personal Exposure Limits (PEL), Threshold Limit Values (TLV) or other exposure limits, see Sec. 3.
GENERAL: Provide ventilation that will keep airborne concentration at a minimum.
EYE/FACE: Safety glasses or splash goggles with face shield.
SKIN: Butyl or nitrile rubber chemical gloves. Don chemical resistant clothing where exposure may occur.
RESPIRATORY: NIOSH approved respirator with organic vapor/HEPA filter cartridges.
OTHER: Decontaminate or discard clothing and materials that have come in contact with this product.

SECTION 9 – PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE: clear syrup ODOR: slightly sweet PHYSICAL STATE: liquid
VAPOR PRESS: N.D.A. SPECIFIC GRAVITY: 1.10 pH: N.D.A.
BOILING PT: N.D.A. MELT PT: N/A SOLUBILITY IN H_2O: slightly

SECTION 10 – STABILITY AND REACTIVITY

CHEMICAL STABILITY: Stable.
INCOMPATIBILITY: Strong acids, caustics, oxidizers, and epoxy hardeners in an uncontrolled condition.
HAZARDOUS POLYMERIZATION: Will not occur.
HAZARDOUS DECOMPOSITION: None known, other than Sec. 5's Combustion Products.

SECTION 11 – TOXICOLOGICAL INFORMATION

Oral: N.D.A.
Dermal: N.D.A.
Inhalation: N.D.A.
Carcinogens under OSHA, ACGIH, NTP, IARC, or Other: None ≥ 0.1%.

PRODUCT NAME: Rhino® 1320 Epoxy Resin

CHEMICAL FAMILY: Epoxy Resin Mixture

SECTION 12 – ECOLOGICAL INFORMATION

N.D.A.

SECTION 13 – DISPOSAL CONSIDERATIONS

Dispose of in accordance with applicable federal, state, and local laws and regulations.

SECTION 14 – TRANSPORT INFORMATION

DOT: Not Regulated.
IATA:
IMO:

SECTION 15 – REGULATORY INFORMATION

OSHA: 29 CFR 1910.1200 Hazardous Chemical "Irritant", "Sensitizer".
TSCA: Ingredients listed.
SARA III: Sec311 & 312 Immediate Health Hazard; Sec313 Not listed.
CA PROP. 65 NOTICE: Not listed.
NFPA: Health 1 Fire 1 Reactivity 0 Other N/A

WHMIS: Hazard Classification: Class D2B Skin Sensitizer. Refer to SDS for specific warnings.
WHMIS Symbols: Stylized T.
WHMIS Trade Secret Registry Numbers: None.
Hazardous Products Act Information: This product SDS contains ingredients which are Controlled and/or on the Ingredient Disclosure List (HPA sections 13 and 14).

SECTION 16 – OTHER INFORMATION

3/30/2015 Change to SDS format. Supersedes 01/04/2012.

ABBREVIATIONS: N/A = not applicable; N.D.A. = no data available; NE = not established

Disclaimer: The data set forth in this sheet are based on information provided by the suppliers of the raw materials and chemicals used in the manufacture of the aforementioned product. Rhino Linings Corporation makes no warranty with respect to the accuracy of the information provided by their suppliers, and disclaims all liability of reliance thereof.

SAFETY DATA SHEET

Revision Date 28-Feb-2020 **Revision Number** 2

1. Identification

Product Name **Viscosity standard, Specpure®, nominally 360cSt @40°C and 42 cSt @ 100°C**

Cat No. : **47021**

Synonyms No information available

Recommended Use Laboratory chemicals.
Uses advised against Food, drug, pesticide or biocidal product use.

Details of the supplier of the safety data sheet

Company
Alfa Aesar
Thermo Fisher Scientific Chemicals, Inc.
30 Bond Street
Ward Hill, MA 01835-8099
Tel: 800-343-0660
Fax: 800-322-4757
Email: tech@alfa.com
www.alfa.com

Emergency Telephone Number
During normal business hours (Monday-Friday, 8am-7pm EST), call (800) 343-0660.
After normal business hours, call Carechem 24 at (866) 928-0789.

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Acute Inhalation Toxicity - Vapors	Category 4
Aspiration Toxicity	Category 1

Label Elements

Signal Word
Danger

Hazard Statements
May be fatal if swallowed and enters airways
Harmful if inhaled

Precautionary Statements
Prevention
Avoid breathing dust/fume/gas/mist/vapors/spray
Use only outdoors or in a well-ventilated area
Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Call a POISON CENTER or doctor/physician if you feel unwell
Ingestion
IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician
Do NOT induce vomiting
Storage
Store locked up
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)
None identified

3. Composition/Information on Ingredients

Component	CAS-No	Weight %
Polyalphaolefin oil	N/A	<=100

4. First-aid measures

General Advice — If symptoms persist, call a physician.

Eye Contact — Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Get medical attention.

Skin Contact — Wash off immediately with plenty of water for at least 15 minutes. If skin irritation persists, call a physician.

Inhalation — Remove to fresh air. If not breathing, give artificial respiration. Get medical attention if symptoms occur. Risk of serious damage to the lungs (by aspiration).

Ingestion — Clean mouth with water and drink afterwards plenty of water. Do NOT induce vomiting. Call a physician or poison control center immediately. If vomiting occurs naturally, have victim lean forward.

Most important symptoms and effects — None reasonably foreseeable.

Notes to Physician — Treat symptomatically

5. Fire-fighting measures

Unsuitable Extinguishing Media — No information available

Flash Point	No information available
Method -	No information available
Autoignition Temperature	No information available
Explosion Limits	
Upper	No data available
Lower	No data available
Sensitivity to Mechanical Impact	No information available
Sensitivity to Static Discharge	No information available

Specific Hazards Arising from the Chemical
Keep product and empty container away from heat and sources of ignition.

Hazardous Combustion Products
Carbon monoxide (CO). Carbon dioxide (CO_2).
Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA

Health	Flammability	Instability	Physical hazards
3	0	0	N/A

6. Accidental release measures

Personal Precautions	Ensure adequate ventilation. Use personal protective equipment as required.
Environmental Precautions	Should not be released into the environment. See Section 12 for additional Ecological Information.
Methods for Containment and Clean Up	Soak up with inert absorbent material. Keep in suitable, closed containers for disposal.

7. Handling and storage

Handling	Wear personal protective equipment/face protection. Ensure adequate ventilation. Avoid ingestion and inhalation. Do not get in eyes, on skin, or on clothing.
Storage	Keep containers tightly closed in a dry, cool and well-ventilated place.

8. Exposure controls / personal protection

Exposure Guidelines	This product does not contain any hazardous materials with occupational exposure limitsestablished by the region specific regulatory bodies.
Engineering Measures	None under normal use conditions.

Personal Protective Equipment

Eye/face Protection	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 and body protection	Wear appropriate protective gloves and clothing to prevent skin exposure.
Respiratory Protection	No protective equipment is needed under normal use conditions.
Hygiene Measures	Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Liquid
Appearance	No information available
Odor	No information available
Odor Threshold	No information available
pH	No information available
Melting Point/Range	No data available
Boiling Point/Range	No information available
Flash Point	No information available
Evaporation Rate	No information available
Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	No data available
Lower	No data available
Vapor Pressure	No information available
Vapor Density	No information available
Specific Gravity	No information available
Solubility	No information available
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	No information available
Decomposition Temperature	No information available
Viscosity	No information available

10. Stability and reactivity

Reactive Hazard None known, based on information available

Stability Stable under normal conditions.

Conditions to Avoid Incompatible products.

Incompatible Materials Strong oxidizing agents

Hazardous Decomposition Products Carbon monoxide (CO), Carbon dioxide (CO_2)

Hazardous Polymerization Hazardous polymerization does not occur.

Hazardous Reactions None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information

Oral LD50	Based on ATE data, the classification criteria are not met. ATE > 2000 mg/kg.
Dermal LD50	Based on ATE data, the classification criteria are not met. ATE > 2000 mg/kg.
Vapor LC50	Based on ATE data, the classification criteria are not met. ATE > 20 mg/l. Category 4. ATE = 10 - 20 mg/l.

Component Information

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation No information available

Sensitization No information available

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
Polyalphaolefin oil	N/A	Not listed	Not listed	Not listed	Not listed	Not listed

Mutagenic Effects No information available

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure None known
STOT - repeated exposure None known

Aspiration hazard No information available

Symptoms / effects,both acute and delayed No information available

Endocrine Disruptor Information No information available

Other Adverse Effects The toxicological properties have not been fully investigated.

12. Ecological information

Ecotoxicity
Do not empty into drains.

Persistence and Degradability Immiscible with water

Bioaccumulation/ Accumulation No information available.

Mobility Is not likely mobile in the environment due its low water solubility.

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

14. Transport information

DOT Not regulated
TDG Not regulated
IATA Not regulated
IMDG/IMO Not regulated

15. Regulatory information

United States of America Inventory

Component	CAS-No	TSCA	TSCA Inventory notification - Active/Inactive	TSCA - EPA Regulatory Flags
Polyalphaolefin oil	N/A	-	-	-

Legend:
TSCA - Toxic Substances Control Act, (40 CFR Part 710)
X - Listed
'-' - Not Listed

TSCA 12(b) - Notices of Export Not applicable

International Inventories

Canada (DSL/NDSL), Europe (EINECS/ELINCS/NLP), Philippines (PICCS), Japan (ENCS), Australia (AICS), China (IECSC), Korea (ECL).

Component	CAS-No	DSL	NDSL	EINECS	PICCS	ENCS	AICS	IECSC	KECL
Polyalphaolefin oil	N/A	-	-	-	-	-	-	-	-

U.S. Federal Regulations

SARA 313 Not applicable

SARA 311/312 Hazard Categories See section 2 for more information

CWA (Clean Water Act) Not applicable

Clean Air Act Not applicable

OSHA - Occupational Safety and Health Administration Not applicable

CERCLA Not applicable

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

U.S. State Right-to-Know Regulations Not applicable

U.S. Department of Transportation

Reportable Quantity (RQ): N
DOT Marine Pollutant N
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade No information available

16. Other information

Prepared By
Health, Safety and Environmental Department
Email: tech@alfa.com
www.alfa.com

Revision Date 28-Feb-2020
Print Date 28-Feb-2020
Revision Summary SDS authoring systems update, replaces ChemGes SDS No. (37238).

Disclaimer

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

End of SDS

Product description					
ZnS powder. Powder can be dense ZnS material (no internal porosity), or powder particles can be sintered agglomerates of smaller particles (particles have internal porosity). **These specifications are preliminary.** For any specifications listed in this document, vendor may suggest changes to better align specifications with vendor capabilities.					
Product Output Requirements / Goals					
Specification category	**Specification**	**Value**	**Notes/test methods**		
Particle Size	*D10 Range*	~ 80-175 um	Particle size specification may change in the future and may be flexible based on vendor's current production.		
	D50 Range	~ 200-380 um			
	D90 Range	~ 500-700 um			
Apparent Density	Sintered agglomerates	>1.4, <2.0 g/cc (can discuss)	Packing density is different for sintered agglomerates vs dense particles. Test: Method for measuring apparent density may be different for different particle sizes. For D50 ~250 micron, use Carney funnel (ASTM B417 or equivalently ISO 3923)		
	Dense ZnS particles	>1.9, <2.7 g/cc			
Composition	Purity, wt% ZnS	>95% (required), >98% (strong preference), >99% (ideal)	Higher purity preferred.		
	ZnO content, wt%	<2%	Higher purity preferred.		
	Silica content, wt%	<2%	Higher purity preferred.		
	Moisture content	Report, lower is better, prefer <0.8wt%	Moisture needs to be consistent.		
Phase	Crystal structure	Report	Cubic (sphalerite) preferred, but hexagonal (wurzite) allowed. Phase needs to be consistent batch-to-batch.		
Additives Allowed?	Yes, but must be compatible with downstream processes and battery performance. Form Energy can advise on historical performance of various additives and impurities if desired based on details of additives present in vendors' materials.				
Granule Metrics (Based On Downstream Processes)	**Must not de-agglomerate or generate fines during blending with abrasive metal powder.**				
	Must not de-agglomerate or otherwise fail during heating to >800°C				
	Prefer vendors that have ability to adjust particle size up/down from specifications.				
Total material output needed for Form Energy evaluation	5 kg (preferred) 2 kg (limited evaluation)		Form Energy eventual production targets	2T delivered per month beginning Q1 2023	25MT / month capability Q1 2024, 130MT / month capacity Q4 2024

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Safety Data Sheet

In accordance with CFR 1910.1200 (OSHA HCS)

SDS No. 1580 Date of review: January 20, 2022

1 Identification of substance and company

Product name: [redacted]
Product code: 12377
Relevant use and restrictions on use: Research and product development
Manufacturer/Supplier: Noah Technologies Corporation
1 Noah Park
San Antonio, Texas 78249-3419
Phone: 210-691-2000
Fax: 210-691-2600
Web site: www.noahtech.com
Emergency information: CHEMTREC
800-424-9300

2 Hazards identification

Emergency Overview:
Pictogram(s):

Signal word(s): Danger

Hazard statements:
H272 May intensify fire; oxidizer
H302+332 Harmful if swallowed or if inhaled
H315 Causes skin irritation
H317 May cause an allergic skin reaction
H318 Causes serious eye damage
H334 May cause allergy or asthma symptoms or breathing difficulties if inhaled
H341 Suspected of causing genetic defects
H350 May cause cancer
H360 May damage fertility or the unborn child
H372 Causes damage to organs through prolonged or repeated exposure if inhaled
H410 Very toxic to aquatic life with long lasting effects

Precautionary statements:
P201 Obtain special instructions before use
P202 Do not handle until all safety precautions have been read and understood
P210 Keep away from heat
P220 Keep/Store away from clothing/ combustible materials
P221 Take any precaution to avoid mixing with combustibles
P260 Do not breathe dust/ fume/ gas/ mist/ vapors/ spray
P264 Wash skin thoroughly after handling
P270 Do not eat, drink or smoke when using this product
P271 Use only outdoors or in a well-ventilated area
P272 Contaminated work clothing should not be allowed out of the workplace
P273 Avoid release to the environment
P280 Wear protective gloves/ protective clothing/ eye protection/ face protection
P285 In case of inadequate ventilation wear respiratory protection
P301+312+330 IF SWALLOWED: Call a POISON CENTER/ doctor if you feel unwell. Rinse mouth.
P302+352 IF ON SKIN: Wash with plenty of soap and water
P304+340+312 IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER/ doctor if you feel unwell.
P305+351+338+310 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER or doctor/physician.
P308+313 IF exposed or concerned: Get medical advice/ attention
P333+313 If skin irritation or rash occurs: Get medical advice/ attention
P362 Take off contaminated clothing and wash before reuse
P370+378 In case of fire: Use dry sand, dry chemical or alcohol-resistant foam to extinguish
P391 Collect spillage
P405 Store locked up
P501 Dispose of contents/ container to an approved waste disposal plant

GHS Classification:	Oxidizing solids - 2 Acute toxicity, Oral - 4 Acute toxicity, Inhalation - 4 Skin irritation - 2 Serious eye damage - 1 Respiratory sensitization - 1 Skin sensitization - 1 Gem cell mutagenicity - 2 Carcinogenicity - 1A Reproductive toxicity - 1B Specific target organ toxicity - repeated exposure, Inhalation - 1 Acute aquatic toxicity - 1 Chronic aquatic toxicity - 1
Hazards not otherwise classified:	None
HMIS ratings (scale 0-4):	Health hazard: 2* Flammability: 0 Physical hazard: 1

3 Composition/Information on ingredients

Chemical name:	[redacted]
Designation:	
CAS number:	[redacted]
EC number:	
Formula:	
Synonyms:	

4 First aid measures

After inhalation:	Move person into fresh air. If not breathing, give artificial respiration. Consult a physician.
After skin contact:	Take off contaminated clothing and shoes immediately. Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.
After eye contact:	Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician. Continue rinsing eyes during transport to hospital.
After ingestion:	Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.
Information for doctor:	Show this safety data sheet to the doctor in attendance
Symptoms/effects; acute and delayed:	Ingestion of large doses has been shown to cause intestinal disorders, convulsions and asphyxia. Skin contact can cause itching ("nickel itch"), which may be followed by erythematic and nodular eruptions on the webs of the fingers, on the wrists and on the forearms. Hypersensitivity to nickel is common and can cause allergic contact dermatitis, pulmonary asthma, conjunctivitis and inflammatory reactions.
Immediate medical attention and special treatment needed:	See above

5 Fire-fighting measures

Suitable and unsuitable extinguishing agents:	Water spray, alcohol-resistant foam, dry chemical or carbon dioxide
Special hazards caused by the material, its products of combustion or resulting gases:	Oxides of nickel and nitrogen (NOx)
Special fire fighting procedures:	Wear self-contained breathing apparatus and fully protective fire fighting equipment/ clothing
Unusual fire and explosion hazard:	Mixing of aluminum powder, water and metal nitrates and phosphinates explode on heating

6 Accidental release measures

Person-related safety precautions:	Wear respiratory protection. Avoid dust formation. Avoid breathing vapors, mist or gas. Ensure adequate ventilation.
Measures for environmental protection:	Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.
Measures for cleaning/collecting:	Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for proper disposal.
Additional information:	See Section 7 for information on safe handling See Section 8 for information on personal protective equipment See Section 13 for information on disposal See Section 15 for regulatory information

7 Handling and storage

Information for safe handling:	Avoid contact with skin and eyes. Avoid dust formation. Provide appropriate exhaust ventilation.
Information about protection against explosions and fires:	No data available

and containers:	Keep container tightly closed in a dry and well-ventilated place
Incompatibility (avoid contact with):	Strong acids, bases and reducing agents. Avoid cyanides, thiocyanates, isothiocyanates and hypophosphites
Further information about storage conditions:	Very low moisture (deliquescent solid)

8 Exposure controls/personal protection

Ventilation requirements:	Local exhaust, chemical fume hood
Components with exposure limits that require monitoring:	OSHA PEL: TWA 1 mg(Ni)/m3 ACGIH TLV: TWA 0.1 mg(Ni)/m3; Lung damage, nasal cancer NIOSH REL: TWA 0.015 mg(Ni)/m3; Potential Occupational Carcinogen California PEL: 0.05 mg(Ni)/m3
Additional information:	No additional data available
General protective and hygienic measures:	The usual precautionary measures for handling chemicals should be adhered to Keep away from foodstuffs, beverages and food Instantly remove any soiled and impregnated garments Wash hands during breaks and at the end of the work Avoid contact with the eyes and skin
Personal protective equipment:	
Respiratory protection:	Filter-dust, fume, mist; respirator equipped with HEPA
(Use only NIOSH or CEN approved Equipment)	
Hand protection:	Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique.
Eye protection:	Safety glasses, goggles
Skin protection:	Completely covering work attire with full length apron
Additional protective equipment:	Sufficient to prevent contact. Emergency eyewash and safety shower
Precautionary labeling:	Wash thoroughly after handling Do not get in eyes, on skin or on clothing Do not breathe dust, vapor, mist, gas Keep away from heat, sparks, and open flames Empty container may contain hazardous residues

9 Physical and chemical properties

Physical state:	Deliquescent crystals
Color:	Green
Odor:	Odorless
Odor threshold:	No data available
Molecular Weight (Calculated):	290.81
pH (5% solution)	3 - 4
Melting point/freezing point/range:	56.7 C
Boiling point/range:	136.7 C
Sublimation temperature/start:	No data available
Decomposition temperature:	No data available
Flammability (solid, gas):	No data available
Flash point:	No data available
Autoignition temperature:	No data available
Danger of explosion:	No data available
Flammable limits:	
Lower:	No data available
Upper:	No data available
Evaporation Rate:	No data available
Vapor pressure (mm Hg):	No data available
Vapor density:	No data available
Specific gravity:	2.05
Bulk density:	No data available
Solubility in/Miscibility with water:	2385 g/L @ 0 C
Partition coefficient n-octanol/water:	No data available
Viscosity:	No data available
Other information:	No additional data available

10 Stability and reactivity

Reactivity:	Not determined
Chemical stability:	Stable under recommended storage conditions
Possibility of hazardous reactions:	Not determined
Conditions to be avoided:	Heat, contact with incompatibles
Materials to be avoided:	Strong acids, bases and reducing agents. Avoid cyanides, thiocyanates, isothiocyanates and hypophosphites
Dangerous reactions:	Mixing of aluminum powder, water and metal nitrates and phosphinates explode on heating
Hazardous decomposition products:	Oxides of nickel and nitrogen (NOx)
(thermal and other)	

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11 Toxicological information

LD/LC50 values that are relevant for classification:	oral-rat LD_{50}: 1,620 mg/kg
Irritation or corrosion of skin:	No data available
Irritation or corrosion of eyes:	No data available
Primary irritant or corrosive effect:	
on the skin:	Causes severe skin burns
on the eye:	Causes serious eye damage
Sensitization:	No data available
Potential health effects:	
Inhalation:	May cause serious respiratory tract damage
Ingestion:	Severe irritation of the stomach and intestines
Skin:	Severe skin burns
Eyes:	Serious eye damage
Signs and symptoms of exposure:	Ingestion of large doses has been shown to cause intestinal disorders, convulsions and asphyxia. Skin contact can cause itching ("nickel itch"), which may be followed by erythematic and nodular eruptions on the webs of the fingers, on the wrists and on the forearms. Hypersensitivity to nickel is common and can cause allergic contact dermatitis, pulmonary asthma, conjunctivitis and inflammatory reactions. To the best of our knowledge the acute and chronic toxicity of this substance is not fully known
Carcinogenicity:	IARC-1: Carcinogenic to humans: sufficient evidence of carcinogenicity NTP-1: Known to be carcinogenic: sufficient evidence from human studies OSHA - No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA
Additional information:	RTECS contains tumorigenic and/or carcinogenic and/or neoplastic data for components in this product

12 Ecotoxicological information

Toxicity:	
Toxicity to fish:	No data available
Toxicity to daphnia and other aquatic invertebrates:	No data available
Toxicity to algae:	No data available
Persistence and degradability:	
Biodegradability:	No data available
Bioaccumulative potential:	
Bioaccumulation:	No data available
Mobility in soil:	No data available
Other adverse effects:	An environmental hazard cannot be excluded in the event of unprofessional handling or disposal Very toxic to aquatic life with long lasting effects

13 Disposal considerations

Recommendation:	Consult state, local or national regulation for proper disposal Allow professional disposal company to handle waste Must be specially treated under adherence to official regulations
Unclean packagings recommendation:	Disposal must be made according to official regulations

14 Transport information

Land transport DOT

Proper shipping name:	[redacted]
DOT Hazard Class:	5.1
UN Identification number:	UN2725
Label(s):	Oxidizer
Packing group:	III
Reportable quantity (RQ):	45.4 kg
North American Emergency Response Guidebook No.:	140

Air transport ICAO-TI and IATA-DGR:

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Proper shipping name:	[redacted]
DOT Hazard Class:	5.1
UN Identification number:	UN2725
Label(s):	Oxidizer
Packing group:	III
Reportable quantity (RQ):	45.4 kg
North American Emergency Response Guidebook No.:	140

UPS Ground / FedEx Ground

Proper shipping name:	[redacted]
DOT Hazard Class:	5.1
UN Identification number:	UN2725
Label(s):	Oxidizer
Packing group:	III
Reportable quantity (RQ):	45.4 kg
North American Emergency Response Guidebook No.:	140
UPS Air	FORBIDDEN

15 Regulatory information

SARA Section 302 Extremely Hazardous components and corresponding TPQs:	Not subject
SARA Section 311 / 312 hazards:	Reactivity Hazard, Acute Health Hazard, Chronic Health Hazard
SARA Section 313 components:	This product contains chemical(s) subject to the reporting requirements of Section 313 of the Emergency Planning & Community Right-to-know Act of 1986 and 40CFR372
California Proposition 65 components:	WARNING: This product contains a chemical known to the State of California to cause cancer
TSCA:	Product is listed on TSCA Inventory

16 Other information

The above information is accurate to the best of our knowledge. However, since data, safety standards and government regulation are subject to change and the conditions of handling and use, or misuse are beyond our control. NOAH MAKES NO WARRANTY, EITHER EXPRESSED OR IMPLIED, WITH RESPECT TO THE COMPLETENESS OR CONTINUING ACCURACY OF THE INFORMATION CONTAINED HEREIN AND DISCLAIMS ALL LIABILITY FOR RELIANCE THEREON. User should satisfy himself that he has all current data relevant to his particular use.

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ThermoFisher SCIENTIFIC

SAFETY DATA SHEET

Creation Date 06-Nov-2010 **Revision Date** 14-Feb-2020 **Revision Number** 2

1. Identification

Product Name [redacted]

Cat No. : [redacted]

CAS-No
Synonyms

Recommended Use Laboratory chemicals.
Uses advised against Food, drug, pesticide or biocidal product use.
Details of the supplier of the safety data sheet

Company
Alfa Aesar
Thermo Fisher Scientific Chemicals, Inc.
30 Bond Street
Ward Hill, MA 01835-8099
Tel: 800-343-0660
Fax: 800-322-4757
Email: tech@alfa.com
www.alfa.com

Emergency Telephone Number
During normal business hours (Monday-Friday, 8am-7pm EST), call (800) 343-0660.
After normal business hours, call Carechem 24 at (866) 928-0789.

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Acute oral toxicity	Category 4
Skin Corrosion/Irritation	Category 2
Serious Eye Damage/Eye Irritation	Category 1
Skin Sensitization	Category 1

Label Elements

Signal Word
Danger

Hazard Statements
Harmful if swallowed
Causes skin irritation
Causes serious eye damage
May cause an allergic skin reaction

Precautionary Statements
Prevention
Wash face, hands and any exposed skin thoroughly after handling
Do not eat, drink or smoke when using this product
Wear protective gloves/protective clothing/eye protection/face protection
Avoid breathing dust/fume/gas/mist/vapors/spray
Contaminated work clothing should not be allowed out of the workplace
Keep only in original container
Skin
IF ON SKIN: Wash with plenty of soap and water
Take off contaminated clothing and wash before reuse
If skin irritation or rash occurs: Get medical advice/attention
Eyes
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
Immediately call a POISON CENTER or doctor/physician
Ingestion
IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell
Rinse mouth
Storage
Store in corrosive resistant polypropylene container with a resistant inliner
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)
None identified

3. Composition/Information on Ingredients

Component	CAS-No	Weight %
[redacted]	[redacted]	100

4. First-aid measures

Eye Contact
Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Immediate medical attention is required.

Skin Contact
Wash off immediately with plenty of water for at least 15 minutes. Get medical attention.

Inhalation
Remove to fresh air. If breathing is difficult, give oxygen. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Get medical attention.

Ingestion
Do NOT induce vomiting. Call a physician or poison control center immediately.

Most important symptoms and effects
Causes eye burns. May cause allergic skin reaction. Symptoms of allergic reaction may include rash, itching, swelling, trouble breathing, tingling of the hands and feet, dizziness, lightheadedness, chest pain, muscle pain or flushing

Notes to Physician
Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media Substance is nonflammable; use agent most appropriate to extinguish surrounding fire.

Unsuitable Extinguishing Media No information available

Flash Point No information available
Method - No information available

Autoignition Temperature
Explosion Limits
Upper No data available
Lower No data available
Sensitivity to Mechanical Impact No information available
Sensitivity to Static Discharge No information available

Specific Hazards Arising from the Chemical
Non-combustible. Thermal decomposition can lead to release of irritating gases and vapors.

Hazardous Combustion Products
Hydrogen chloride gas.
Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA

Health	Flammability	Instability	Physical hazards
2	0	1	N/A

6. Accidental release measures

Personal Precautions Use personal protective equipment as required. Ensure adequate ventilation. Avoid dust formation. Avoid contact with skin, eyes or clothing.

Environmental Precautions Avoid release to the environment. See Section 12 for additional Ecological Information. Do not flush into surface water or sanitary sewer system.

Methods for Containment and Clean Up Sweep up and shovel into suitable containers for disposal. Avoid dust formation.

7. Handling and storage

Handling Wear personal protective equipment/face protection. Ensure adequate ventilation. Avoid dust formation. Do not get in eyes, on skin, or on clothing. Do not breathe (dust, vapor, mist, gas). Do not ingest. If swallowed then seek immediate medical assistance.

Storage Keep containers tightly closed in a dry, cool and well-ventilated place. Corrosives area.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico OEL (TWA)
[redacted]	TWA: 1 mg/m³	(Vacated) TWA: 1 mg/m³	TWA: 1 mg/m³	TWA: 1 mg/m³

Legend

ACGIH *- American Conference of Governmental Industrial Hygienists*
OSHA *- Occupational Safety and Health Administration*
NIOSH IDLH: *NIOSH - National Institute for Occupational Safety and Health*

Engineering Measures	Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal Protective Equipment

Eye/face Protection	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 and body protection	Wear appropriate protective gloves and clothing to prevent skin exposure.
Respiratory Protection	Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.
Hygiene Measures	Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Powder Solid
Appearance	Dark grey
Odor	Odorless
Odor Threshold	No information available
pH	2.0 (0.1M)
Melting Point/Range	No data available
Boiling Point/Range	No information available
Flash Point	No information available
Evaporation Rate	Not applicable
Flammability (solid,gas)	No information available
Flammability or explosive limits	
Upper	No data available
Lower	No data available
Vapor Pressure	1 hPa @ 20 °C
Vapor Density	Not applicable
Specific Gravity	No information available
Solubility	480 g/L (20°C)
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	
Decomposition Temperature	>200 °C
Viscosity	Not applicable
Molecular Formula	Cl3 Fe
Molecular Weight	162.21

10. Stability and reactivity

Reactive Hazard	None known, based on information available
Stability	Hygroscopic.
Conditions to Avoid	Avoid dust formation. Incompatible products. Excess heat. Exposure to moist air or water.
Incompatible Materials	Strong oxidizing agents, Metals
Hazardous Decomposition Products	Hydrogen chloride gas
Hazardous Polymerization	Hazardous polymerization does not occur.
Hazardous Reactions	Corrosive to metals.

11. Toxicological information

Acute Toxicity

Product Information

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
[redacted]	LD50 = 450 mg/kg (Rat) LD50 = 316 mg/kg (Rat)	Not listed	Not listed

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation Causes eye burns; Irritating to skin

Sensitization May cause sensitization by skin contact

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
[redacted]		Not listed	Not listed	Not listed	Not listed	Not listed

Mutagenic Effects No information available

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure None known

STOT - repeated exposure None known

Aspiration hazard No information available

Symptoms / effects,both acute and delayed Symptoms of allergic reaction may include rash, itching, swelling, trouble breathing, tingling of the hands and feet, dizziness, lightheadedness, chest pain, muscle pain or flushing

Endocrine Disruptor Information No information available

Other Adverse Effects The toxicological properties have not been fully investigated.

12. Ecological information

Ecotoxicity

Do not empty into drains.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
[redacted]	Not listed	LC50: = 75.6 mg/L, 96h static (Gambusia affinis) LC50: 20.95 - 22.56 mg/L, 96h semi-static (Pimephales promelas) LC50: = 20.26 mg/L, 96h semi-static (Lepomis macrochirus)	Not listed	EC50: = 9.6 mg/L, 48h Static (Daphnia magna) EC50: = 27.9 mg/L, 48h (Daphnia magna)

Persistence and Degradability Soluble in water Persistence is unlikely based on information available.

Bioaccumulation/ Accumulation No information available.

Mobility . Will likely be mobile in the environment due to its water solubility.

Component	log Pow
[redacted]	-4

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

14. Transport information

DOT

UN-No UN1773
Proper Shipping Name [redacted]
Hazard Class 8
Packing Group III

TDG

UN-No UN1773
Proper Shipping Name [redacted]
Hazard Class 8
Packing Group III

IATA

UN-No UN1773
Proper Shipping Name [redacted]
Hazard Class 8
Packing Group III

IMDG/IMO

UN-No UN1773
Proper Shipping Name [redacted]
Hazard Class 8
Packing Group III

15. Regulatory information

United States of America Inventory

Component	CAS-No	TSCA	TSCA Inventory notification - Active/Inactive	TSCA - EPA Regulatory Flags
[redacted]		X	ACTIVE	-

Legend:
TSCA - Toxic Substances Control Act, (40 CFR Part 710)
X - Listed
'-' - Not Listed

TSCA 12(b) - Notices of Export Not applicable

International Inventories
Canada (DSL/NDSL), Europe (EINECS/ELINCS/NLP), Philippines (PICCS), Japan (ENCS), Australia (AICS), China (IECSC), Korea (ECL).

Component	CAS-No	DSL	NDSL	EINECS	PICCS	ENCS	AICS	IECSC	KECL
[redacted]									

U.S. Federal Regulations

SARA 313 Not applicable

SARA 311/312 Hazard Categories See section 2 for more information

CWA (Clean Water Act)

Component	CWA - Hazardous	CWA - Reportable	CWA - Toxic Pollutants	CWA - Priority Pollutants

	Substances	Quantities		
[redacted]	X	1000 lb	-	-

Clean Air Act Not applicable

OSHA - Occupational Safety and Health Administration Not applicable

CERCLA This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
[redacted]	1000 lb	-

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

U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
[redacted]	X	X	X	-	-

U.S. Department of Transportation
Reportable Quantity (RQ): N
DOT Marine Pollutant N
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade No information available

16. Other information

Prepared By Health, Safety and Environmental Department
Email: tech@alfa.com
www.alfa.com

Creation Date 06-Nov-2010
Revision Date 14-Feb-2020
Print Date 14-Feb-2020
Revision Summary SDS authoring systems update, replaces ChemGes SDS No. 7705-08-0/2.

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

End of SDS

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ThermoFisher SCIENTIFIC

SAFETY DATA SHEET

Creation Date 26-Jan-2010 **Revision Date** 27-Apr-2021 **Revision Number** 3

1. Identification

Product Name [redacted]

Cat No. : **A13261**

CAS-No 107-96-0
Synonyms 3-Thiopropionic acid.; beta-Mercaptopropanoic acid

Recommended Use Laboratory chemicals.
Uses advised against Food, drug, pesticide or biocidal product use.

Details of the supplier of the safety data sheet

Company
Alfa Aesar
Thermo Fisher Scientific Chemicals, Inc.
30 Bond Street
Ward Hill, MA 01835-8099
Tel: 800-343-0660
Fax: 800-322-4757
Email: tech@alfa.com
www.alfa.com

Emergency Telephone Number
During normal business hours (Monday-Friday, 8am-7pm EST), call (800) 343-0660.
After normal business hours, call Carechem 24 at (866) 928-0789.

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Corrosive to metals	Category 1
Acute oral toxicity	Category 3
Acute Inhalation Toxicity - Vapors	Category 4
Skin Corrosion/Irritation	Category 1 B
Serious Eye Damage/Eye Irritation	Category 1
Specific target organ toxicity (single exposure)	Category 3
Target Organs - Respiratory system.	

Label Elements

Signal Word
Danger

Hazard Statements
May be corrosive to metals
Toxic if swallowed
Causes severe skin burns and eye damage
May cause respiratory irritation
Harmful if inhaled

Precautionary Statements
Prevention
Wash face, hands and any exposed skin thoroughly after handling
Do not eat, drink or smoke when using this product
Use only outdoors or in a well-ventilated area
Do not breathe dust/fume/gas/mist/vapors/spray
Wear protective gloves/protective clothing/eye protection/face protection
Keep only in original container
Response
Immediately call a POISON CENTER or doctor/physician
Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Skin
IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower
Wash contaminated clothing before reuse
Eyes
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
Ingestion
Rinse mouth
Do NOT induce vomiting
Spills
Absorb spillage to prevent material damage
Storage
Store locked up
Store in a well-ventilated place. Keep container tightly closed
Store in corrosive resistant polypropylene container with a resistant inliner
Store in a dry place
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)
None identified
Other hazards
Stench.

3. Composition/Information on Ingredients

Component	CAS-No	Weight %
[redacted]	[redacted]	<=100

4. First-aid measures

General Advice	Show this safety data sheet to the doctor in attendance. Immediate medical attention is required.
Eye Contact	In the case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
Skin Contact	Wash off immediately with plenty of water for at least 15 minutes. Immediate medical attention is required.
Inhalation	If not breathing, give artificial respiration. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Remove to fresh air. Immediate medical attention is required.
Ingestion	Do NOT induce vomiting. Call a physician or poison control center immediately.
Most important symptoms and effects	Causes burns by all exposure routes. Product is a corrosive material. Use of gastric lavage or emesis is contraindicated. Possible perforation of stomach or esophagus should be investigated: Ingestion causes severe swelling, severe damage to the delicate tissue and danger of perforation: Inhalation of corrosive fumes/gases may cause coughing, choking, headache, dizziness, and weakness for several hours. Pulmonary edema may occur with tightness in the chest, shortness of breath, bluish skin, decreased blood pressure and increased heart rate: Symptoms of overexposure may be headache, dizziness, tiredness, nausea and vomiting
Notes to Physician	Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media	CO_2, dry chemical, dry sand, alcohol-resistant foam. Water mist may be used to cool closed containers.
Unsuitable Extinguishing Media	No information available
Flash Point	124 °C / 255.2 °F
Method -	No information available
Autoignition Temperature	295 °C / 563 °F

Explosion Limits

Upper	No data available
Lower	1.60%
Sensitivity to Mechanical Impact	No information available
Sensitivity to Static Discharge	No information available

Specific Hazards Arising from the Chemical
Thermal decomposition can lead to release of irritating gases and vapors. The product causes burns of eyes, skin and mucous membranes.

Hazardous Combustion Products
Carbon monoxide (CO). Carbon dioxide (CO_2). Sulfur oxides.
Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear. Thermal decomposition can lead to release of irritating gases and vapors.

NFPA

Health	Flammability	Instability	Physical hazards
3	2	0	N/A

6. Accidental release measures

Personal Precautions Use personal protective equipment as required. Ensure adequate ventilation. Evacuate personnel to safe areas. Keep people away from and upwind of spill/leak.

Environmental Precautions Should not be released into the environment. Do not flush into surface water or sanitary sewer system.

Methods for Containment and Clean Up Soak up with inert absorbent material. Keep in suitable, closed containers for disposal.

7. Handling and storage

Handling Wear personal protective equipment/face protection. Do not get in eyes, on skin, or on clothing. Use only under a chemical fume hood. Do not breathe mist/vapors/spray. Do not ingest. If swallowed then seek immediate medical assistance.

Storage Corrosives area. Keep away from heat, sparks and flame. Keep containers tightly closed in a dry, cool and well-ventilated place.

8. Exposure controls / personal protection

Exposure Guidelines This product does not contain any hazardous materials with occupational exposure limitsestablished by the region specific regulatory bodies.

Engineering Measures Use only under a chemical fume hood. Ensure that eyewash stations and safety showers are close to the workstation location. Use explosion-proof electrical/ventilating/lighting/equipment. Ensure adequate ventilation, especially in confined areas.

Personal Protective Equipment

Eye/face Protection 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 and body protection Wear appropriate protective gloves and clothing to prevent skin exposure.

Respiratory Protection Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Hygiene Measures When using do not eat, drink or smoke. Provide regular cleaning of equipment, work area and clothing.

9. Physical and chemical properties

Physical State	Liquid
Appearance	Colorless, Light yellow
Odor	Stench
Odor Threshold	No information available
pH	No information available 120 g/L
Melting Point/Range	17 - 19 °C / 62.6 - 66.2 °F
Boiling Point/Range	110 - 111 °C / 230 - 231.8 °F @ 15 mmHg
Flash Point	124 °C / 255.2 °F
Evaporation Rate	No information available
Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	No data available
Lower	1.60%

Vapor Pressure	0.04 mmHg @ 20 °C
Vapor Density	No information available
Specific Gravity	1.218
Solubility	Soluble in water
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	295 °C / 563 °F
Decomposition Temperature	No information available
Viscosity	No information available
Molecular Formula	C3 H6 O2 S
Molecular Weight	106.14

10. Stability and reactivity

Reactive Hazard None known, based on information available

Stability Stable under normal conditions.

Conditions to Avoid Incompatible products. Excess heat. Keep away from open flames, hot surfaces and sources of ignition.

Incompatible Materials Bases, Reducing Agent, Oxidizing agent

Hazardous Decomposition Products Carbon monoxide (CO), Carbon dioxide (CO_2), Sulfur oxides

Hazardous Polymerization Hazardous polymerization does not occur.

Hazardous Reactions None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information The toxicological properties have not been fully investigated

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
[redacted]	LD50 = 96 mg/kg (Rat)	Not listed	LC50 = 1.818 mg/L/4h (Rat)

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation Causes burns by all exposure routes

Sensitization No information available

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
[redacted]	[redacted]	Not listed	Not listed	Not listed	Not listed	Not listed

Mutagenic Effects Not mutagenic in AMES Test

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure Respiratory system

STOT - repeated exposure None known

Aspiration hazard No information available

Symptoms / effects,both acute and delayed Product is a corrosive material. Use of gastric lavage or emesis is contraindicated. Possible perforation of stomach or esophagus should be investigated: Ingestion causes severe swelling, severe damage to the delicate tissue and danger of perforation: Inhalation of corrosive fumes/gases may cause coughing, choking, headache, dizziness, and weakness for several hours. Pulmonary edema may occur with tightness in the chest, shortness of breath, bluish skin, decreased blood pressure and increased heart rate: Symptoms of overexposure may be headache, dizziness, tiredness, nausea and vomiting

Endocrine Disruptor Information No information available

Other Adverse Effects The toxicological properties have not been fully investigated.

12. Ecological information

Ecotoxicity

Do not empty into drains. Contains a substance which is:. Harmful to aquatic organisms. The product contains following substances which are hazardous for the environment.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
[redacted]	Not listed	LC50: 88 mg/L/72h (Brachydanio rerio)	Not listed	EC50: 9 mg/L/48h

Persistence and Degradability Persistence is unlikely

Bioaccumulation/ Accumulation No information available.

Mobility Will likely be mobile in the environment due to its water solubility.

Component	log Pow
[redacted]	-2.32

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

14. Transport information

DOT

- **UN-No** UN2922
- **Proper Shipping Name** Corrosive liquid, toxic, n.o.s.
- **Technical Name** [redacted]
- **Hazard Class** 8
- **Subsidiary Hazard Class** 6.1
- **Packing Group** II

TDG

- **UN-No** UN2922
- **Proper Shipping Name** Corrosive liquid, toxic, n.o.s.
- **Hazard Class** 8
- **Subsidiary Hazard Class** 6.1
- **Packing Group** II

IATA

- **UN-No** UN2922
- **Proper Shipping Name** Corrosive liquid, toxic, n.o.s.
- **Hazard Class** 8
- **Subsidiary Hazard Class** 6.1
- **Packing Group** II

IMDG/IMO

- **UN-No** UN2922
- **Proper Shipping Name** Corrosive liquid, toxic, n.o.s.

Hazard Class	8
Subsidiary Hazard Class	6.1
Packing Group	II

15. Regulatory information

United States of America Inventory

Component	CAS-No	TSCA	TSCA Inventory notification - Active/Inactive	TSCA - EPA Regulatory Flags
[redacted]		X	ACTIVE	-

Legend:
TSCA - Toxic Substances Control Act, (40 CFR Part 710)
X - Listed
'-' - Not Listed

TSCA 12(b) - Notices of Export — Not applicable

International Inventories
Canada (DSL/NDSL), Europe (EINECS/ELINCS/NLP), Philippines (PICCS), Japan (ENCS), Australia (AICS), China (IECSC), Korea (ECL).

Component	CAS-No	DSL	NDSL	EINECS	PICCS	ENCS	AICS	IECSC	KECL
[redacted]		-	X	203-537-0	X	X	X	X	KE-23107

U.S. Federal Regulations

SARA 313 — Not applicable

SARA 311/312 Hazard Categories — See section 2 for more information

CWA (Clean Water Act) — Not applicable

Clean Air Act — Not applicable

OSHA - Occupational Safety and Health Administration — Not applicable

CERCLA — Not applicable

California Proposition 65 — This product does not contain any Proposition 65 chemicals.

U.S. State Right-to-Know Regulations — Not applicable

U.S. Department of Transportation

Reportable Quantity (RQ):	N
DOT Marine Pollutant	N
DOT Severe Marine Pollutant	N

U.S. Department of Homeland Security — This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade — Slight risk, Grade 1

16. Other information

Prepared By	Health, Safety and Environmental Department Email: tech@alfa.com www.alfa.com
Creation Date	26-Jan-2010
Revision Date	27-Apr-2021
Print Date	27-Apr-2021
Revision Summary	SDS authoring systems update, replaces ChemGes SDS No. 107-96-0/2.

Disclaimer

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

End of SDS

SAFETY DATA SHEET

Section 1. Identification

CHS Inc.
P.O. Box 64089
Mail station 525
St. Paul, MN 55164-0089

Transportation Emergency (CHEMTREC) : **1-800-424-9300**
Technical Information : **1-651-355-8443**
SDS Information : **1-651-355-8445**

Product name : CONCRETE FORM OIL
Common name : Form release oil.
Chemical name : Lubricating oil.
Chemical family : Hydrocarbon.

SDS no. : 0132-043799
Revision date : 05/07/2015
Chemical formula : Mixture

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

Not available.

Section 2. Hazards identification

OSHA/HCS status : While this material is not considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910. 1200), this SDS contains valuable information critical to the safe handling and proper use of the product. This SDS should be retained and available for employees and other users of this product.

Classification of the substance or mixture : Not classified.

GHS label elements

Signal word : No signal word.

Hazard statements : No known significant effects or critical hazards.

Precautionary statements

General : Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand.

Prevention : Not applicable.

Response : Not applicable.

Storage : Not applicable.

Disposal : Not applicable.

Hazards not otherwise classified (HNOC) : None known.

Hazardous Material Information System (U.S.A.) **Health :** 1 * **Flammability :** 1 **Physical hazards :** 0

National Fire Protection Association (U.S.A.) **Health :** 1 **Flammability :** 1 **Instability :** 0

Section 3. Composition/information on ingredients

Substance/mixture : Mixture

Chemical name : Lubricating oil.

Other means of identification : Form release oil.

Ingredient name	%	CAS number
Distillates (petroleum), hydrotreated light	60 - 100	64742-47-8

Any concentration shown as a range is to protect confidentiality or is due to batch variation.

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : If material comes in contact with the eyes, immediately wash the eyes with large amounts of water for 15 minutes, occasionally lifting the lower and upper lids. Get medical attention.

Inhalation : If person breathes in large amounts of material, move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Keep the person warm and at rest. Get medical attention as soon as possible.

Skin contact : If the material comes in contact with the skin, wash the contaminated skin with soap and water promptly. If the material penetrates through clothing, remove the clothing and wash the skin with soap and water promptly. If irritation persists after washing, get medical attention immediately.

Ingestion : If material has been swallowed, do not induce vomiting. Get medical attention immediately.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following: pain or irritation, watering, redness.

Inhalation : Adverse symptoms may include the following: respiratory tract irritation, coughing.

Skin contact : Adverse symptoms may include the following: irritation, redness.

Ingestion : No known significant effects or critical hazards.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media : Use water spray to cool fire exposed surfaces and to protect personnel. Foam, dry chemical or water spray (fog) to extinguish fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : Toxic fumes gases or vapors may evolve on burning.

Hazardous thermal decomposition products : Decomposition products may include the following materials:
carbon dioxide
carbon monoxide

Special protective actions for fire-fighters : When fighting fires wear full turnout gear and self contained breathing apparatus. Water may cause splattering. Material floats on water.

Special protective equipment for fire-fighters : Not applicable.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : Keep unnecessary and unprotected personnel from entering. Avoid breathing vapor or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

Methods and materials for containment and cleaning up

Spill : Contain with dikes or absorbent to prevent migration to sewers/streams. Take up small spill with dry chemical absorbent; large spills may require pump or vacuum prior to absorbent. May require excavation of severely contaminated soil.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Do not get in eyes or on skin or clothing. Do not breathe vapor or mist. Do not ingest. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking.

Conditions for safe storage, including any incompatibilities : Handling temperatures should not exceed 175°F (80°C). Odorous and toxic fumes may form from the decomposition of this product if stored at excessive temperatures for extended periods of time. Store in accordance with local regulations. Do not store at temperatures exceeding 113°F (45°C). Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10).

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
Distillates (petroleum), hydrotreated light	**OSHA PEL (United States).** TWA: 213 ppm TWA: 1200 mg/m³ **ACGIH TLV (United States, 6/2013). Absorbed through skin.** TWA: 200 mg/m³, (as total hydrocarbon vapor) 8 hours.

Appropriate engineering controls : Use only with adequate ventilation.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Recommended: Splash goggles and a face shield, where splash hazard exists.

Skin protection

Hand protection : 4 - 8 hours (breakthrough time): Nitrile gloves.

Body protection : Recommended: Long sleeved coveralls.

Other skin protection : Recommended: Impervious boots.

Respiratory protection : If ventilation is inadequate, use a NIOSH-certified respirator with an organic vapor cartridge and P95 particulate filter.

Section 9. Physical and chemical properties

Appearance

Physical state : Liquid.

Color : Amber.

Odor : Mild.

Odor threshold : Not available.

pH : Not available.

Melting point : Not available.

Boiling point : Not available.

Flash point : Closed cup: >144°C (>291.2°F)

Flammability : Not available.

Lower and upper explosive (flammable) limits : Not available.

Relative density : 0.885 to 0.895

Evaporation rate : <1 (Ether. = 1)

Solubility : Insoluble in the following materials: cold water and hot water.

Solubility in water : Insoluble

Partition coefficient: n-octanol/water : Not available.

Auto-ignition temperature : >260°C (>500°F)

Decomposition temperature : Not available.

SADT : Not available.

Viscosity : Not available.

Vapor pressure : <0.13 kPa (<1 mm Hg) (68°F)

Vapor density : Not available.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.
Chemical stability : The product is stable.
Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : No specific data.
Incompatible materials : Reactive or incompatible with the following materials: oxidizing materials.
Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

There is no data available.

Irritation/Corrosion

Skin : There is no data available.
Eyes : There is no data available.
Respiratory : There is no data available.

Sensitization

Skin : There is no data available.
Respiratory : There is no data available.

Mutagenicity

There is no data available.

Carcinogenicity

There is no data available.

Reproductive toxicity

There is no data available.

Teratogenicity

There is no data available.

Specific target organ toxicity (single exposure)

There is no data available.

Specific target organ toxicity (repeated exposure)

There is no data available.

Aspiration hazard

Name	Result
Distillates (petroleum), hydrotreated light	ASPIRATION HAZARD - Category 1

Information on the likely routes of exposure : Dermal contact. Eye contact. Inhalation. Ingestion.

Section 12. Ecological information

Toxicity

Product/ingredient name	Result	Species	Exposure
Distillates (petroleum), hydrotreated light	Acute LC50 2200 µg/L Fresh water	Fish - Lepomis macrochirus	4 days

Persistence and degradability

There is no data available.

Bioaccumulative potential

There is no data available.

Mobility in soil

Soil/water partition coefficient (K_{OC}) : There is no data available.

Other adverse effects : No known significant effects or critical hazards.

Section 13. Disposal considerations

Disposal methods : Disposal of this product, solutions and any by-products should comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements.

Section 14. Transport information

DOT IDENTIFICATION NUMBER Not applicable. **DOT proper shipping name** Not applicable.

DOT Hazard Class(es) Not applicable. **PG** Not applicable. **DOT EMER. RESPONSE GUIDE NO.** Not available.

Section 15. Regulatory information

U.S. Federal regulations : **TSCA 8(a) CDR Exempt/Partial exemption**: Not determined
United States inventory (TSCA 8b): All components are listed or exempted.

Clean Air Act Section 602 Class I Substances : Not listed
Clean Air Act Section 602 Class II Substances : Not listed
Clean Air Act Section 112(b) Hazardous Air Pollutants (HAPs) : Not listed
DEA List I Chemicals (Precursor Chemicals) : Not listed
DEA List II Chemicals (Essential Chemicals) : Not listed

SARA 302/304

Composition/information on ingredients

No products were found.

SARA 304 RQ : Not applicable.

SARA 311/312

Hazard classifications : Not applicable.

Composition/information on ingredients

Name	%	Fire hazard	Sudden release of pressure	Reactive	Immediate (acute) health hazard	Delayed (chronic) health hazard
Distillates (petroleum), hydrotreated light	60 - 100	Yes.	No.	No.	No.	No.

SARA 313 : This product (does/not) contain toxic chemicals subject to the reporting requirements of SARA Section 313 of the Emergency Planning and Community Right-To-Know Act of 1986 and of 40 CFR 372.

Product name	CAS number	%
Not applicable.		

SARA 313 notifications must not be detached from the SDS and any copying and redistribution of the SDS shall include copying and redistribution of the notice attached to copies of the SDS subsequently redistributed.

State regulations

Massachusetts : The following components are listed: Distillates (petroleum), hydrotreated light naphthenic

New York : None of the components are listed.

New Jersey : The following components are listed: Distillates (petroleum), hydrotreated light naphthenic

Pennsylvania : None of the components are listed.

California Prop. 65 : No products were found.

Section 16. Other information

Revision date	: 05/07/2015	**Supersedes**	: 06/23/2014
Revised Section(s)	: 1, 2, 16.	**Prepared by**	: KMK Regulatory Services Inc.

Notice to reader

THE INFORMATION CONTAINED IN THIS SDS RELATES ONLY TO THE SPECIFIC MATERIAL IDENTIFIED. IT DOES NOT COVER USE OF THAT MATERIAL IN COMBINATION WITH ANY OTHER MATERIAL OR IN ANY PARTICULAR PROCESS. IN COMPLIANCE WITH 29 C.F.R. 1910.1200(g), CHS HAS PREPARED THIS SDS IN SEGMENTS, WITH THE INTENT THAT THOSE SEGMENTS BE READ TOGETHER AS A WHOLE WITHOUT TEXTUAL OMISSIONS OR ALTERATIONS. CHS BELIEVES THE INFORMATION CONTAINED HEREIN TO BE ACCURATE, BUT MAKES NO REPRESENTATION, GUARANTEE, OR WARRANTY, EXPRESS OR IMPLIED, ABOUT THE ACCURACY, RELIABILITY, OR COMPLETENESS OF THE INFORMATION OR ABOUT THE FITNESS OF CONTENTS HEREIN FOR EITHER GENERAL OR PARTICULAR PURPOSES. PERSONS REVIEWING THIS SDS SHOULD MAKE THEIR OWN DETERMINATION AS TO THE MATERIAL'S SUITABILITY AND COMPLETENESS FOR USE IN THEIR PARTICULAR APPLICATIONS.

CENEX

OUR ENERGY COMES THROUGH.

A BRAND OF CHS

Attachment I:

Emissions Units Table

Attachment I

Emission Units Table

(includes all emission units and air pollution control devices that will be part of this permit application review, regardless of permitting status)

Emission Unit ID[1]	Emission Point ID[2]	Emission Unit Description	Year Installed/ Modified	Design Capacity	Type[3] and Date of Change	Control Device[4]
1S-1	1E-1	Anode Process Materials	2023	517,250 Cells/Years	New, 2023	1C-1
1S-2	1E-2	Furnace 1	2023	120 kW	New, 2023	None
1S-3		Furnace 2	2023	120 kW	New, 2023	None
1S-4		Furnace 3	2023	120 kW	New, 2023	None
1S-5		Furnace 4	2023	120 kW	New, 2023	None
1S-6		Furnace 5	2023	120 kW	New, 2023	None
1S-7		Furnace 6	2023	120 kW	New, 2023	None
1S-8		Furnace 7	2023	120 kW	New, 2023	None
1S-9		Furnace 8	2023	120 kW	New, 2023	None
1S-10		Furnace 9	2023	120 kW	New, 2023	None
1S-11		Furnace 10	2023	120 kW	New, 2023	None
2S-1	2E-1	Cathode 1 Process Materials	2023	517,250 Cells/Years	New, 2023	2C-1
2S-2	2E-2	Oxidizer Burner 1	2023	8 MMBtu/hr	New, 2023	2C-2
3S-1	3E-2	Cathode 2 Process Materials	2023	517250 Cells/Years	New, 2023	3C-1
3S-2	3E-1	IPA Tank	2023	6,000-gallons	New, 2023	None
3S-3	3E-3	Oven 1	2023	1 MMBtu/hr	New, 2023	None
3S-4	3E-4	Oven 2	2023	4 MMBtu/hr	New, 2023	None
3S-5	3E-2	Oxidizer Burner 2	2023	8 MMBtu/hr	New, 2023	3C-1
4S-1	4E	Assembly Process Materials	2023	517,250 Cells/Years	New, 2023	None
5S-1	5E-1	Chiller Cooling Tower 1	2023	4,100 GPM	New, 2023	None

5S-2		Chiller Cooling Tower 2	2023	4,100 GPM	New, 2023	None
5S-3	5E-2	Process Cooling Tower Closed Circuit 1	2023	1,800 GPM	New, 2023	None
5S-4		Process Cooling Tower Closed Circuit 2	2023	1,800 GPM	New, 2023	None
5S-5	5E-3	Boiler 1	2023	6 MMBtu/hr	New, 2023	None
5S-6		Boiler 2	2023	6 MMBtu/hr	New, 2023	None
5S-7		Boiler 3	2023	6 MMBtu/hr	New, 2023	None
5E-8	5E-4	Emergency Diesel Generator	2023	1500 kW	New, 2023	None

[1] For Emission Units (or Sources) use the following numbering system:1S, 2S, 3S,... or other appropriate designation.
[2] For Emission Points use the following numbering system:1E, 2E, 3E, ... or other appropriate designation.
[3] New, modification, removal
[4] For Control Devices use the following numbering system: 1C, 2C, 3C,... or other appropriate designation.

Attachment J:

Emission Points Data Summary Sheet

Attachment J
EMISSION POINTS DATA SUMMARY SHEET

Table 1: Emissions Data

Emission Point ID No. *(Must match Emission Units Table & Plot Plan)*	Emission Point Type[1]	Emission Unit Vented Through This Point *(Must match Emission Units Table & Plot Plan)*		Air Pollution Control Device *(Must match Emission Units Table & Plot Plan)*		Vent Time for Emission Unit *(chemical processes only)*		All Regulated Pollutants - Chemical Name/CAS[3] *(Speciate VOCs & HAPS)*	Maximum Potential Uncontrolled Emissions [4]		Maximum Potential Controlled Emissions [5]		Emission Form or Phase *(At exit conditions, Solid, Liquid or Gas/Vapor)*	Est. Method Used [6]	Emission Concentration [7] (ppmv or mg/m^3)
		ID No.	Source	ID No.	Device Type	Short Term[2]	Max (hr/yr)		lb/hr	ton/yr	lb/hr	ton/yr			
1E-1	Vertical	1S-1	Anode Process Materials	1C-1	Cartridge Dust Collector	NA	NA	VOCs PM SO2 CO	6.218 5.224 1.314 12.821	27.235 22.883 5.756 56.154	7.772 0.653 1.643 16.026	34.043 2.860 7.195 70.192	Solids/Gas	EE	NA
1E-2	Vertical	1S-2 1S-3 1S-4 1S-5 1S-6 1S-7 1S-8 1S-9 1S-10 1S-11	Furnace 1-10	NA	NA	NA	NA	VOCs PM SO2 NOx CO Pb	0.00266 0.00368 0.000290 0.0484 0.0406 0.000000242	0.0116 0.0161 0.00127 0.212 0.178 0.00000106	0.00332 0.00459 0.000363 0.0605 0.0508 0.000000302	0.0146 0.0201 0.00159 0.265 0.222 0.00000132	Solids/Gas	EE	NA
2E-1	Vertical	2S-1	Cathode 1 Process Materials	2C-1	Cartridge Dust Collector	NA	NA	VOCs PM	16.366 0.248	71.681 1.086	01.023 0.0310	4.480 0.136	Solids/Gas	EE	NA

2E-2	Vertical	2S-2	Oxidizer Burner	2C-2	RTO	NA	NA	VOCs PM SO2 NOx CO Pb	0.0431 0.0596 0.00471 0.784 0.659 0.000004	0.189 0.261 0.0206 3.435 2.886 0.000017	0.00269 0.0745 0.00588 0.980 0.824 0.0000049	0.0118 0.326 0.0258 4.294 3.607 0.0000215	Solids/Gas	EE	NA
3E-1	Vertical	3S-2	IPA Tank	NA	NA	NA	NA	VOCs	0.00481	0.0211	0.00601	0.0263	Gas	EE	NA
3E-2	Vertical	3S-1 3S-5	Cathode 2 Process Materials Oxidizer Burner 2	3C-1	RTO	NA	NA	VOCs PM SO2 NOx CO Pb	60.348 0.060 0.372 1.759 0.659 0.0000039	264.325 0.261 1.627 7.704 2.886 0.0000172	3.772 0.0745 0.464 2.199 0.824 0.0000049	16.52 0.326 2.0338 9.629 3.607 0.0000215	Solids/Gas	EE	NA
3E-3	Vertical	3S-3	Oven 1	NA	NA	NA	NA	VOCs PM SO2 NOx CO Pb	0.00539 0.00745 0.000588 0.0980 0.0824 0.00000049	0.0236 0.0326 0.00258 0.429 0.361 0.00000215	0.00674 0.00931 0.000735 0.123 0.103 0.00000061	0.0295 0.0408 0.00322 0.537 0.451 0.00000268	Solids/Gas	EE	NA
3E-4	Vertical	3S-4	Oven 2	NA	NA	NA	NA	VOCs PM SO2 NOx CO Pb	0.0216 0.0298 0.00235 0.392 0.329 0.000002	0.0945 0.131 0.0103 1.718 1.443 0.0000086	0.0269 0.0373 0.00294 0.491 0.412 0.00000245	0.118 0.163 0.0129 2.147 1.804 0.0000107	Solids/Gas	EE	NA
4E	Vents to Plant	4S-1	Assembly Process Materials	NA	NA	NA	NA	VOCs	0.0229	0.1003	0.0286	0.125	Gas	EE	NA

5E-1	Outside	5S-1 5S-2	Chiller Cooling Tower 1 and 2	NA	NA	NA	NA	PM	9.348	40.944	11.685	51.180	Solids	EE	NA
5E-2	Outside	5S-3 5S-4	Process Cooling Tower 1 and 2	NA	NA	NA	NA	PM	4.104	17.976	5.130	22.469	Solids	EE	NA
5E-3	Outside	5S-5 5S-6 5S-7	Boilers 1-3	NA	NA	NA	NA	VOCs PM SO2 NOx CO Pb	0.0971 0.134 0.0106 1.765 1.482 0.00000882	0.425 0.587 0.046 7.729 6.493 0.0000387	0.121 0.168 0.0132 2.205 1.853 0.0000110	0.631 0.734 0.0579 9.662 8.116 0.0000483	Solids/Gas	EE	NA
5E-4	Outside	5S-8	Emergency Generator	NA	NA	NA	NA	VOCs PM SO2 NOx CO HAPs	0.0576 0.0505 0.0471 0.712 0.153 0.000611	0.252 0.221 0.206 3.116 0.672 0.00268	0.0720 0.0631 0.0588 0.889 0.192 0.000765	0.315 0.276 0.258 3.895 0.839 0.00335	Solids/Gas	EE	NA

The EMISSION POINTS DATA SUMMARY SHEET provides a summation of emissions by emission unit. Note that uncaptured process emission unit emissions are not typically considered to be fugitive and must be accounted for on the appropriate EMISSIONS UNIT DATA SHEET and on the EMISSION POINTS DATA SUMMARY SHEET. Please note that total emissions from the source are equal to all vented emissions, all fugitive emissions, plus all other emissions (e.g. uncaptured emissions). Please complete the FUGITIVE EMISSIONS DATA SUMMARY SHEET for fugitive emission activities.

[1] Please add descriptors such as upward vertical stack, downward vertical stack, horizontal stack, relief vent, rain cap, etc.

[2] Indicate by "C" if venting is continuous. Otherwise, specify the average short-term venting rate with units, for intermittent venting (ie., 15 min/hr). Indicate as many rates as needed to clarify frequency of venting (e.g., 5 min/day, 2 days/wk).

[3] List all regulated air pollutants. Speciate VOCs, including all HAPs. Follow chemical name with Chemical Abstracts Service (CAS) number. **LIST** Acids, CO, CS_2, VOCs, H_2S, Inorganics, Lead, Organics, O_3, NO, NO_2, SO_2, SO_3, all applicable Greenhouse Gases (including CO_2 and methane), etc. **DO NOT LIST** H_2, H_2O, N_2, O_2, and Noble Gases.

[4] Give maximum potential emission rate with no control equipment operating. If emissions occur for less than 1 hr, then record emissions per batch in minutes (e.g. 5 lb VOC/20 minute batch).

[5] Give maximum potential emission rate with proposed control equipment operating. If emissions occur for less than 1 hr, then record emissions per batch in minutes (e.g. 5 lb VOC/20 minute batch).

[6] Indicate method used to determine emission rate as follows: MB = material balance; ST = stack test (give date of test); EE = engineering estimate; O = other (specify).

[7] Provide for all pollutant emissions. Typically, the units of parts per million by volume (ppmv) are used. If the emission is a mineral acid (sulfuric, nitric, hydrochloric or phosphoric)

use units of milligram per dry cubic meter (mg/m^3) at standard conditions (68 °F and 29.92 inches Hg) (see 45CSR7). If the pollutant is SO_2, use units of ppmv (See 45CSR10).

Attachment J
EMISSION POINTS DATA SUMMARY SHEET

Table 2: Release Parameter Data								
Emission Point ID No. *(Must match Emission Units Table)*	Inner Diameter (ft.)	Exit Gas			Emission Point Elevation (ft)		UTM Coordinates (km)	
		Temp. (°F)	Volumetric Flow [1] (acfm) *at operating conditions*	Velocity (fps)	Ground Level *(Height above mean sea level)*	Stack Height [2] *(Release height of emissions above ground level)*	Northing	Easting
1E-1	NA	Ambient	NA	NA	TBD	TBD	TBD	TBD
1E-2	NA	Ambient	NA	NA	TBD	TBD	TBD	TBD
2E-1	NA	Ambient	NA	NA	TBD	TBD	TBD	TBD
2E-2	NA	Ambient	NA	NA	TBD	TBD	TBD	TBD
3E-1	NA	Ambient	NA	NA	TBD	TBD	TBD	TBD
3E-2	NA	Ambient	NA	NA	TBD	TBD	TBD	TBD
3E-3	NA	Ambient	NA	NA	TBD	TBD	TBD	TBD
3E-4	NA	Ambient	NA	NA	TBD	TBD	TBD	TBD
4E	NA	Ambient	NA	NA	TBD	TBD	TBD	TBD
5E-1	NA	Ambient	NA	NA	TBD	TBD	TBD	TBD
5E-2	NA	Ambient	NA	NA	TBD	TBD	TBD	TBD
5E-3	NA	Ambient	NA	NA	TBD	TBD	TBD	TBD
5E-4	NA	Ambient	NA	NA	TBD	TBD	TBD	TBD

[1] Give at operating conditions. Include inerts.
[2] Release height of emissions above ground level.

Attachment K:
Fugitive Emissions Data Summary Sheet

Attachment K

FUGITIVE EMISSIONS DATA SUMMARY SHEET

The FUGITIVE EMISSIONS SUMMARY SHEET provides a summation of fugitive emissions. Fugitive emissions are those emissions which could not reasonably pass through a stack, chimney, vent or other functionally equivalent opening. Note that uncaptured process emissions are not typically considered to be fugitive, and must be accounted for on the appropriate EMISSIONS UNIT DATA SHEET and on the EMISSION POINTS DATA SUMMARY SHEET.

Please note that total emissions from the source are equal to all vented emissions, all fugitive emissions, plus all other emissions (e.g. uncaptured emissions).

APPLICATION FORMS CHECKLIST - FUGITIVE EMISSIONS
1.) Will there be haul road activities? ☐ Yes ☒ No ☐ If YES, then complete the HAUL ROAD EMISSIONS UNIT DATA SHEET.
2.) Will there be Storage Piles? ☐ Yes ☒ No ☐ If YES, complete Table 1 of the NONMETALLIC MINERALS PROCESSING EMISSIONS UNIT DATA SHEET.
3.) Will there be Liquid Loading/Unloading Operations? ☐ Yes ☒ No ☐ If YES, complete the BULK LIQUID TRANSFER OPERATIONS EMISSIONS UNIT DATA SHEET.
4.) Will there be emissions of air pollutants from Wastewater Treatment Evaporation? ☐ Yes ☒ No ☐ If YES, complete the GENERAL EMISSIONS UNIT DATA SHEET.
5.) Will there be Equipment Leaks (e.g. leaks from pumps, compressors, in-line process valves, pressure relief devices, open-ended valves, sampling connections, flanges, agitators, cooling towers, etc.)? ☐ Yes ☒ No ☐ If YES, complete the LEAK SOURCE DATA SHEET section of the CHEMICAL PROCESSES EMISSIONS UNIT DATA SHEET.
6.) Will there be General Clean-up VOC Operations? ☐ Yes ☒ No ☐ If YES, complete the GENERAL EMISSIONS UNIT DATA SHEET.
7.) Will there be any other activities that generate fugitive emissions? ☒ Yes ☐ No ☒ If YES, complete the GENERAL EMISSIONS UNIT DATA SHEET or the most appropriate form.
If you answered "NO" to all of the items above, it is not necessary to complete the following table, "Fugitive Emissions Summary."

FUGITIVE EMISSIONS SUMMARY	All Regulated Pollutants - Chemical Name/CAS [1]	Maximum Potential Uncontrolled Emissions [2]		Maximum Potential Controlled Emissions [3]		Est. Method Used [4]
		lb/hr	ton/yr	lb/hr	ton/yr	
Haul Road/Road Dust Emissions Paved Haul Roads	N/A	N/A	N/A	N/A	N/A	N/A
Unpaved Haul Roads	N/A	N/A	N/A	N/A	N/A	N/A
Storage Pile Emissions	N/A	N/A	N/A	N/A	N/A	N/A
Loading/Unloading Operations	N/A	N/A	N/A	N/A	N/A	N/A
Wastewater Treatment Evaporation & Operations	N/A	N/A	N/A	N/A	N/A	N/A
Equipment Leaks	N/A	N/A	N/A	N/A	N/A	N/A
General Clean-up VOC Emissions	N/A	N/A	N/A	N/A	N/A	N/A
Other – AMBIENT REFRIGERANT EMISSIONS	Hydrocarbons	0.0114	0.0498	0.0114	0.0498	EE

[1] List all regulated air pollutants. Speciate VOCs, including all HAPs. Follow chemical name with Chemical Abstracts Service (CAS) number. LIST Acids, CO, CS_2, VOCs, H_2S, Inorganics, Lead, Organics, O_3, NO, NO_2, SO_2, SO_3, all applicable Greenhouse Gases (including CO_2 and methane), etc. DO NOT LIST H_2, H_2O, N_2, O_2, and Noble Gases.

[2] Give rate with no control equipment operating. If emissions occur for less than 1 hr, then record emissions per batch in minutes (e.g. 5 lb VOC/20 minute batch).

[3] Give rate with proposed control equipment operating. If emissions occur for less than 1 hr, then record emissions per batch in minutes (e.g. 5 lb VOC/20 minute batch).

[4] Indicate method used to determine emission rate as follows: MB = material balance; ST = stack test (give date of test); EE = engineering estimate; O = other (specify).

Attachment L:
Emissions Unit Data Sheet(s)

Attachment L
EMISSIONS UNIT DATA SHEET
GENERAL

To be used for affected sources other than asphalt plants, foundries, incinerators, indirect heat exchangers, and quarries.

Identification Number (as assigned on *Equipment List Form*): Fugitive Emissions

1. Name or type and model of proposed affected source:

   Ambient refrigerant fugitive emissions from 2 chillers (5S-1 and 5S-2).

2. On a separate sheet(s), furnish a sketch(es) of this affected source. If a modification is to be made to this source, clearly indicated the change(s). Provide a narrative description of all features of the affected source which may affect the production of air pollutants.

3. Name(s) and maximum amount of proposed process material(s) charged per hour:

   R513A Refrigerant, 2488 lb/unit, 2 units

4. Name(s) and maximum amount of proposed material(s) produced per hour:

   N/A

5. Give chemical reactions, if applicable, that will be involved in the generation of air pollutants:

   N/A

* The identification number which appears here must correspond to the air pollution control device identification number appearing on the *List Form*.

6. Combustion Data (if applicable):

(a) Type and amount in appropriate units of fuel(s) to be burned:

N/A

(b) Chemical analysis of proposed fuel(s), excluding coal, including maximum percent sulfur and ash:

(c) Theoretical combustion air requirement (ACF/unit of fuel):

@ °F and psia.

(d) Percent excess air:

(e) Type and BTU/hr of burners and all other firing equipment planned to be used:

(f) If coal is proposed as a source of fuel, identify supplier and seams and give sizing of the coal as it will be fired:

(g) Proposed maximum design heat input: × 10^6 BTU/hr.

7. Projected operating schedule:

Hours/Day	24h/d	Days/Week	7 d/w	Weeks/Year	52 w/y

8. Projected amount of pollutants that would be emitted from this affected source if no control devices were used:

@ ambient °F and ambient psia

a.	NO_X		lb/hr	grains/ACF
b.	SO_2		lb/hr	grains/ACF
c.	CO		lb/hr	grains/ACF
d.	PM_{10}		lb/hr	grains/ACF
e.	Hydrocarbons	0.0114	lb/hr	grains/ACF
f.	VOCs		lb/hr	grains/ACF
g.	Pb		lb/hr	grains/ACF
h.	Specify other(s)			
			lb/hr	grains/ACF
			lb/hr	grains/ACF
			lb/hr	grains/ACF
			lb/hr	grains/ACF

NOTE: (1) An Air Pollution Control Device Sheet must be completed for any air pollution device(s) used to control emissions from this affected source.

(2) Complete the Emission Points Data Sheet.

9. Proposed Monitoring, Recordkeeping, Reporting, and Testing
Please propose monitoring, recordkeeping, and reporting in order to demonstrate compliance with the proposed operating parameters. Please propose testing in order to demonstrate compliance with the proposed emissions limits.

MONITORING	RECORDKEEPING
Refrigerant monitoring system installed on chillers.	Keep records of refrigerant service from third party.
REPORTING	**TESTING**
N/A	N/A

MONITORING. PLEASE LIST AND DESCRIBE THE PROCESS PARAMETERS AND RANGES THAT ARE PROPOSED TO BE MONITORED IN ORDER TO DEMONSTRATE COMPLIANCE WITH THE OPERATION OF THIS PROCESS EQUIPMENT OPERATION/AIR POLLUTION CONTROL DEVICE.

RECORDKEEPING. PLEASE DESCRIBE THE PROPOSED RECORDKEEPING THAT WILL ACCOMPANY THE MONITORING.

REPORTING. PLEASE DESCRIBE THE PROPOSED FREQUENCY OF REPORTING OF THE RECORDKEEPING.

TESTING. PLEASE DESCRIBE ANY PROPOSED EMISSIONS TESTING FOR THIS PROCESS EQUIPMENT/AIR POLLUTION CONTROL DEVICE.

10. Describe all operating ranges and maintenance procedures required by Manufacturer to maintain warranty
N/A

Job Information	*Technical Data Sheet*
Job Name	Form
Date	6/20/2023
Submitted By	Steve Alauzen
Software Version	19.10
Unit Tag	CH-1
Unit FPA#	AUTO_54
Country of Origin	USA

Unit Overview

Model Number	Net Capacity ton	NPLV.IP kW/ton	Voltage	Starter Type	ASHRAE 90.1	LEED EA Credit 4
WME092CDCSNA	1000	0.3293	460 V / 60 Hz / 3 Ph	VFD	'07, '10, '13 & '16	Qualifies

Unit

Model/Evap/Cond Number:	WME092CDCSNA-BB/E4216-JB2C-2/C4216-YE3C-2/R513-CEEABABA	**Vintage:**	C
Approval:	AHRI and ETL / cETL		
Vessel Code:	ASME		

Unit Shipping Weight	Unit Operating Weight	Overall Unit Length	Overall Unit Width	Overall Unit Height
36539 lb	45977 lb	251.7 in	116.5 in	109.0 in
Compressor Quantity	**Capacity Control**	**Refrigerant Type**	**Refrigerant Weight**	**Altitude**
2	VFD / Inlet Guide Vanes	R513A	2488 lb	0 to 3,280 ft

Evaporator

Input Type	Entering Fluid Temperature	Leaving Fluid Temperature	Fluid Type	Actual Fluid Flow	Minimum Fluid Flow
EWT + LWT	58.00 °F	44.00 °F	Water	1710 gpm	528.2 gpm
Length	**Diameter**	**Number of Passes**	**Tube**		**Fouling Factor**
			Material	**Wall Thickness**	
16 ft	42 in	2	Copper	0.025 in	0.000100 °F.ft².h/Btu

Condenser

Input Type	Entering Fluid Temperature	Leaving Fluid Temperature	Fluid Type	Fluid Flow
Flow + EWT	85.00 °F	95.14 °F	Water	2767 gpm
Length	**Diameter**	**Number of Passes**	**Tube**	**Fouling Factor**
			Material	**Wall Thickness**
16 ft	42 in	2	Copper	0.028 in	0.000250 °F.ft².h/Btu

Unit Performance (AHRI 550/590)

Design Points Rated with AHRI Condenser Relief – With Water

Net Capacity ton	Input kW	Cooling Efficiency kW/ton	NPLV.IP kW/ton	Part Load Cooling Efficiency			Evaporator Fluid		Condenser Fluid	
				75% kW/ton	50% kW/ton	25% kW/ton	Pressure Drop ft H_2O	Entering Temperature °F	Pressure Drop ft H_2O	Leaving Temperature °F
1000	565.5	0.5655	0.3293	0.4076	0.2930	0.2650	24.0	58.00	12.8	95.14

Performance Points Rated with AHRI Condenser Relief – With Water

Point #	% of Design Load	Net Capacity ton	Input kW	Cooling Efficiency kW/ton	Evaporator Fluid				Condenser Fluid			
					Flow gpm	Temperature		Pressure Drop ft H_2O	Flow gpm	Temperature		Pressure Drop ft H_2O
						Entering °F	Leaving °F			Entering °F	Leaving °F	
1	100.0	1000	565.5	0.5655	1710	58.00	44.00	24.0	2767	85.00	95.14	12.8
2	75.0	750.0	305.7	0.4076	1710	54.50	44.00	24.0	2767	75.00	82.28	12.7
3	50.0	500.0	146.5	0.2930	1710	51.00	44.00	23.9	2767	65.00	69.69	12.6
4	25.0	250.0	66.26	0.2650	1710	47.50	44.00	23.9	2767	65.00	67.33	12.6

Service Data

Service Points Rated with AHRI Condenser Relief

Point #	Superheat Δ °F	Subcooling Δ °F	Evaporator Fluid			Condenser Fluid		
			Temperature °F	Pressure psig	Velocity ft/s	Temperature °F	Pressure psig	Velocity ft/s
1	1.0	8.5	42.9	43.2	5.9	96.2	124.2	4.9
2	1.0	6.9	43.0	43.2	5.9	83.0	99.1	4.9
3	1.0	4.9	43.0	43.3	5.9	70.1	78.0	4.9
4	1.0	2.6	43.1	43.3	5.9	67.6	74.1	4.9

Physical

Evaporator

Inlet Location	Header			Tube Sheet Material	Design Pressure (Waterside)
	Type	Orientation	Material		
Right	Marine Water Box, Grooved	Rear	Carbon Steel	Carbon Steel	150 psig

Condenser

Inlet Location	Header			Tube Sheet Material	Design Pressure (Waterside)
	Type	Orientation	Material		
Right	Marine Water Box, Grooved	Front	Carbon Steel	Carbon Steel	150 psig

Electrical

Voltage:	460 V / 60 Hz / 3 Ph	Power Connection:	Multipoint

Circuit (Compr)	Rated Load Amps (RLA)	Minimum Circuit Ampacity (MCA)	Recommended Overcurrent Protection Size (ROCP)	Maximum Overcurrent Protection Size (MOCP)	Locked Rotor Amps (LRA)	Power Factor	Lug Connection Size
1	379	476	600 A	800	417	0.94	800A / (3) 3/0-400 MCM
2	379	476	600 A	800	417	0.94	800A / (3) 3/0-400 MCM

Above RLA, MCA, MOCP & LRA values are per compressor.

Drive

Type	Model	Location	Harmonic Distortion	Enclosure Type	Motor Protection
VFD	Integral	Unit Mounted	Standard	NEMA 1	Standard

Circuit Breaker	Short Circuit Current Rating	Approval
65 KAIC	65 KAIC	ETL, ETLc

Sound (with insulation)

Sound Pressure

63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	Overall	75% Load	50% Load	25% Load
41.0	57.0	66.0	71.0	72.0	71.0	81.0	69.0	**83.2**	79.1	78.1	75.1

Sound Pressure (dB) measured in accordance with ANSI/AHRI Standard 575-2008 ('A' weighted)

Options

Basic Unit

Packaging:	Bagging only

Insulation

Thermal:	1.5" on Evaporator Shell. 0.75" on Suction Piping, Compressor Inlet, Motor Barrel & High Humidity
Head:	Evaporator Return & Connection Heads

Control

Communication Protocol:	BACnet MS/TP
RapidRestore®:	Included

Warranty

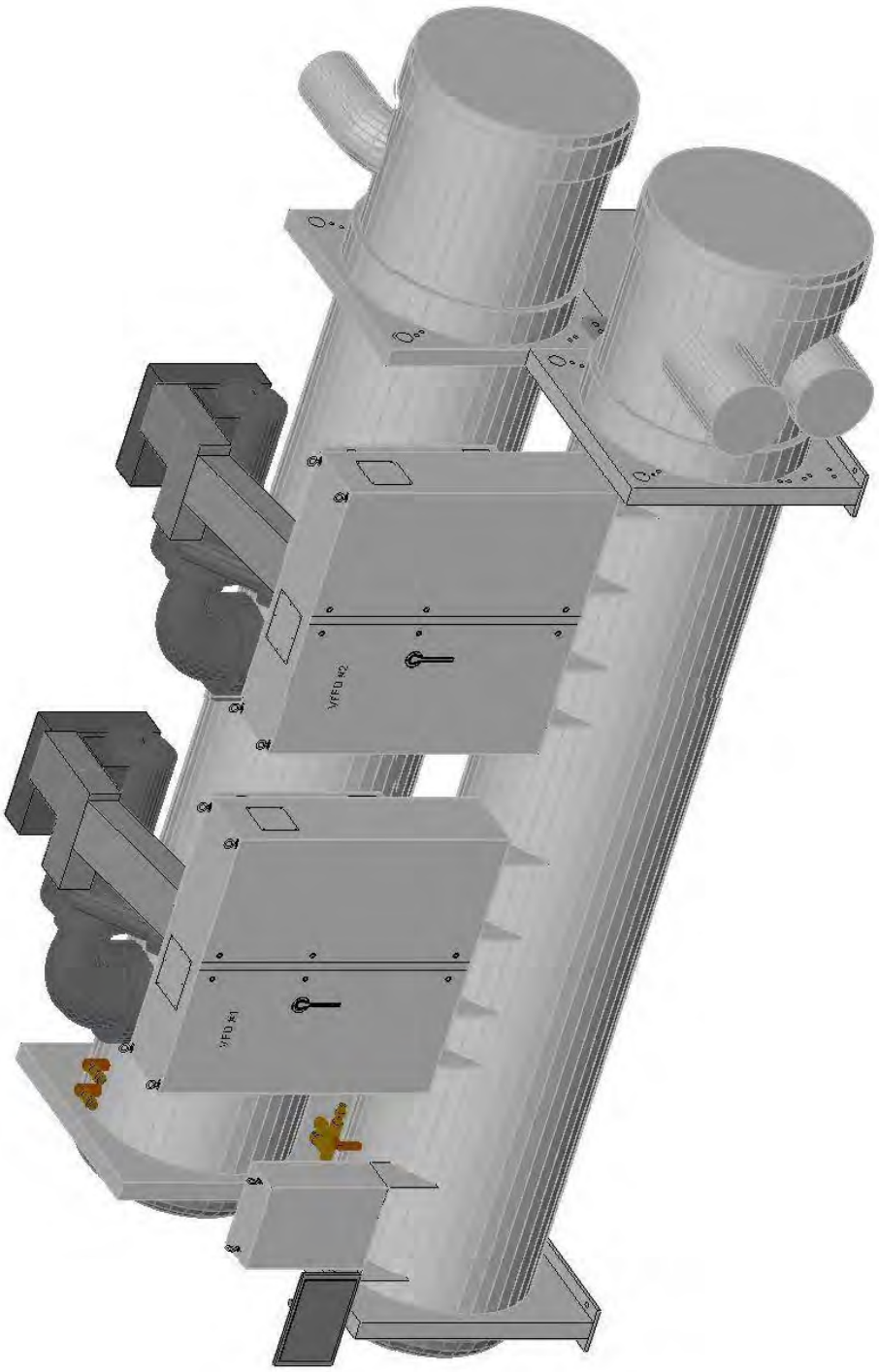
Unit Startup:	Domestic by Daikin Factory Service (Std.)
Standard Warranty:	Domestic, First Year Standard Warranty (Parts & Labor)
Extended Warranty:	2 Years Compressor only Parts & Labor
Delayed Warranty Start:	None (Startup 12-18 months after ship date)

AHRI Certification

Certified in accordance with the AHRI Water-Cooled Water-Chilling and Heat Pump Water-Heating Packages Certification Program, which is based on AHRI Standard 550/590 (I-P) and AHRI Standard 551/591 (SI). Certified units may be found in the AHRI Directory at www.ahridirectory.org.

Notes

1. Above RLA, MCA, MOCP & LRA values are per compressor. and are for input amps.
2. Performance kW & kW/ton values are total values unless noted otherwise.
3. Minimum flow is based upon standard condenser water relief and not increased lift due to constant condenser water temperature.
4. Motor overload settings determined by motor amps. Refer to unit nameplate for proper settings.
5. The USGBC bases its LEED EA credit 4 calculations for Enhanced Refrigerant Management on the default values for a water cooled centrifugal chiller with a 25-year life, 10% end of life loss and 2% annual leak rate. The gross AHRI cooling capacity for the unit is at least 10 tons, and the refrigerant charge is 10 lbs.
6. The LEED result above considers the chiller only. When applying this information for credit or prerequisite compliance the entire building must be considered.
7. Use only copper supply wires with ampacity based on 75°C conductor rating. Connections to terminals must be made with copper lugs and copper wire.
8. For orientation purposes, left and right hand vessel connection locations are determined by facing the starter panels. The unit front is the long dimension side with the starter panels and rear is the opposite side long dimension. The HMI (Human Machine Interface) is on the rear of the chiller.



Model View	Unit Tag: CH-1	Sales Office: Thermaltech	DAIKIN
Product: Magnitude® Chiller	Project Name: Form	Sales Engineer:	13600 Industrial Park Blvd. Minneapolis, MN 55441
Model: WME092CDCSNA/E4216-JB2CR2V/C4216-YE3CR2V	June 20, 2023 | Ver/Rev: | Sheet: 1 of 1	Scale: NTS | Tolerance: +/- 1.0" | Dwg Units: In	www.DaikinApplied.com Software Version: 19.10
WME092CDCSNBB00460H6D/E4216JB2CR2VHN4E/C4216YE3CR2VIN4E/MNAM1			

No change to this drawing may be made unless approved in writing by Daikin Applied. Purchaser must determine that the equipment is fit and sufficient for the job specifications.

Attachment L
EMISSIONS UNIT DATA SHEET
STORAGE TANKS

Provide the following information for each new or modified bulk liquid storage tank as shown on the *Equipment List Form* and other parts of this application. A tank is considered modified if the material to be stored in the tank is different from the existing stored liquid.

IF USING US EPA'S TANKS EMISSION ESTIMATION PROGRAM (AVAILABLE AT **www.epa.gov/tnn/tanks.html**), APPLICANT MAY ATTACH THE SUMMARY SHEETS IN LIEU OF COMPLETING SECTIONS III, IV, & V OF THIS FORM. HOWEVER, SECTIONS I, II, AND VI OF THIS FORM MUST BE COMPLETED. US EPA'S AP-42, SECTION 7.1, "ORGANIC LIQUID STORAGE TANKS," MAY ALSO BE USED TO ESTIMATE VOC AND HAP EMISSIONS (**http://www.epa.gov/tnn/chief/**).

I. GENERAL INFORMATION (required)

1. Bulk Storage Area Name IPA Tank	2. Tank Name Isopropyl Alcohol Tank
3. Tank Equipment Identification No. (as assigned on *Equipment List Form*) 3S-2	4. Emission Point Identification No. (as assigned on *Equipment List Form*) 3E
5. Date of Commencement of Construction (for existing tanks)	
6. Type of change ☒ New Construction ☐ New Stored Material ☐ Other Tank Modification	
7. Description of Tank Modification (if applicable)	
7A. Does the tank have more than one mode of operation? (e.g. Is there more than one product stored in the tank?) ☐ Yes ☒ No	
7B. If YES, explain and identify which mode is covered by this application (Note: A separate form must be completed for each mode).	
7C. Provide any limitations on source operation affecting emissions, any work practice standards (e.g. production variation, etc.):	

II. TANK INFORMATION (required)

8. Design Capacity (specify barrels or gallons). Use the internal cross-sectional area multiplied by internal height. 6,000-gallons	
9A. Tank Internal Diameter (ft) 8 (used for calculations, size TBD)	9B. Tank Internal Height (or Length) (ft) 16 (used for calculations, size TBD)
10A. Maximum Liquid Height (ft) TBD	10B. Average Liquid Height (ft) TBD
11A. Maximum Vapor Space Height (ft) TBD	11B. Average Vapor Space Height (ft) TBD
12. Nominal Capacity (specify barrels or gallons). This is also known as "working volume" and considers design liquid levels and overflow valve heights. 5,800-gallons	

13A. Maximum annual throughput (gal/yr)	13B. Maximum daily throughput (gal/day)
79,125	9.03

14. Number of Turnovers per year (annual net throughput/maximum tank liquid volume): 27

15. Maximum tank fill rate (gal/min): TBD

16. Tank fill method: ☐ Submerged ☐ Splash ☒ Bottom Loading

17. Complete 17A and 17B for Variable Vapor Space Tank Systems ☒ Does Not Apply

17A. Volume Expansion Capacity of System (gal)	17B. Number of transfers into system per year

18. Type of tank (check all that apply):
- ☒ Fixed Roof ___ vertical ___ horizontal ___ flat roof ___ cone roof x dome roof
- ___ other (describe)
- ☐ External Floating Roof ___ pontoon roof ___ double deck roof
- ☐ Domed External (or Covered) Floating Roof
- ☐ Internal Floating Roof ___ vertical column support ___ self-supporting
- ☐ Variable Vapor Space ___ lifter roof ___ diaphragm
- ☐ Pressurized ___ spherical ___ cylindrical
- ☐ Underground
- ☐ Other (describe)

III. TANK CONSTRUCTION & OPERATION INFORMATION (optional if providing TANKS Summary Sheets)

19. Tank Shell Construction:
☐ Riveted ☐ Gunite lined ☐ Epoxy-coated rivets ☒ Other (describe) TBD

20A. Shell Color	20B. Roof Color	20C. Year Last Painted
TBD	TBD	2023

21. Shell Condition (if metal and unlined):
☒ No Rust ☐ Light Rust ☐ Dense Rust ☐ Not applicable

22A. Is the tank heated? ☐ YES ☒ NO

22B. If YES, provide the operating temperature (°F)

22C. If YES, please describe how heat is provided to tank.

23. Operating Pressure Range (psig): Ambient to Ambient

24. Complete the following section for **Vertical Fixed Roof Tanks** ☒ Does Not Apply

24A. For dome roof, provide roof radius (ft)

24B. For cone roof, provide slope (ft/ft)

25. Complete the following section for **Floating Roof Tanks** ☒ Does Not Apply

25A. Year Internal Floaters Installed:

25B. Primary Seal Type: (check one)
☐ Metallic (Mechanical) Shoe Seal ☐ Liquid Mounted Resilient Seal
☐ Vapor Mounted Resilient Seal ☐ Other (describe):

25C. Is the Floating Roof equipped with a Secondary Seal? ☐ YES ☐ NO

25D. If YES, how is the secondary seal mounted? (check one) ☐ Shoe ☐ Rim ☐ Other (describe):

25E. Is the Floating Roof equipped with a weather shield? ☐ YES ☐ NO

25F. Describe deck fittings; indicate the number of each type of fitting:		
ACCESS HATCH		
BOLT COVER, GASKETED:	UNBOLTED COVER, GASKETED:	UNBOLTED COVER, UNGASKETED:
AUTOMATIC GAUGE FLOAT WELL		
BOLT COVER, GASKETED:	UNBOLTED COVER, GASKETED:	UNBOLTED COVER, UNGASKETED:
COLUMN WELL		
BUILT-UP COLUMN – SLIDING COVER, GASKETED:	BUILT-UP COLUMN – SLIDING COVER, UNGASKETED:	PIPE COLUMN – FLEXIBLE FABRIC SLEEVE SEAL:
LADDER WELL		
PIP COLUMN – SLIDING COVER, GASKETED:	PIPE COLUMN – SLIDING COVER, UNGASKETED:	
GAUGE-HATCH/SAMPLE PORT		
SLIDING COVER, GASKETED:	SLIDING COVER, UNGASKETED:	
ROOF LEG OR HANGER WELL		
WEIGHTED MECHANICAL ACTUATION, GASKETED:	WEIGHTED MECHANICAL ACTUATION, UNGASKETED:	SAMPLE WELL-SLIT FABRIC SEAL (10% OPEN AREA)
VACUUM BREAKER		
WEIGHTED MECHANICAL ACTUATION, GASKETED:	WEIGHTED MECHANICAL ACTUATION, UNGASKETED:	
RIM VENT		
WEIGHTED MECHANICAL ACTUATION GASKETED:	WEIGHTED MECHANICAL ACTUATION, UNGASKETED:	
DECK DRAIN (3-INCH DIAMETER)		
OPEN:	90% CLOSED:	
STUB DRAIN		
1-INCH DIAMETER:		
OTHER (DESCRIBE, ATTACH ADDITIONAL PAGES IF NECESSARY)		

26. Complete the following section for Internal Floating Roof Tanks ☒ Does Not Apply	
26A. Deck Type: ☐ Bolted ☐ Welded	
26B. For Bolted decks, provide deck construction:	
26C. Deck seam: ☐ Continuous sheet construction 5 feet wide ☐ Continuous sheet construction 6 feet wide ☐ Continuous sheet construction 7 feet wide ☐ Continuous sheet construction 5 × 7.5 feet wide ☐ Continuous sheet construction 5 × 12 feet wide ☐ Other (describe)	
26D. Deck seam length (ft)	26E. Area of deck (ft^2)
For column supported tanks: 26F. Number of columns:	26G. Diameter of each column:

IV. SITE INFORMANTION (optional if providing TANKS Summary Sheets)

27. Provide the city and state on which the data in this section are based. Weirton, WV	
28. Daily Average Ambient Temperature (°F)	50.25
29. Annual Average Maximum Temperature (°F)	61.5
30. Annual Average Minimum Temperature (°F)	39
31. Average Wind Speed (miles/hr)	4.8
32. Annual Average Solar Insulation Factor (BTU/(ft^2·day))	0.1
33. Atmospheric Pressure (psia)	14.7

V. LIQUID INFORMATION (optional if providing TANKS Summary Sheets)

34. Average daily temperature range of bulk liquid:	
34A. Minimum (°F) Ambient	34B. Maximum (°F) Ambient
35. Average operating pressure range of tank: TBD	
35A. Minimum (psig) Ambient	35B. Maximum (psig) Ambient
36A. Minimum Liquid Surface Temperature (°F) Ambient	36B. Corresponding Vapor Pressure (psia) Ambient
37A. Average Liquid Surface Temperature (°F) Ambient	37B. Corresponding Vapor Pressure (psia) Ambient
38A. Maximum Liquid Surface Temperature (°F) Ambient	38B. Corresponding Vapor Pressure (psia) Ambient

39. Provide the following for <u>each</u> liquid or gas to be stored in tank. Add additional pages if necessary.

39A.	Material Name or Composition	Isopropyl Alcohol		
39B.	CAS Number	67-63-0		
39C.	Liquid Density (lb/gal)	6.55		
39D.	Liquid Molecular Weight (lb/lb-mole)	0.1325		
39E.	Vapor Molecular Weight (lb/lb-mole)			

Maximum Vapor Pressure 39F. True (psia) 39G. Reid (psia)	Ambient		
Months Storage per Year 39H. From 39I. To	12		

VI. EMISSIONS AND CONTROL DEVICE DATA (required)

40. Emission Control Devices (check as many as apply): ☒ Does Not Apply

- ☐ Carbon Adsorption[1]
- ☐ Condenser[1]
- ☐ Conservation Vent (psig)
  - Vacuum Setting — Pressure Setting
- ☐ Emergency Relief Valve (psig)
- ☐ Inert Gas Blanket of
- ☐ Insulation of Tank with
- ☐ Liquid Absorption (scrubber)[1]
- ☐ Refrigeration of Tank
- ☐ Rupture Disc (psig)
- ☐ Vent to Incinerator[1]
- ☐ Other[1] (describe):

[1] Complete appropriate Air Pollution Control Device Sheet.

41. Expected Emission Rate (submit Test Data or Calculations here or elsewhere in the application).

Material Name & CAS No.	Breathing Loss (lb/hr)	Working Loss Amount	Working Loss Units	Annual Loss (lb/yr)	Estimation Method[1]
Isoprpyl Alcohol 67-63-0	0.000153	40.75	lb/yr	42.1	MB

[1] EPA = EPA Emission Factor, MB = Material Balance, SS = Similar Source, ST = Similar Source Test, Throughput Data, O = Other (specify)

☒ Remember to attach emissions calculations, including TANKS Summary Sheets if applicable.

Attachment M:
Air Pollution Control Device Sheet(s)

Attachment M
Air Pollution Control Device Sheet
(OTHER COLLECTORS)

Control Device ID No. (must match Emission Units Table): 1C-1

Equipment Information

1. Manufacturer: Airex Industries Model No. PS-42	2. Control Device Name: Cartridge Dust Collector Anode Type: Cartridge Dust Collector
3. Provide diagram(s) of unit describing capture system with duct arrangement and size of duct, air volume, capacity, horsepower of movers. If applicable, state hood face velocity and hood collection efficiency.	
4. On a separate sheet(s) supply all data and calculations used in selecting or designing this collection device.	
5. Provide a scale diagram of the control device showing internal construction.	
6. Submit a schematic and diagram with dimensions and flow rates.	
7. Guaranteed minimum collection efficiency for each pollutant collected: 95%	
8. Attached efficiency curve and/or other efficiency information.	
9. Design inlet volume: 17,000 CFM	10. Capacity:
11. Indicate the liquid flow rate and describe equipment provided to measure pressure drop and flow rate, if any. N/A	
12. Attach any additional data including auxiliary equipment and operation details to thoroughly evaluate the control equipment.	
13. Description of method of handling the collected material(s) for reuse of disposal. Removal of cartridges via third party.	

Gas Stream Characteristics

14. Are halogenated organics present?	☐ Yes	☒ No
Are particulates present?	☒ Yes	☐ No
Are metals present?	☒ Yes	☐ No

15. Inlet Emission stream parameters:	Maximum	Typical
Pressure (mmHg):		
Heat Content (BTU/scf):		
Oxygen Content (%):		
Moisture Content (%):		
Relative Humidity (%):		

16. Type of pollutant(s) controlled: ☐ SO_x ☐ Odor
☒ Particulate (type): PM10, PM2.5 – Carbon and Iron powders ☐ Other

17. Inlet gas velocity: ft/sec

18. Pollutant specific gravity:

19. Gas flow into the collector:
ACF @ °F and PSIA

20. Gas stream temperature:
Inlet: °F
Outlet: °F

21. Gas flow rate:
Design Maximum: 17,000 CFM
Average Expected: ACFM

22. Particulate Grain Loading in grains/scf:
Inlet:
Outlet:

23. Emission rate of each pollutant (specify) into and out of collector:

Pollutant	IN Pollutant		Emission Capture Efficiency %	OUT Pollutant		Control Efficiency %
	lb/hr	grains/acf		lb/hr	grains/acf	
A						
B						
C						
D						
E						

24. Dimensions of stack: Height ft. Diameter ft.

25. Supply a curve showing proposed collection efficiency versus gas volume from 25 to 130 percent of design rating of collector.

Particulate Distribution

26. Complete the table:	Particle Size Distribution at Inlet to Collector	Fraction Efficiency of Collector
Particulate Size Range (microns)	Weight % for Size Range	Weight % for Size Range
0 – 2		
2 – 4		
4 – 6		
6 – 8		
8 – 10		
10 – 12		
12 – 16		
16 – 20		
20 – 30		
30 – 40		
40 – 50		
50 – 60		
60 – 70		
70 – 80		
80 – 90		
90 – 100		
>100		

27. Describe any air pollution control device inlet and outlet gas conditioning processes (e.g., gas cooling, gas reheating, gas humidification):

28. Describe the collection material disposal system:

29. Have you included ***Other Collectores Control Device*** in the Emissions Points Data Summary Sheet?

30. **Proposed Monitoring, Recordkeeping, Reporting, and Testing**
Please propose monitoring, recordkeeping, and reporting in order to demonstrate compliance with the proposed operating parameters. Please propose testing in order to demonstrate compliance with the proposed emissions limits.

MONITORING:	RECORDKEEPING:
REPORTING:	TESTING:

MONITORING:	Please list and describe the process parameters and ranges that are proposed to be monitored in order to demonstrate compliance with the operation of this process equipment or air control device.
RECORDKEEPING:	Please describe the proposed recordkeeping that will accompany the monitoring.
REPORTING:	Please describe any proposed emissions testing for this process equipment on air pollution control device.
TESTING:	Please describe any proposed emissions testing for this process equipment on air pollution control device.

31. Manufacturer's Guaranteed Control Efficiency for each air pollutant.
95% PM

32. Manufacturer's Guaranteed Control Efficiency for each air pollutant.
95% PM

33. Describe all operating ranges and maintenance procedures required by Manufacturer to maintain warranty.

Attachment M
Air Pollution Control Device Sheet
(OTHER COLLECTORS)

Control Device ID No. (must match Emission Units Table): 2C-1

Equipment Information

1. Manufacturer: Airex Industries Model No. PS-24	2. Control Device Name: Cartridge Dust Collector Anode Type: Cartridge Dust Collector
3. Provide diagram(s) of unit describing capture system with duct arrangement and size of duct, air volume, capacity, horsepower of movers. If applicable, state hood face velocity and hood collection efficiency.	
4. On a separate sheet(s) supply all data and calculations used in selecting or designing this collection device.	
5. Provide a scale diagram of the control device showing internal construction.	
6. Submit a schematic and diagram with dimensions and flow rates.	
7. Guaranteed minimum collection efficiency for each pollutant collected: 95%	
8. Attached efficiency curve and/or other efficiency information.	
9. Design inlet volume: 9,000 CFM	10. Capacity:
11. Indicate the liquid flow rate and describe equipment provided to measure pressure drop and flow rate, if any. N/A	
12. Attach any additional data including auxiliary equipment and operation details to thoroughly evaluate the control equipment.	
13. Description of method of handling the collected material(s) for reuse of disposal. Removal of cartridges via third party.	

Gas Stream Characteristics

14. Are halogenated organics present?	☐ Yes	☒ No
Are particulates present?	☒ Yes	☐ No
Are metals present?	☐ Yes	☒ No

15. Inlet Emission stream parameters:	Maximum	Typical
Pressure (mmHg):		
Heat Content (BTU/scf):		
Oxygen Content (%):		
Moisture Content (%):		
Relative Humidity (%):		

16. Type of pollutant(s) controlled: ☐ SO_x ☐ Odor
☒ Particulate (type): PM10, PM2.5 – Carbon and Iron powders ☐ Other

17. Inlet gas velocity: ft/sec

18. Pollutant specific gravity:

19. Gas flow into the collector:
ACF @ °F and PSIA

20. Gas stream temperature:
Inlet: °F
Outlet: °F

21. Gas flow rate:
Design Maximum: 9,000 CFM
Average Expected: ACFM

22. Particulate Grain Loading in grains/scf:
Inlet:
Outlet:

23. Emission rate of each pollutant (specify) into and out of collector:

Pollutant	IN Pollutant		Emission Capture Efficiency %	OUT Pollutant		Control Efficiency %
	lb/hr	grains/acf		lb/hr	grains/acf	
A						
B						
C						
D						
E						

24. Dimensions of stack: Height ft. Diameter ft.

25. Supply a curve showing proposed collection efficiency versus gas volume from 25 to 130 percent of design rating of collector.

Particulate Distribution

26. Complete the table:	Particle Size Distribution at Inlet to Collector	Fraction Efficiency of Collector
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0 – 2		
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10 – 12		
12 – 16		
16 – 20		
20 – 30		
30 – 40		
40 – 50		
50 – 60		
60 – 70		
70 – 80		
80 – 90		
90 – 100		
>100		

27. Describe any air pollution control device inlet and outlet gas conditioning processes (e.g., gas cooling, gas reheating, gas humidification):

28. Describe the collection material disposal system:

29. Have you included ***Other Collectores Control Device*** in the Emissions Points Data Summary Sheet?

30. **Proposed Monitoring, Recordkeeping, Reporting, and Testing**
Please propose monitoring, recordkeeping, and reporting in order to demonstrate compliance with the proposed operating parameters. Please propose testing in order to demonstrate compliance with the proposed emissions limits.

MONITORING:	RECORDKEEPING:
REPORTING:	TESTING:

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95% PM

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33. Describe all operating ranges and maintenance procedures required by Manufacturer to maintain warranty.

FR

Cartridge Dust Collector

Platinum Series

model PS-42: 17,000 CFM
model PS-24: 9,000 CFM

HOW CAN WE HELP ?

Discover The Power Of The New Generation Of Vertical Cartridge Dust Collectors

Airex Industries Platinum™ Series Dust Collectors are different from other dust collectors. Their ability to filter highly-contaminated air volumes in an extremely compact format is what sets them apart from the rest. As part of an efficient compressed air self-cleaning system, the cartridges allow for the continuous filtration of sub-micron dust particles with a constant differential pressure loss.

Our Platinum™ dust collectors have doors and a manual cam system that require no tools and allows for an easy cartridge change out.

Main Advantages At A Glance

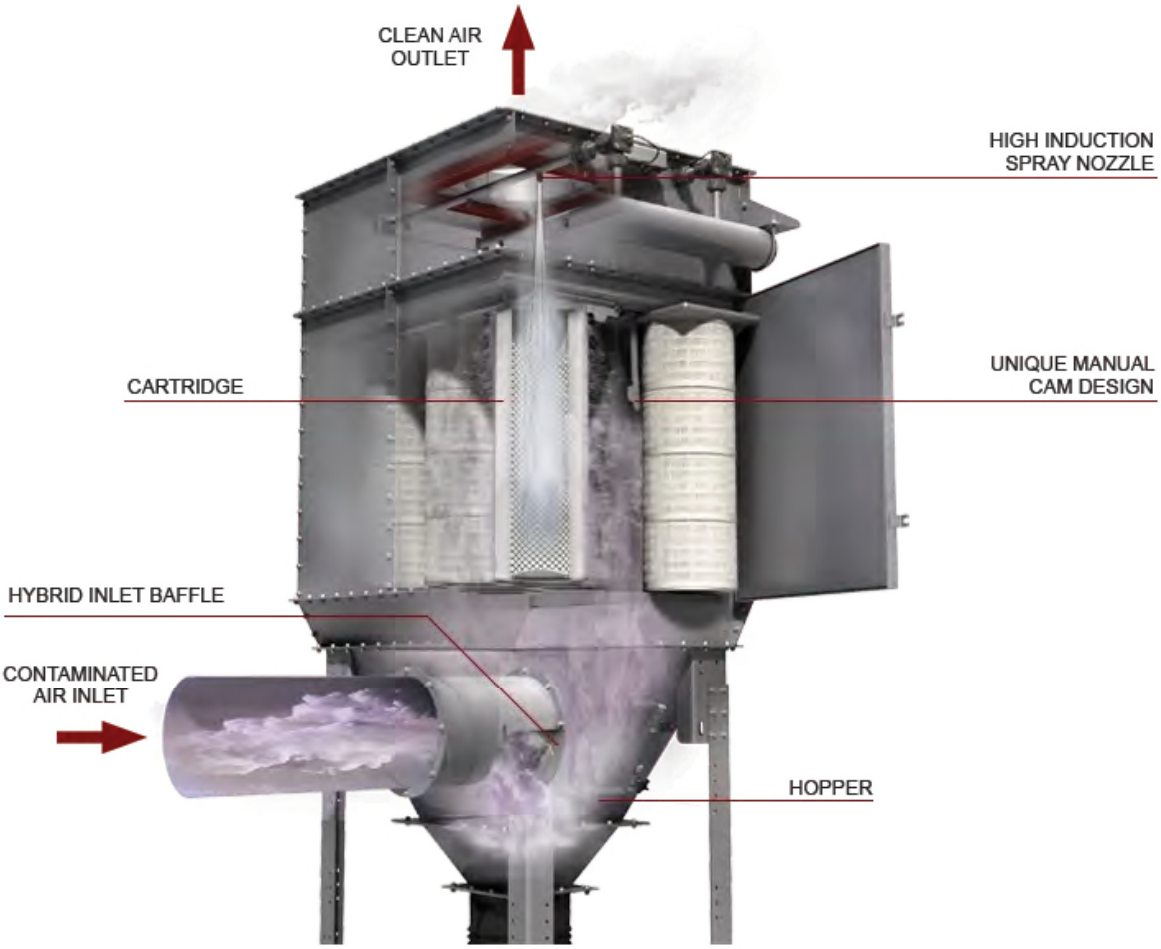
High Filtration Capacity
Models from 2 to 224 cartridges and up to 100 000 CFM capacity.

Custom Engineering
Special needs and custom designs available with Platinum™ systems.

Low Inital Cost
The optimization of our design and assembly technics allows us to offer highly competitive prices.

Vertical Cartridge Design
Unlike horizontal cartridge designs that reduce filtering surface efficiency by up to 30%, Airex Industries Platinum™ series dust collectors maintain a 100% filtration rate at all times.

Vertical Filtration Principle



How The Cartridge Dust Collector Works

The dust-laden gases enter through the side intake of the dust collector's hopper, under vacuum or pressure (except for bin vents, where the air comes in from the bottom).

The gases are then filtered through the cartridges and exit through the openings into the clean air plenum. The clean air can either be channeled outside or re-circulated depending on the application.

Advantages

Fast, Simple and Safe Cartridge Replacement

Cartridge replacement is performed outside the dust collector and requires no tools. This eliminates the need to work within a confined space and allows the worker to access the cartridge without getting dirty. The cartridge comes with a rectangular top plate that simplifies manipulation and eliminates potential installation errors.

Continuous Operation

Unlike other types of dust collectors such as the shaker, the cartridge dust collector does not have to be stopped in order to remove and clean dust particles from its filters.

Economical

The cartridge dust collector is an economical choice because it requires minimal maintenance: only periodic cartridge replacement is necessary (depending on the application).

Filtration Technology

We Have The Right Filtering Media For Your Needs

In terms of performance, one of the most important criteria during the initial design of a dust collection system is the proper selection of the filtering media.

There are several cartridge models providing adaptation flexibility based on the characteristics of the various types of aerosols. The filtration effectiveness of Airex cartridges can achieve a level equivalent to HEPA, classified as MERV 16. In fact, a single cartridge has a total filtering surface that can reach up to 315 sq. ft. The compact aspect of such a filtering medium makes it a highly prized solution when the available space is limited.

Common Features

End Cap and Gaskets

Our standard end caps are made of galvanized metal (16" x 14.25") while our D-Shape gaskets are fabricated with continuous rubber (0.5" W x 0.625" H).

HOW CAN WE HELP ?

Operation Temperature

Cartridges maximum continuous operating temperature is 250 °F (120 °C) while the maximum short term operating temperature can reach up to 295 °F (145 °C).

Weight and Dimensions

Weight : 22 lb

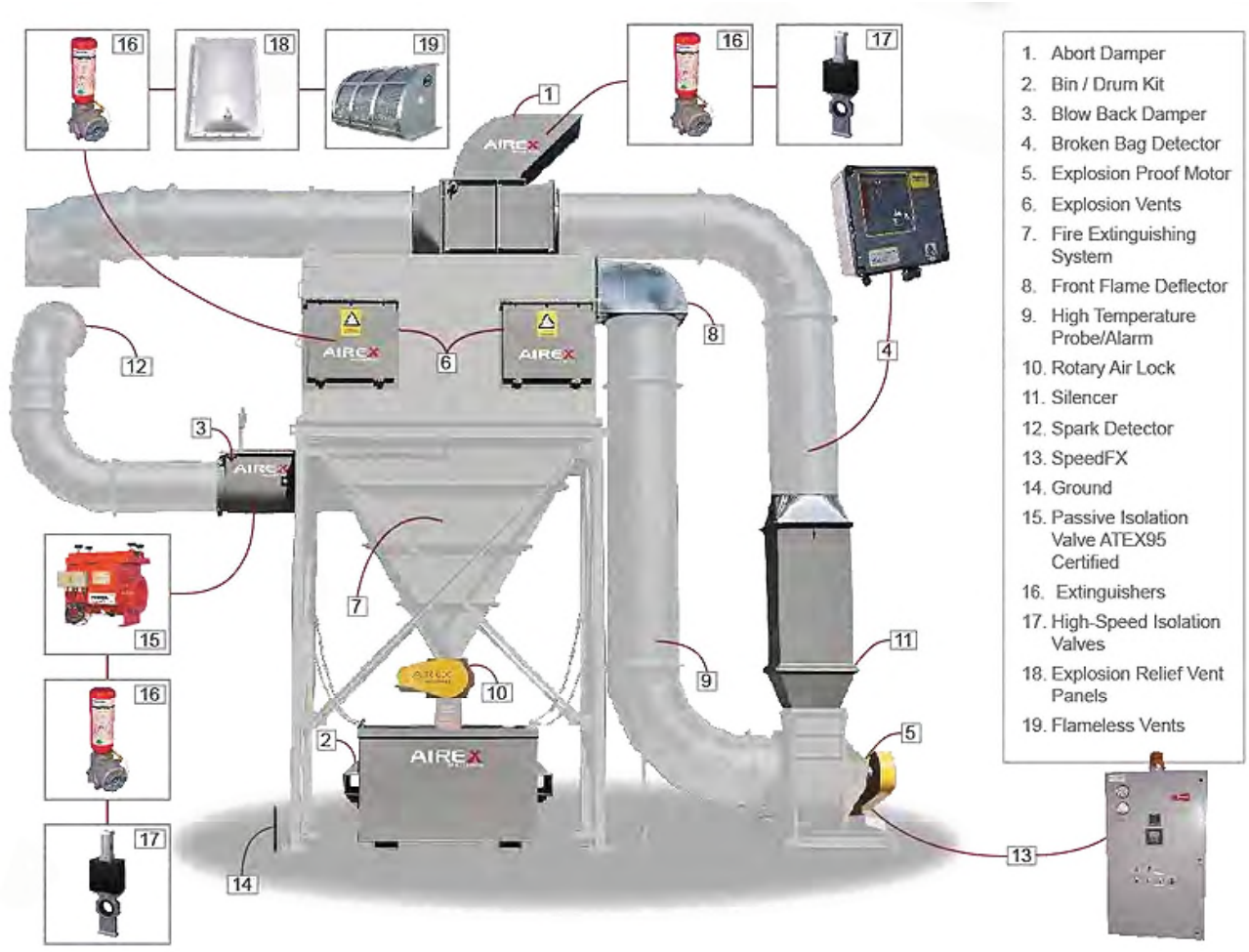
Height : 36"

Outside diameter : 12.75"

Inside diameter : 8.3"

View our datasheet

Accessories



HOW CAN WE HELP ?

Enhance Your Performance And Security

Some options like the SpeedFX™ can vary motor speed and energy consumption thus improving efficiency.

A number of Airex accessories aim to meet NFPA regulations, preventing against fire and explosions while better protecting workers and facilities.

Fire Protection Accessories

Abort Damper

Connected with a proper spark or fire detection system, the abort damper redirects exhaust air into the atmosphere as soon as a spark is detected.

Blow Back Damper

Ensure there is a seal, if a fire or explosion occurs in the dust collector, preventing return of smoke and fire to the shop by the intake ductwork.

Explosion Vents

The explosion vents redirect a propagating flame or explosion to atmosphere via pressure rated washers.

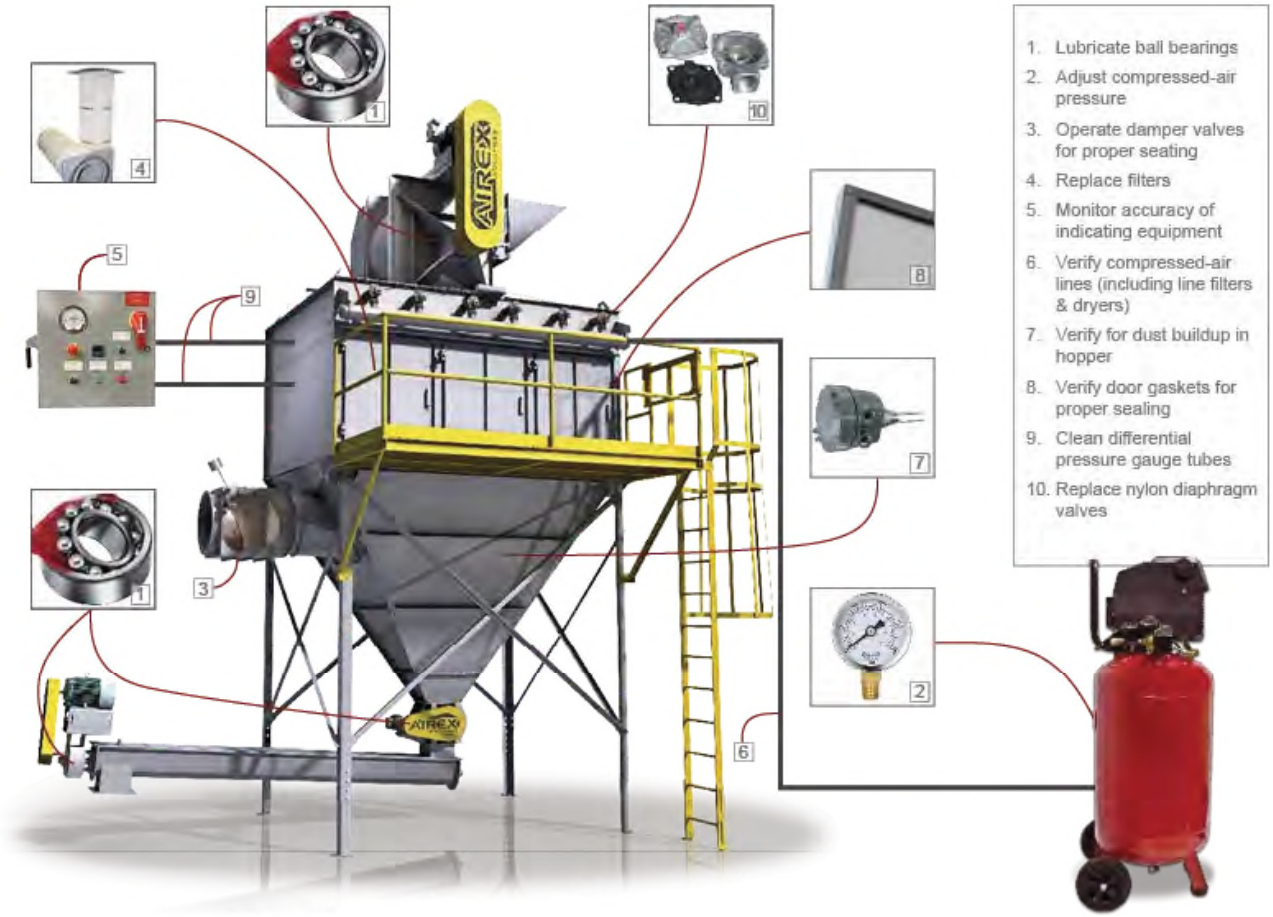
Rotary Air Lock

Designed to control the flow of discharge material from a dust collector or other type of process while maintaining an air seal.

Spark Detection & Fire Extinguishing System

Counters the spread of fire with a temperature probe and sprinkler. : Spraying the collector and stops the blower (eliminating oxygen intake).

Preventive Maintenance



HOW CAN WE HELP ?

Use A Proactive Approach To Increase The Lifespan Of Your Unit

Like other industrial equipment, a dust collector has an assortment of components that you need to keep an eye on to ensure the unit is operating optimally. If these components are not maintained, the company could find itself in a potentially risky situation in terms of health and safety.

Airex offers a preventive maintenance contract that can increase the useful life of your dust collection system and its accessories. This type of program is also an excellent strategy for avoiding the unforeseeable in terms of breakages and unit stoppages.

By investing in the maintenance of your dust collector, you will also save money by avoiding emergency repair costs that are of course much most onerous over the medium and long term.

Stay Alert For Early Signs Of Deterioration

Visual Inspection
Be vigilant to the appearance of corrosion, dust accumulation or even wear and tear of your system.

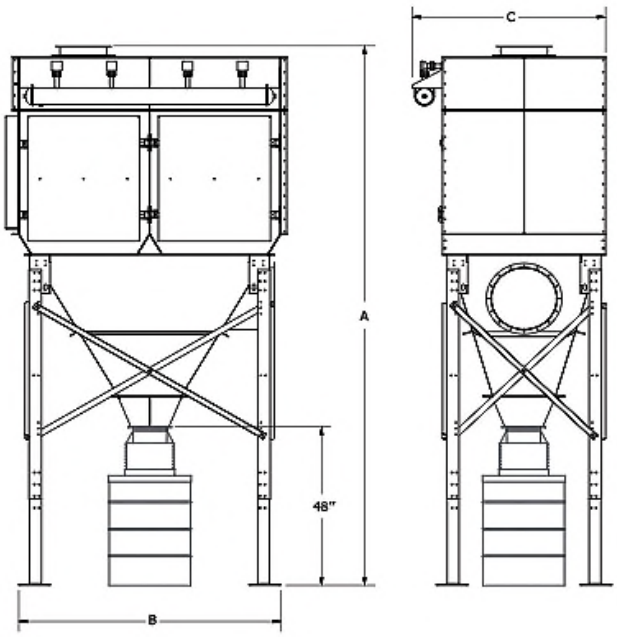
Variation of Noise and Vibration
Listen for a compressed air leak, fan vibration, or even an unusual sound from your system.

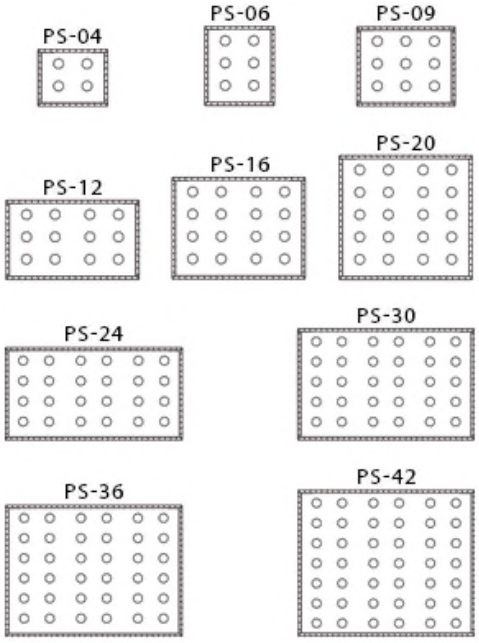
Tracking Operation Parameters
Make sure the performance indicators stay within the prescribed limits of your system.

ASK FOR A FREE PRELIMINARY TOUR OF YOUR FACILITIES

SCHEDULE AN APPOINTMENT

Specifications - PS

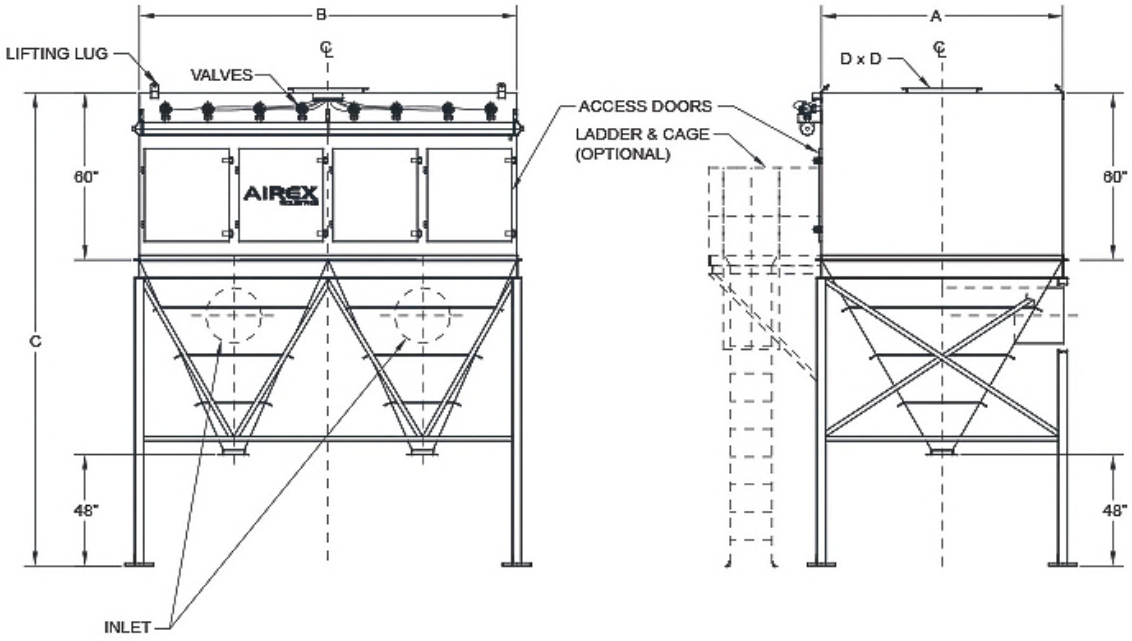




View our datasheet

HOW CAN WE HELP ?

Specifications - DCCH



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Get In Touch

If you have any questions or request, please contact us by phone or by filling the form below.

Toll Free: +1-800-263-2303

Full Name (*)

Organization

Email (*)

Phone (*)

Message (*)

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HOW CAN WE HELP ?

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HOW CAN WE HELP ?

Attachment M
Air Pollution Control Device Sheet
(OTHER COLLECTORS)

Control Device ID No. (must match Emission Units Table): 2C-2

Equipment Information

1. Manufacturer: Epcon Industrial Systems LP Model No. Custom - 18,000 SCFM Recuperative Thermal Oxidizer with Primary and Secondary Heat Exchangers (Secondary Heat Exchanger supplies recovered heat to both Ovens)	2. Control Device Name: RTO Type: Recuperative Thermal Oxidizer
3. Provide diagram(s) of unit describing capture system with duct arrangement and size of duct, air volume, capacity, horsepower of movers. If applicable, state hood face velocity and hood collection efficiency.	
4. On a separate sheet(s) supply all data and calculations used in selecting or designing this collection device.	
5. Provide a scale diagram of the control device showing internal construction.	
6. Submit a schematic and diagram with dimensions and flow rates.	
7. Guaranteed minimum collection efficiency for each pollutant collected: 95% VOC	
8. Attached efficiency curve and/or other efficiency information.	
9. Design inlet volume: 18,000 SCFM	10. Capacity: 18,000 SCFM
11. Indicate the liquid flow rate and describe equipment provided to measure pressure drop and flow rate, if any. 435 lbs/hr of Isopar L	
12. Attach any additional data including auxiliary equipment and operation details to thoroughly evaluate the control equipment.	
13. Description of method of handling the collected material(s) for reuse of disposal.	

Gas Stream Characteristics

14. Are halogenated organics present?	☐ Yes	☒ No
Are particulates present?	☐ Yes	☒ No
Are metals present?	☐ Yes	☒ No

15. Inlet Emission stream parameters:	Maximum	Typical
Pressure (mmHg):		
Heat Content (BTU/scf):		
Oxygen Content (%):		

Moisture Content (%):		
Relative Humidity (%):		

16. Type of pollutant(s) controlled: ☐ SO_x ☐ Particulate (type):	☐ Odor ☒ Other Volatile Organic Compounds (VOCs)
17. Inlet gas velocity: ft/sec	18. Pollutant specific gravity:
19. Gas flow into the collector: ACF @ °F and PSIA	20. Gas stream temperature: Inlet: °F Outlet: °F
21. Gas flow rate: Design Maximum: ACFM Average Expected: ACFM	22. Particulate Grain Loading in grains/scf: Inlet: Outlet:

23. Emission rate of each pollutant (specify) into and out of collector:

Pollutant	IN Pollutant		Emission Capture Efficiency %	OUT Pollutant		Control Efficiency %
	lb/hr	grains/acf		lb/hr	grains/acf	
A						
B						
C						
D						
E						

24. Dimensions of stack: Height ft. Diameter ft.

25. Supply a curve showing proposed collection efficiency versus gas volume from 25 to 130 percent of design rating of collector.

Particulate Distribution

26. Complete the table: N/A	Particle Size Distribution at Inlet to Collector	Fraction Efficiency of Collector
Particulate Size Range (microns)	**Weight % for Size Range**	**Weight % for Size Range**
0 – 2		
2 – 4		
4 – 6		
6 – 8		
8 – 10		
10 – 12		
12 – 16		
16 – 20		
20 – 30		
30 – 40		
40 – 50		
50 – 60		
60 – 70		
70 – 80		
80 – 90		
90 – 100		
>100		

27. Describe any air pollution control device inlet and outlet gas conditioning processes (e.g., gas cooling, gas reheating, gas humidification):

28. Describe the collection material disposal system:

29. Have you included ***Other Collectores Control Device*** in the Emissions Points Data Summary Sheet?

30. **Proposed Monitoring, Recordkeeping, Reporting, and Testing**
Please propose monitoring, recordkeeping, and reporting in order to demonstrate compliance with the proposed operating parameters. Please propose testing in order to demonstrate compliance with the proposed emissions limits.

MONITORING:	RECORDKEEPING:
REPORTING:	TESTING:

MONITORING:	Please list and describe the process parameters and ranges that are proposed to be monitored in order to demonstrate compliance with the operation of this process equipment or air control device.
RECORDKEEPING:	Please describe the proposed recordkeeping that will accompany the monitoring.
REPORTING:	Please describe any proposed emissions testing for this process equipment on air pollution control device.
TESTING:	Please describe any proposed emissions testing for this process equipment on air pollution control device.

31. Manufacturer's Guaranteed Control Efficiency for each air pollutant.
95% VOCs

32. Manufacturer's Guaranteed Control Efficiency for each air pollutant.
95% VOCs

33. Describe all operating ranges and maintenance procedures required by Manufacturer to maintain warranty.

Attachment M
Air Pollution Control Device Sheet
(OTHER COLLECTORS)

Control Device ID No. (must match Emission Units Table): 3C-1

Equipment Information

1. Manufacturer: Epcon Industrial Systems LP Model No. Custom - 18,000 SCFM Recuperative Thermal Oxidizer with Primary and Secondary Heat Exchangers (Secondary Heat Exchanger supplies recovered heat to both Ovens)	2. Control Device Name: RTO Type: Recuperative Thermal Oxidizer
3. Provide diagram(s) of unit describing capture system with duct arrangement and size of duct, air volume, capacity, horsepower of movers. If applicable, state hood face velocity and hood collection efficiency.	
4. On a separate sheet(s) supply all data and calculations used in selecting or designing this collection device.	
5. Provide a scale diagram of the control device showing internal construction.	
6. Submit a schematic and diagram with dimensions and flow rates.	
7. Guaranteed minimum collection efficiency for each pollutant collected: 95% VOC	
8. Attached efficiency curve and/or other efficiency information.	
9. Design inlet volume: 18,000 SCFM	10. Capacity: 18,000 SCFM
11. Indicate the liquid flow rate and describe equipment provided to measure pressure drop and flow rate, if any. Isopropyl Alcohol – 25.107 kg/hr	
12. Attach any additional data including auxiliary equipment and operation details to thoroughly evaluate the control equipment.	
13. Description of method of handling the collected material(s) for reuse of disposal.	

Gas Stream Characteristics

14. Are halogenated organics present?	☐ Yes	☒ No
Are particulates present?	☐ Yes	☒ No
Are metals present?	☐ Yes	☒ No

15. Inlet Emission stream parameters:	Maximum	Typical
Pressure (mmHg):		
Heat Content (BTU/scf):		
Oxygen Content (%):		

Moisture Content (%):		
Relative Humidity (%):		

16. Type of pollutant(s) controlled: ☐ SO_x ☐ Particulate (type):	☐ Odor ☒ Other Volatile Organic Compounds (VOCs)
17. Inlet gas velocity: ft/sec	18. Pollutant specific gravity:
19. Gas flow into the collector: ACF @ °F and PSIA	20. Gas stream temperature: Inlet: °F Outlet: °F
21. Gas flow rate: Design Maximum: ACFM Average Expected: ACFM	22. Particulate Grain Loading in grains/scf: Inlet: Outlet:

23. Emission rate of each pollutant (specify) into and out of collector:

Pollutant	IN Pollutant		Emission Capture Efficiency %	OUT Pollutant		Control Efficiency %
	lb/hr	grains/acf		lb/hr	grains/acf	
A						
B						
C						
D						
E						

24. Dimensions of stack: Height ft. Diameter ft.

25. Supply a curve showing proposed collection efficiency versus gas volume from 25 to 130 percent of design rating of collector.

Particulate Distribution

26. Complete the table: N/A	Particle Size Distribution at Inlet to Collector	Fraction Efficiency of Collector
Particulate Size Range (microns)	**Weight % for Size Range**	**Weight % for Size Range**
0 – 2		
2 – 4		
4 – 6		
6 – 8		
8 – 10		
10 – 12		
12 – 16		
16 – 20		
20 – 30		
30 – 40		
40 – 50		
50 – 60		
60 – 70		
70 – 80		
80 – 90		
90 – 100		
>100		

27. Describe any air pollution control device inlet and outlet gas conditioning processes (e.g., gas cooling, gas reheating, gas humidification):

28. Describe the collection material disposal system:

29. Have you included ***Other Collectores Control Device*** in the Emissions Points Data Summary Sheet?

30. **Proposed Monitoring, Recordkeeping, Reporting, and Testing**
Please propose monitoring, recordkeeping, and reporting in order to demonstrate compliance with the proposed operating parameters. Please propose testing in order to demonstrate compliance with the proposed emissions limits.

MONITORING:	RECORDKEEPING:
REPORTING:	TESTING:

MONITORING:	Please list and describe the process parameters and ranges that are proposed to be monitored in order to demonstrate compliance with the operation of this process equipment or air control device.
RECORDKEEPING:	Please describe the proposed recordkeeping that will accompany the monitoring.
REPORTING:	Please describe any proposed emissions testing for this process equipment on air pollution control device.
TESTING:	Please describe any proposed emissions testing for this process equipment on air pollution control device.

31. Manufacturer's Guaranteed Control Efficiency for each air pollutant.
95% VOCs

32. Manufacturer's Guaranteed Control Efficiency for each air pollutant.
95% VOCs

33. Describe all operating ranges and maintenance procedures required by Manufacturer to maintain warranty.

ENGINEERING DATA
Recuperative Thermal Oxidizer with Primary and Secondary Heat Exchangers
(Secondary Heat Exchanger Recovered Heat for Ovens)

Capacity	15,000 - 18,000 SCFM
Inlet Temperature	400°F – 570°F
VOC Loading (max.)	435 lbs/hr Isopar L (18,200 Btuh/lbs)
Design Operating Temperature	1450°F (1600°F Max)
Residence Time	1.0 Second
Hydrocarbon Destruction Efficiency	>95% or 25 ppmv

HEAT EXCHANGERS

Primary	304/309 Stainless Steel
Secondary	304 Stainless Steel

BURNER (Qty.1)

Type	Maxon “LV” (or equal)
Burner Fuel	Natural Gas
Installed Capacity	8.0 x 10^6 BTUH
Turndown Capability	20:1

PROCESS FAN (Qty.1)

Type	Induced Draft
Capacity	18,000 SCFM
Motor HP	150 HP with VFD

HOT AIR SUPPLY FAN (Qty.1) – Oven Heat Source

Type	Forced Draft
Capacity	14,000 SCFM
Motor HP	50 HP with VFD

MISCELLANEOUS

Gas Train (QTY.1)	NFPA
Control Panel (Common)	NEMA-12 with PLC and Panel-view
Approximate Overall Dimensions	50’-0” L x 12’-0” W x 12’-0” H
Approximate Weight	110,000 lbs (To be reconfirmed)
Power Supply	480V/3PH/60HZ

Electrical and Instrumentation Classification: General

- *Capacities, dimensions and weight may vary depending upon final design. Heat Exchanger efficiencies are nominal, may vary up or down slightly according to actual operating conditions.*

SYSTEM GUARANTY & TESTING

DESTRUCTION EFFICIENCY

The system will be designed for destruction removal efficiency (DRE) of >95.0% of Non-Methane Hydrocarbons or <25 ppmv measured as Propane, whichever is first achieved, based on the code of Federal Regulations, Title 40 – Protection of Environment, Chapter 1 – Environmental Protection Agency – Subchapter C – Air Programs, Part 60 – Standards of performance for new stationary sources, Appendix A – Test Methods, Method 25A – Determination of total gaseous organic concentration using a flame ionization analyze, as per Section 1.

(Customer must include Epcon®'s performance guarantee statement in the permit of the regulatory agency.)

This explicit warranty is based solely on design maximum VOC input/loading to the Oxidizer.

Epcon® shall specifically design, manufacture, deliver, and warrant a Thermal Oxidizer system, solely based on the information furnished by the purchaser; information or data such as exhaust sources and flow rates, types of solvents or VOCs, concentration of VOCs.

Design specifications shall be developed based on customer-supplied information. Once the system is operational, the performance warrantees and guarantees shall be based on the operating parameters specified by Epcon® and accepted by the Customer.

The purchaser, hereby understands, approves and accepts responsibility for the correctness of the design specifications, either furnished by purchaser or Epcon®'s understanding of the specifications and the design basis, concerning the conditions under which the system is required to operate and perform.

The design parameters developed either by Epcon® or the purchaser shall be the governing document.

Likewise, any physical modifications or process changes to the system, without Epcon®'s written approval and authorization shall make all system warranties null and void.

These unauthorized changes may lead to undesirable consequences, and Epcon® shall be held harmless and free of any and all liabilities.

Any compliance testing must be accomplished within 45 days from startup or within 90 days of shipment, whichever comes first. Third-party testing for regulatory requirement is the responsibility of the Buyer.

Attachment N:
Supporting Emissions Calculations
Without Controls

Facility Wide Emissions Without Control

Facility Emissions for 50 MW Without Control

	PM	VOCs	CO	Nox	SO2	Lead	HAPs
	tons	tons	tons	tons	tons	tons	tons
Anode	22.899	27.246	56.332	0.212	5.757	0.00000	0
Cathode 1	1.347	71.870	2.886	3.435	0.021	0.00002	0
Cathode 2	0.163	264.276	1.804	87.515	32.142	0.00001	0
Assembly	0	0.100	0	0	0	0	0
CEP	59.728	0.677	7.164	10.846	0.252	0.00004	0.003
Totals	**84.138**	**364.170**	**68.185**	**102.008**	**38.172**	**0.00007**	**0.003**

Facility Emissions for 5 MW Without Control

	PM	VOCs	CO	Nox	SO2	Lead	HAPs
	tons	tons	tons	tons	tons	tons	tons
Totals	**8.414**	**36.417**	**6.819**	**10.201**	**3.8172**	**0.000007**	**0.0003**

Combined 5MW and 50MW Facility Totals	**92.552**	**400.586**	**75.004**	**112.209**	**41.989**	**0.000**	**0.003**

Anode Without Control

Emissions Factors from AP-42, Section 1.4, Table 1.4-1 for Natural Gas					
lb/Mmbtu					
VOC	PM	CO	Nox	SO2	Lead
0.0054	0.00745	0.0824	0.0980	0.000588235	4.90196E-07

Anode Emissions for 50 MW without Control

Materials and Equipment Electrode	Emissions Unit ID	Throughput (kg/hr)	Rating (MMBTU/hr)	Hours*	PM	VOCs	CO	Nox	SO2	Lead	Calculation Methodology
					lb/yr	lb/yr	lb/yr	lb/yr	lb/yr	lb/yr	
Main Powder	1S-1	2375	N/A	8760	See "SO2 and CO Table from Client" below***	See "VOC Table from Client" below***	See "SO2 and CO Table from Client" below***	N/A	See "SO2 and CO Table from Client" below****	N/A	Methodology for "SO2 and CO Table from Client" includes benchscale testing at pilot plant. Results were scaled up to 50 MW facility based on estimated production. Methodology for "VOC Table from Client" based on estimated production at 50 MW facility and volatile percentages of known materials.
Powder Additive		125	N/A	8760	See "SO2 and CO Table from Client" below***	See "VOC Table from Client" below***	See "SO2 and CO Table from Client" below***	N/A	See "SO2 and CO Table from Client" below****	N/A	Methodology for "SO2 and CO Table from Client" includes benchscale testing at pilot plant. Results were scaled up to 50 MW facility based on estimated production. Methodology for "VOC Table from Client" based on estimated production at 50 MW facility and volatile percentages of known materials.
Oil Additive			N/A	8760	N/A	See "VOC Table from Client" below***	See "SO2 and CO Table from Client" below***	N/A	See "SO2 and CO Table from Client" below****	N/A	Methodology for "SO2 and CO Table from Client" includes benchscale testing at pilot plant. Results were scaled up to 50 MW facility based on estimated production. Methodology for "VOC Table from Client" based on estimated production at 50 MW facility and volatile percentages of known materials.
Nitrogen			N/A	8760	N/A	See "VOC Table from Client" below***	See "SO2 and CO Table from Client" below***	N/A	See "SO2 and CO Table from Client" below****	N/A	Methodology for "SO2 and CO Table from Client" includes benchscale testing at pilot plant. Results were scaled up to 50 MW facility based on estimated production. Methodology for "VOC Table from Client" based on estimated production at 50 MW facility and volatile percentages of known materials.
Furnace 1-10	1S-2 to 1S-11	N/A	0.493	8760	32.1981	23.3012	355.8733	423.6587	2.5420	0.0021	Calculations made by multiplying emissions factors from AP-42, Section 1.4, Table 1.4-1 with the equipment rating, from client-provided information, and hours run.
				Totals (tons/yr)	22.899	27.2463	56.33178	0.2118	5.7570	0.0000011	

*Based on 7 days/week and 24 hr/day, 52 weeks/year

Notes:
Throughput numbers and ratings are based on estimates from call with Client Anode team.
Equipment is dust sealed (~0.1% dust lost in equipment)

***VOC Table from Client

Calculated Emissions Estimates

Last updated 2023-01-06 by Mike Gibson (just formatting and parameter imports)

Line Item	Units	Value
Oil Emission material behavior		
Char/non-volatiles percentage	%	10%
Assumed percent of volatiles classified as VOC's	%	95%
Total yield of VOC's from oil	%	86%
Pore former material behavior (This is excluded from the first round of analysis)		
Char/non-volatiles percentage	%	5%
Assumed percent of volatiles classified as VOC's	%	5%
Total yield of VOC's from pore formers	%	4.75%
Mass of an oil film per electrode and emitted VOC's per electrode		
Oil film thickness	mm	0.010
Percent open area of the pan	%	50%
Surface area of expanded mesh per lateral area	m2 (SA)/ per m2 (she	1.00
Lateral area of pan	meters^2	0.265
Lateral area of pan covered by oil film	meters^2	0.265
Area of a mesh covered in oil films	m^2	0.27
Area of a non-mesh back covered in oil films	m^2	0.53
Number of meshes per pan	Number/pan	2
Number of non-mesh backs per pan	Number/pan	0
Total area of subassembly covered by oil film	m^2/electrode	0.53
Total volume of oil film per pan	m^3 oil per pan	0.0000053
Total volume of oil film per pan	mL	5.3
Density of oil	kg/m3	900
Mass of oil per electrode	kg oil/electrode	0.005
Mass of oil per electrode	grams oil/electrode	4.7700
Mass of VOC emitted per electrode	**kg VOC emitted/elec**	**0.0041**
Conversion to emissions/year - Oil film contribution		
Anodes per shift (total)	anodes/shift	6066.51848
Anodes per hour	anodes/hour	758.3
Working days per month	days/month	21.7261905
Anodes per month/shift	anodes/shift/month	131802
kg VOC per month/shift	kg VOC/shift/month	538
kg VOC per year/shift	kg VOC/year/shift	6450
3-shift yearly VOC emissions, 24/5	**tons VOC/year**	**19.4**
3-shift yearly VOC emissions, 24/7	**tons VOC/year**	**27.1**

5MW HCA Furnace VOC emissions, 24/5	tons VOC/year	1.9
50MW HCA Furnace VOC emissions, 24/5	tons VOC/year	19.4

Scaled Emissions +

27.23462 tons/year of VOC based on Client table

+Scaled up to 8760 hours from

****SO2 and CO Table from Client

5MW HCA Furnace CO emissions, 24/5	tons CO/year	4.0
5MW HCA Furnace CO2 emissions, 24/5	tons CO2/year	1.4
5MW HCA Furnace SO2 emissions, 24/5	tons SO2/year	0.4
50MW HCA Furnace CO emissions, 24/5	tons CO/year	40.0
50MW HCA Furnace CO2 emissions, 24/5	tons CO2/year	13.7
50MW HCA Furnace SO2 emissions, 24/5	tons SO2/year	4.1
5MW HCA Furnace dust emissions, 24/5	tons dust/year	1.6
50MW HCA Furnace dust emissions, 24/5	tons dust/year	16.3

Scaled Emissions +

56.1538 tons/year of CO based on Client table

5.7558 tons/year of SO2 based on Client table

22.8827 tons/year of PM based on Client table

+Scaled up to 8760 hours from 24 hours a day/5 days a week/52 weeks per year

Cathode 1 Without Control

Emissions Factors AP-42, Section 6.1,
Fugitive PM (unitless)
0.1

Emissions Factors from AP-42, Section 1.4, Table 1.4-1 for Natural Gas					
lb/Mmbtu					
VOC	PM	CO	Nox	SO2	Lead
0.0054	0.00745	0.0824	0.0980	0.000588235	4.90196E-07

Emissions Factor from AP-42, Section 13.4, Table 13.4-1 for Wet
lb/103 gal
PM
0.019

Cathode 1 Emissions for 50 MW without Control

Materials and Equipment Cathode 1	Emissions Unit ID	Throughput (kg/hr)	Rating (mmBTU)	Hours*	PM	VOC	CO	Nox	SO2	Lead	Calculation Methodology
					lb/yr	lb/yr	lb/yr	lb/yr	lb/yr	lb/yr	
Lubricant		212.000	N/A	8760	N/A	143361.8137	N/A	N/A	N/A	N/A	Calculations based on estimated throughputs from client information which were based on pilot plant production and scaled up to 50MW production. Multiplying the throughput by hours by lubricant density, yielded gallons of lubricant. Then 7.4 lbs/gal rate of vaporization for n-butyl acetate multiplied by the gallons of lubricant and multiplied by the ratio 0.03 evaporation rate of the lubricant from SDS, vs n-butyl acetate, yielded lbs of lubricant evaporated/year.
Carbon Black		62.5	N/A	8760	1207.0	N/A	N/A	N/A	N/A	N/A	Calculations based on estimated throughputs from client information which were based on pilot plant production and scaled up to 50MW production. Throughputs were converted to pounds from kg using 2.2046lb/kg. Then throughputs were multiplied by hours run and the assumption that ~0.1% of dust is lost in equipment.
Binder 1		25	N/A	8760	482.8	N/A	N/A	N/A	N/A	N/A	Calculations based on estimated throughputs from client information which were based on pilot plant production and scaled up to 50MW production. Throughputs were converted to pounds from kg using 2.2046lb/kg. Then throughputs were multiplied by hours run and the assumption that ~0.1% of dust is lost in equipment. Particulate matter calculations are also multiplied by 10% to account for the 90% efficiency of the dust collector.
Binder 2		25	N/A	8760	482.8	N/A	N/A	N/A	N/A	N/A	Calculations based on estimated throughputs from client information which were based on pilot plant production and scaled up to 50MW production. Throughputs were converted to pounds from kg using 2.2046lb/kg. Then throughputs were multiplied by hours run and the assumption that ~0.1% of dust is lost in equipment.

Oxidizer Burner	2S-2	N/A	8.000	8760	522.165	377.882	5771.294	6870.588	41.224	0.034	Calculations made by multiplying emissions factors from AP-42, Section 1.4, Table 1.4-1 with the equipment rating, from client-provided information, and hours run.
				Total (tons/year)	1.347	71.870	2.886	3.435	0.021	0.00002	

*Based on 7 days/week and 24 hr/day, 52 weeks/year

Notes:

Throughput numbers and ratings are based on estimates from call with Client Cathode 1 team.

To convert from lb/106 scf to 1b/MMBtu, divide by 1,020

1 kWh = 0.003412 MMBTU

Equipment is dust sealed (~0.1% dust lost in equipment)

Cathode 2 Without Control

Emissions Factors from AP-42, Section 1.4, Table 1.4-1 for Natural Gas					
lb/Mmbtu					
VOC	PM	CO	Nox	SO2	Lead
0.0054	0.00745	0.0824	0.0980	0.000588235	4.90196E-07

Emissions Factor from AP-42, Section 13.4, Table 13.4-1 for Wet
lb/103 gal
PM
0.019

Cathode 2 Emissions for 50 MW without Control

Materials and Equipment Cathode 1	Emissions Unit ID	Throughput (kg/hr)	Rating (mmBTU)	Hours*	PM	VOC	CO	Nox	SO2	Lead	Calculation Methodology
					lb/yr	lb/yr	lb/yr	lb/yr	lb/yr	lb/yr	
Dip Mix**	3S-1	22.50	N/A	8760	N/A	48250.934	N/A	170735.703	64257.682	N/A	Methodology for the "Client provided calculations of assumed emissions" table and the resulting emissions includes benchscale testing at pilot plant. Results were scaled to a 50 MW facility based on estimated production.
Isopropyl Alcohol 99%		25.107	N/A	8760	N/A	480021.973	N/A	N/A	N/A	N/A	Calculations made by multiplying the volatility of the material from the SDS by the estimated throughput, provided by the client from benchscale testing at pilot plant.
6,000-gallon Isopropyl Alcohol Tank	3S-2	N/A	N/A	8760	N/A	42.1	N/A	N/A	N/A	N/A	Calculations made by using the client provided capacity of the tank and methodology in AP-42, Section 7.1.
Oven 1 (1 MMBtu/hr)	3S-3	N/A	1	8760	65.271	47.235	721.412	858.824	5.153	0.0043	Calculations made by multiplying emissions factors from AP-42, Section 1.4, Table 1.4-1 with the equipment rating, from client-provided information, and hours run.
Oven 2 (4 MMBtu/hr)	3S-4	N/A	4	8760	261.082	188.941	2885.647	3435.294	20.612	0.017	Calculations made by multiplying emissions factors from AP-42, Section 1.4, Table 1.4-1 with the equipment rating, from client-provided information, and hours run.
Oxidizer Burner 2	3S-5	N/A	8	8760	522.165	377.882	5771.294	6870.588	41.224	0.034	Calculations made by multiplying emissions factors from AP-42, Section 1.4, Table 1.4-1 with the equipment rating, from client-provided information, and hours run.
				Total (tons/year)	0.163	264.276	1.804	87.515	32.142	0.000011	

Notes:

Throughput numbers and ratings are based on estimates from call with Client Cathode 2 team.

To convert from lb/106 scf to 1b/MMBtu, divide by 1,020

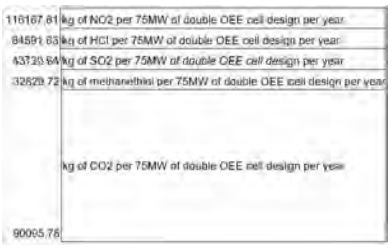
1 kWh = 0.003412 MMBTU

Production Numbers based on information from Client Cathode 2 team:

445554 kg of mix per year

235000 kg per year of IPA

****Client provided calculations of assumed emissions**



170735.7026 lb/yr of NO2 based on Client table

64257.68196 lb/yr of SO2 based on Client table

48250.93381 lb/yr of VOC based on client table

Assembly

Emissions Unit ID	4S-1

*Assembly VOC Emissions for 50 MW**

		Units
Estimated volume of busbar potting	1000	mm^3
Number of busbars per part	8	
Number of cells for 50 MW	517250	
Total volume (50MW)	4.138	m^3
Epoxy density	1100	kg/m^3
Epoxy weight	4551.8	kg
Estimated VOCs wose case	1%	
Safety factor	2	
VOCs weight	91.036	kg/year
VOCs weight	0.1003	tons/year

*Based on client provided calculations using estimated volume of potting from benchscale pilot plant operations and estimated 50MW production.

Note: Assumed the potting is occurring and welding is not occurring yet.

Central Energy Plant

Emissions Factors from AP-42, Section 1.4, Table 1.4-1 for Natural Gas					
lb/Mmbtu					
VOC	PM	CO	Nox	SO2	Lead
0.00539	0.00745	0.08235	0.09804	0.00059	4.90E-07

Emissions Factor from AP-42, Section 13.4, Table 13.4-1 for Wet
lb/103 gal
PM
0.019

Emissions Factors from AP-42, Section 3.3, Table 3.3-1 for Diesel					
kg/kw-hr					
VOC	PM	CO	Nox	SO2	HAPs
0.00153	0.00134	0.00406	0.01885	0.00125	1.6E-05

Central Energy Plant Emissions for 50 MW

Equipment	Emissions Unit ID	Throughput (GPM)	Rating		Hours*	PM	VOC	CO	Nox	SO2	Lead	HAPs	Calculation Methodology
			MMBtu	kW		lb/yr	lb/yr	lb/yr	lb/yr	lb/yr	lb/yr	lb/yr	
Open Cooling Towers 1 and 2	5S-1, 5S-2	4,100	N/A	N/A	8760	81888.48	N/A	N/A	N/A	N/A	N/A	N/A	Calculations made by multiplying emissions factors from AP-42, Section 13.4, Table 13.4-1 with the equipment rating, from client-provided information, and hours run.
Chiller Cooling Towers Closed Circuit 1 and 2	5S-3, 5S-4	1,800	N/A	N/A	8760	35951.04	N/A	N/A	N/A	N/A	N/A	N/A	Calculations made by multiplying emissions factors from AP-42, Section 13.4, Table 13.4-1 with the equipment rating, from client-provided information, and hours run.
Boilers 1-3 (6MMBtu/hr each)	5S- 5 TO 7	N/A	18	N/A	8760	1174.871	850.235	12985.412	15458.824	92.753	7.73E-02	N/A	Calculations made by multiplying emissions factors from AP-42, Section 1.4, Table 1.4-1 with the equipment rating, from client-provided information, and hours run.
Emergency Diesel Generator (1500kW)	5S-1	N/A	N/A	1500	100	442.33	504.66	1343.08	6232.85	412.17	N/A	5.36	Calculations made by multiplying emissions factors from AP-42, Section 3.3, Table 3.3-1 with the equipment rating, from client-provided information, and the emergency generator run hours limit of 100 hours.*
					Total (tons/year)	59.728	0.677	7.164	10.846	0.252	0.0000386	0.00268	

*Based on 7 days/week and 24 hr/day, 52 weeks/year

Notes:
Throughput numbers and ratings are based on estimates from call with Client team.

Confidential

Emission Unit #:	3S-2	
	IPA Bulk Storage	
Description:	Tank	
Capacity:	6,000	gallons
Actual Throughput:	79,125	gallons

Standing Loss Calculations

Ls=365*VV*WV*KE (AP-42, Chap 7.1, eq. 1-2)

Vapor Space Volume Vv			
Tank Size	6,000	gallons	
Tank Size	401	ft3	
Tank Diameter	8	ft	assumed size
Tank Height	16	ft	
Average Fill	5,800	gallons	
VV	27	ft3	

Vapor Density Wv (at average liquid temperature)							
WV=(MV*PVA)/(R*TLA) (AP-42, 7.1, eq. 1-21)							
Average liquid temp	51	°F					
Calculate Mv & Pv							
Chemical	Wt%1	Molecular Wt1	g. Liquid Temp (TLA	Moles	Mole %	@ Avg. Liquid Temp	ar Weight of the Vapor (Mv)
Isopropyl Alcohol	100%	60.09	0.36	60.1	100%	0.36	60.09
				60.1		0.36	
Average Mv	60.09						
Average Pv	0.36						
R	10.731	psia-ft3/lbmole-°R					
TLA	51	°F =	511	°R			
Average Wv	0.0039	lb/ft3					

1 Molecular weights are taken from AP-4

2 Vapor pressues are interpolated from

Vapor Space Expansion Factor (Ke)

KE=ΔTv/TLA+((ΔPV-42, Chap 7.1, eq. 1-7)

Symbols	Description	Values	Units	
ΔTv	Daily Temperature Range	19.48	°F	ΔTv=0.72*ΔTA+0.028*α*I
TAX	Avg. Daily Maximum Temperature	61.5	°F	From AP-42 Table 7.1-7
TAN	Avg. Daily Minimum Temperature	39	°F	From AP-42 Table 7.1-7
α	Paint Solar Absorption Factor	0.1		Assume white paint/good condition (or AP-42 Table 7.1-6)
I	Daily Total Solar Insulation Factor	1173	Btu/ft2 day	From AP-42 Table 7.1-7
ΔPv	Daily Vapor Pressure Range	0.018	psia	ΔPV=(0.5*B*PVA*ΔTV)/TLA2
B Value	B Constant from Vapor Pressure Equation	1357.4		From AP-42 Table 7.1-5
TLA	Average Liquid Temperature	511	°R	TLA=0.44*TAA+0.56*TB+0.0079*α*I
TAA	Daily Average Ambient Temperature	510.25	°R	TAA=(TAX+TAN)/2
TB	Bulk Liquid Temperature	509.9	°R	TB=TAA+6*α-1
ΔPB	Vent Pressure Range (usually 0.06 psia)	0.06	psia	
PA	Atmospheric Pressure (14.7 psia)	14.7	psia	
PVA	Vapor Pressure at Average Temperature of Liquid	0.36	psia	
	KE =	0.0352		

Vented Vapor Saturation Factor (Ks)

Ks=1/(1+(0.053*Pva*Hvo)) (AP-42, Chap 7.1, eq. 1-20)

Symbol	Description	Values	Units
Pva	Vapor pressure at average liquid temperature	0.36	psia
Hvo	vapor space outage	0.5	ft
	Ks =	0.9911	

Standing Loss (Ls	**1.34**	**lbs/year**

Working Loss Calculations

Lw=0.001*Mv*Pva*KN*Kp (AP-42, Chap 7.1, eq. 1-29)

Symbol	Desription	Value	Units
Mv	Vapor molecular weight	60.09	lb/lb-mole
Pva	Vapor pressure at average liquid temperature	0.36	psia
KN	Turnover factor	1	
Kp	working loss product factor (0.75 for crude, 1 for all others)	1	
Working Loss (Lw	**40.75**	**lbs/year**	

Total Emissions (L	**42.1**	**lbs/yr**

Attachment N:
Supporting Emissions Calculations
With Controls

Facility Wide Emissions With Control

Facility Emissions Breakdown with 25% Contingency

Emissions Unit	ID	PM		VOCs		CO		Nox		SO2		Lead		HAPs	
		lb/hr with 25% contingency	tons/year with 25% contingency	lb/hr with 25% contingency	tons/year with 25% contingency	lb/hr with 25% contingency	tons/year with 25% contingency	lb/hr with 25% contingency	tons/year with 25% contingency	lb/hr with 25% contingency	tons/year with 25% contingency	lb/hr with 25% contingency	tons/year with 25% contingency	lb/hr with 25% contingency	tons/year with 25% contingency
Anode Process Materials	1S-1	0.65304487	2.86033654	7.77243590	34.04326923	16.02564103	70.19230769	N/A	N/A	1.64262821	7.19471154	N/A	N/A	N/A	N/A
Furnace 1	1S-2	0.00045945	0.00201238	0.00033249	0.00145633	0.00507810	0.02224208	0.00604536	0.02647867	0.00003627	0.00015887	0.0000000302	0.000000132	N/A	N/A
Furnace 2	1S-3	0.00045945	0.00201238	0.00033249	0.00145633	0.00507810	0.02224208	0.00604536	0.02647867	0.00003627	0.00015887	0.0000000302	0.000000132	N/A	N/A
Furnace 3	1S-4	0.00045945	0.00201238	0.00033249	0.00145633	0.00507810	0.02224208	0.00604536	0.02647867	0.00003627	0.00015887	0.0000000302	0.000000132	N/A	N/A
Furnace 4	1S-5	0.00045945	0.00201238	0.00033249	0.00145633	0.00507810	0.02224208	0.00604536	0.02647867	0.00003627	0.00015887	0.0000000302	0.000000132	N/A	N/A
Furnace 5	1S-6	0.00045945	0.00201238	0.00033249	0.00145633	0.00507810	0.02224208	0.00604536	0.02647867	0.00003627	0.00015887	0.0000000302	0.000000132	N/A	N/A
Furnace 6	1S-7	0.00045945	0.00201238	0.00033249	0.00145633	0.00507810	0.02224208	0.00604536	0.02647867	0.00003627	0.00015887	0.0000000302	0.000000132	N/A	N/A
Furnace 7	1S-8	0.00045945	0.00201238	0.00033249	0.00145633	0.00507810	0.02224208	0.00604536	0.02647867	0.00003627	0.00015887	0.0000000302	0.000000132	N/A	N/A
Furnace 8	1S-9	0.00045945	0.00201238	0.00033249	0.00145633	0.00507810	0.02224208	0.00604536	0.02647867	0.00003627	0.00015887	0.0000000302	0.000000132	N/A	N/A
Furnace 9	1S-10	0.00045945	0.00201238	0.00033249	0.00145633	0.00507810	0.02224208	0.00604536	0.02647867	0.00003627	0.00015887	0.0000000302	0.000000132	N/A	N/A
Furnace 10	1S-11	0.00045945	0.00201238	0.00033249	0.00145633	0.00507810	0.02224208	0.00604536	0.02647867	0.00003627	0.00015887	0.0000000302	0.000000132	N/A	N/A
Cathode 1 Process Materials	2S-1	0.03100247	0.13579081	1.02284399	4.48005668	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Oxidizer Burner 1	2S-2	0.07450980	0.32635294	0.00269608	0.01180882	0.82352941	3.60705882	0.98039216	4.29411765	0.00588235	0.02576471	0.00000490	0.00002147	N/A	N/A
Cathode 2 Process Materials	3S-1	N/A	N/A	3.76907039	16.50852833	N/A	N/A	1.21814856	5.33549071	0.45845949	2.00805256	N/A	N/A	N/A	N/A
IPA Tank	3S-2	N/A	N/A	0.00600742	0.02631250	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Oven 1	3S-3	0.00931373	0.04079412	0.00674020	0.02952206	0.10294118	0.45088235	0.12254902	0.53676471	0.00073529	0.00322059	0.00000061	0.00000268	N/A	N/A
Oven 2	3S-4	0.03725490	0.16317647	0.02696078	0.11808824	0.41176471	1.80352941	0.49019608	2.14705882	0.00294118	0.01288235	0.00000245	0.00001074	N/A	N/A
Oxidizer Burner 2	3S-5	0.07450980	0.32635294	0.00269608	0.01180882	0.82352941	3.60705882	0.98039216	4.29411765	0.00588235	0.02576471	0.00000490	0.00002147	N/A	N/A
Assembly Process Materials	4S-1	N/A	N/A	0.02863867	0.12543737	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chiller Cooling Tower 1	5S-1	5.84250000	25.59015000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chiller Cooling Tower 2	5S-2	5.84250000	25.59015000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Process Cooling Tower 1	5S-3	2.56500000	11.23470000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Process Cooling Tower 2	5S-4	2.56500000	11.23470000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Boiler 1	5S-5	0.05588235	0.24476471	0.04044118	0.17713235	0.61764706	2.70529412	0.73529412	3.22058824	0.00441176	0.01932353	0.00000368	0.00001610	N/A	N/A
Boiler 2	5S-6	0.05588235	0.24476471	0.04044118	0.17713235	0.61764706	2.70529412	0.73529412	3.22058824	0.00441176	0.01932353	0.00000368	0.00001610	N/A	N/A
Boiler 3	5S-7	0.05588235	0.24476471	0.04044118	0.17713235	0.61764706	2.70529412	0.73529412	3.22058824	0.00441176	0.01932353	0.00000368	0.00001610	N/A	N/A
Emergency Generator	5S-8	0.06311800	0.27645684	0.07201190	0.31541212	0.19164920	0.83942350	0.88939000	3.89552820	0.05881450	0.25760751	N/A	N/A	0.00076448	0.00334840

Facility Emissions Totals for 50 MW with 25% Contingency

	PM	VOCs	CO	Nox	SO2	Lead	HAPs
	tons/year	tons/year	tons/year	tons/year	tons/year	tons/year	tons/year
Anode	2.880	34.058	70.415	0.265	7.196	0.00000132	0
Cathode 1	0.462	4.492	3.607	4.294	0.026	0.00002147	0
Cathode 2	0.204	16.682	2.254	8.019	2.024	0.00001342	0
Assembly	0	0.125	0	0	0	0	0
CEP	74.660	0.847	8.955	13.557	0.316	0.000048	0.003
Totals	**78.207**	**56.204**	**85.232**	**26.136**	**9.562**	**0.00008**	**0.003**

Facility Emissions Calculated Totals for 5 MW with 25% Contingency

	PM	VOCs	CO	Nox	SO2	Lead	HAPs
	tons/year	tons/year	tons/year	tons/year	tons/year	tons/year	tons/year
Totals	**7.821**	**5.620**	**8.523**	**2.614**	**0.9562**	**0.000008**	**0.0003**

Combined 5MW and 50MW Facility Totals with 25% Contingency	**86.028**	**61.825**	**93.755**	**28.749**	**10.518**	**0.00009**	**0.004**

Anode With Control

Emissions Factors from AP-42, Section 1.4, Table 1.4-1 for Natural Gas					
lb/Mmbtu					
VOC	PM	CO	Nox	SO2	Lead
0.0054	0.00745	0.0824	0.0980	0.000588235	4.90196E-07

Anode Emissions for 50 MW with Control

Materials and Equipment Electrode	Emissions Unit ID	Throughput (kg/hr)	Rating (MMBTU/hr)	Hours*	PM	VOCs	CO	Nox	SO2	Lead	Calculation Methodology
					lb/yr	lb/yr	lb/yr	lb/yr	lb/yr	lb/yr	
Main Powder	1S-1	2375	N/A	8760	See "SO2 and CO Table from Client" below***	See "VOC Table from Client" below***	See "SO2 and CO Table from Client" below***	N/A	See "SO2 and CO Table from Client" below****	N/A	Methodology for "SO2 and CO Table from Client" includes benchscale testing at pilot plant. Results were scaled up to 50 MW facility based on estimated production. Methodology for "VOC Table from Client" based on estimated production at 50 MW facility and volatile percentages of known materials. Particulate matter calculations are also multiplied by 10% to account for the 90% efficiency of the dust collector.
Powder Additive		125	N/A	8760	See "SO2 and CO Table from Client" below***	See "VOC Table from Client" below***	See "SO2 and CO Table from Client" below***	N/A	See "SO2 and CO Table from Client" below****	N/A	Methodology for "SO2 and CO Table from Client" includes benchscale testing at pilot plant. Results were scaled up to 50 MW facility based on estimated production. Methodology for "VOC Table from Client" based on estimated production at 50 MW facility and volatile percentages of known materials. Particulate matter calculations are also multiplied by 10% to account for the 90% efficiency of the dust collector.
Oil Additive			N/A	8760	N/A	See "VOC Table from Client" below***	See "SO2 and CO Table from Client" below***	N/A	See "SO2 and CO Table from Client" below****	N/A	Methodology for "SO2 and CO Table from Client" includes benchscale testing at pilot plant. Results were scaled up to 50 MW facility based on estimated production. Methodology for "VOC Table from Client" based on estimated production at 50 MW facility and volatile percentages of known materials.
Nitrogen			N/A	8760	N/A	See "VOC Table from Client" below***	See "SO2 and CO Table from Client" below***	N/A	See "SO2 and CO Table from Client" below****	N/A	Methodology for "SO2 and CO Table from Client" includes benchscale testing at pilot plant. Results were scaled up to 50 MW facility based on estimated production. Methodology for "VOC Table from Client" based on estimated production at 50 MW facility and volatile percentages of known materials.
Furnace 1-10	1S-2 to 1S-11	N/A	0.493	8760	32.1981	23.3012	355.8733	423.6587	2.5420	0.0021	Calculations made by multiplying emissions factors from AP-42, Section 1.4, Table 1.4-1 with the equipment rating, from client-provided information, and hours run.
				Totals (tons/yr)	2.304	27.2463	56.33178	0.2118	5.7570	0.0000011	

*Based on 7 days/week and 24 hr/day, 52 weeks/year

Notes:

Throughput numbers and ratings are based on estimates from call with Client Anode team.

Equipment is dust sealed (~0.1% dust lost in equipment)

Local dust collection via cartridge collector is used for powder handling emission reduction - assumed 95% efficiency

***VOC Table from Client

Calculated Emissions Estimates

Last updated 2023-01-06 by Mike Gibson (just formatting and parameter imports)

Line Item	Units	Value
Oil Emission material behavior		
Char/non-volatiles percentage	%	10%
Assumed percent of volatiles classified as VOC's	%	95%
Total yield of VOC's from oil	%	86%
Pore former material behavior (This is excluded from the first round of analysis)		
Char/non-volatiles percentage	%	5%
Assumed percent of volatiles classified as VOC's	%	5%
Total yield of VOC's from pore formers	%	4.75%
Mass of an oil film per electrode and emitted VOC's per electrode		
Oil film thickness	mm	0.010
Percent open area of the pan	%	50%
Surface area of expanded mesh per lateral area	m2 (SA)/ per m2 (sha	1.00
Lateral area of pan	meters^2	0.265
Lateral area of pan covered by oil film	meters^2	0.265
Area of a mesh covered in oil films	m^2	0.27
Area of a non-mesh back covered in oil films	m^2	0.53
Number of meshes per pan	Number/pan	2
Number of non-mesh backs per pan	Number/pan	0
Total area of subassembly covered by oil film	m^2/electrode	0.53
Total volume of oil film per pan	m^3 oil per pan	0.0000053
Total volume of oil film per pan	mL	5.3
Density of oil	kg/m3	900
Mass of oil per electrode	kg oil/electrode	0.005
Mass of oil per electrode	grams oil/electrode	4.7700
Mass of VOC emitted per electrode	**kg VOC emitted/elec**	**0.0041**
Conversion to emissions/year - Oil film contribution		
Anodes per shift (total)	anodes/shift	6066.51848
Anodes per hour	anodes/hour	758.3
Working days per month	days/month	21.7261905
Anodes per month/shift	anodes/shift/month	131802
kg VOC per month/shift	kg VOC/shift/month	538
kg VOC per year/shift	kg VOC/year/shift	6450
3-shift yearly VOC emissions, 24/5	**tons VOC/year**	**19.4**
3-shift yearly VOC emissions, 24/7	**tons VOC/year**	**27.1**

5MW HCA Furnace VOC emissions, 24/5	**tons VOC/year**	**1.9**
50MW HCA Furnace VOC emissions, 24/5	**tons VOC/year**	**19.4**

Scaled Emissions +

27.23462 tons/year of VOC based on Client table

+Scaled up to 8760 hours from

****SO2 and CO Table from Client

5MW HCA Furnace CO emissions, 24/5	**tons CO/year**	4.0
5MW HCA Furnace CO2 emissions, 24/5	**tons CO2/year**	1.4
5MW HCA Furnace SO2 emissions, 24/5	**tons SO2/year**	0.4
50MW HCA Furnace CO emissions, 24/5	**tons CO/year**	40.0
50MW HCA Furnace CO2 emissions, 24/5	**tons CO2/year**	13.7
50MW HCA Furnace SO2 emissions, 24/5	**tons SO2/year**	4.1
5MW HCA Furnace dust emissions, 24/5	**tons dust/year**	1.6
50MW HCA Furnace dust emissions, 24/5	**tons dust/year**	16.3

Scaled Emissions +

56.1538 tons/year of CO based on Client table

5.7558 tons/year of SO2 based on Client table

22.8827 tons/year of PM based on Client table

+Scaled up to 8760 hours from 24 hours a day/5 days a week/52 weeks per year

Cathode 1 With Control

Emissions Factors AP-42, Section 6.1,
Fugitive PM (unitless)
0.1

Emissions Factors from AP-42, Section 1.4, Table 1.4-1 for Natural Gas					
lb/Mmbtu					
VOC	PM	CO	Nox	SO2	Lead
0.0054	0.00745	0.0824	0.0980	0.000588235	4.90196E-07

Emissions Factor from AP-42, Section 13.4, Table 13.4-1 for Wet
lb/103 gal
PM
0.019

Cathode 1 Emissions for 50 MW with Control

Materials and Equipment Cathode 1	Emissions Unit ID	Throughput (kg/hr)	Rating (mmBTU)	Hours*	PM	VOC	CO	Nox	SO2	Lead	Calculation Methodology
					lb/yr	lb/yr	lb/yr	lb/yr	lb/yr	lb/yr	
Lubricant		212.000	N/A	8760	N/A	7168.090686	N/A	N/A	N/A	N/A	Calculations based on estimated throughputs from client information which were based on pilot plant production and scaled up to 50MW production. Multiplying the throughput by hours by lubricant density, yielded gallons of lubricant. Then 7.4 lbs/gal rate of vaporization for n-butyl acetate multiplied by the gallons of lubricant and multiplied by the ratio 0.03 evaporation rate of the lubricant from SDS, vs n-butyl acetate, yielded lbs of lubricant evaporated/year. VOC calculations are also multiplied by 5% to account for the 95% efficiency of the RTO.
Carbon Black		62.5	N/A	8760	120.7	N/A	N/A	N/A	N/A	N/A	Calculations based on estimated throughputs from client information which were based on pilot plant production and scaled up to 50MW production. Throughputs were converted to pounds from kg using 2.2046lb/kg. Then throughputs were multiplied by hours run and the assumption that ~0.1% of dust is lost in equipment. Particulate matter calculations are also multiplied by 10% to account for the 90% efficiency of the dust collector.
Binder 1		25	N/A	8760	48.3	N/A	N/A	N/A	N/A	N/A	Calculations based on estimated throughputs from client information which were based on pilot plant production and scaled up to 50MW production. Throughputs were converted to pounds from kg using 2.2046lb/kg. Then throughputs were multiplied by hours run and the assumption that ~0.1% of dust is lost in equipment. Particulate matter calculations are also multiplied by 10% to account for the 90% efficiency of the dust collector.

Binder 2		25	N/A	8760	48.3	N/A	N/A	N/A	N/A	N/A	Calculations based on estimated throughputs from client information which were based on pilot plant production and scaled up to 50MW production. Throughputs were converted to pounds from kg using 2.2046lb/kg. Then throughputs were multiplied by hours run and the assumption that ~0.1% of dust is lost in equipment. Particulate matter calculations are also multiplied by 10% to account for the 90% efficiency of the dust collector.
Oxidizer Burner 1	2S-2	N/A	8.000	8760	522.165	18.894	5771.294	6870.588	41.224	0.034	Calculations made by multiplying emissions factors from AP-42, Section 1.4, Table 1.4-1 with the equipment rating, from client-provided information, and hours run. VOC calculations are also multiplied by 5% to account for the 95% efficiency of the RTO.
				Total (tons/year)	0.370	3.593	2.886	3.435	0.021	0.00002	

*Based on 7 days/week and 24 hr/day, 52 weeks/year

Notes:

Throughput numbers and ratings are based on estimates from call with Client Cathode 1 team.

To convert from lb/106 scf to 1b/MMBtu, divide by 1,020

1 kWh = 0.003412 MMBTU

Local dust collection via cartridge collector is used for powder handling emission reduction - assumed 95% efficiency

Equipment is dust sealed (~0.1% dust lost in equipment)

Lubricant VOC is assumed to be destroyed at 95% with RTO per manufacturer guarantee

Cathode 2 With Control

Emissions Factors from AP-42, Section 1.4, Table 1.4-1 for Natural Gas					
lb/Mmbtu					
VOC	PM	CO	Nox	SO2	Lead
0.0054	0.00745	0.0824	0.0980	0.000588235	4.90196E-07

Emissions Factor from AP-42, Section 13.4, Table 13.4-1 for Wet
lb/103 gal
PM
0.019

Cathode 2 Emissions for 50 MW with Control

Materials and Equipment Cathode 1	Emissions Unit ID	Throughput (kg/hr)	Rating (mmBTU)	Hours*	PM lb/yr	VOC lb/yr	CO lb/yr	Nox lb/yr	SO2 lb/yr	Lead lb/yr	Calculation Methodology
Dip Mix**	3S-1	22.50	N/A	8760	N/A	2412.547	N/A	8536.785	3212.884	N/A	Methodology for the "Client provided calculations of assumed emissions" table and the resulting emissions includes benchscale testing at pilot plant. Results were scaled to a 50 MW facility based on estimated production. VOC calculations are also multiplied by 5% to account for the 95% efficiency of the RTO.
Isopropyl Alcohol 99%		25.107	N/A	8760	N/A	24001.099	N/A	N/A	N/A	N/A	Calculations made by multiplying the volatility of the material from the SDS by the estimated throughput, provided by the client from benchscale testing at pilot plant. VOC calculations are also multiplied by 5% to account for the 95% efficiency of the RTO.
6,000-gallon Isopropyl Alcohol Tank	3S-2	N/A	N/A	8760	N/A	42.1	N/A	N/A	N/A	N/A	Calculations made by using the client provided capacity of the tank and methodology in AP-42, Section 7.1.
Oven 1 (1 MMBtu/hr)	3S-3	N/A	1	8760	65.271	47.235	721.412	858.824	5.153	0.0043	Calculations made by multiplying emissions factors from AP-42, Section 1.4, Table 1.4-1 with the equipment rating, from client-provided information, and hours run.
Oven 2 (4 MMBtu/hr)	3S-4	N/A	4	8760	261.082	188.941	2885.647	3435.294	20.612	0.017	Calculations made by multiplying emissions factors from AP-42, Section 1.4, Table 1.4-1 with the equipment rating, from client-provided information, and hours run.

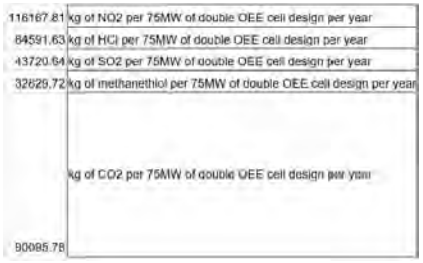
Oxidizer Burner 2	3S-5	N/A	8	8760	522.165	18.894	5771.294	6870.588	41.224	0.034	Calculations made by multiplying emissions factors from AP-42, Section 1.4, Table 1.4-1 with the equipment rating, from client-provided information, and hours run. VOC calculations are also multiplied by 5% to account for the 95% efficiency of the RTO.
				Total (tons/year)	0.163	13.346	1.804	6.415	1.619	0.000011	

Notes:

Throughput numbers and ratings are based on estimates from call with Client Cathode 2 team.
To convert from lb/106 scf to 1b/MMBtu, divide by 1,020
1 kWh = 0.003412 MMBTU
Assumed 95% efficient Recuperative Thermal Oxidizer (RTO) used to reduce VOC emissions
Production Numbers based on information from Client Cathode 2 team:

445554	kg of mix per year
235000	kg per year of IPA

****Client provided calculations of assumed emissions**



170735.7026 lb/yr of NO2 based on Client table

64257.68196 lb/yr of SO2 based on Client table
48250.93381 lb/yr of VOC based on client table

Assembly

Emissions Unit ID	4S-1

*Assembly VOC Emissions for 50 MW**

		Units
Estimated volume of busbar potting	1000	mm^3
Number of busbars per part	8	
Number of cells for 50 MW	517250	
Total volume (50MW)	4.138	m^3
Epoxy density	1100	kg/m^3
Epoxy weight	4551.8	kg
Estimated VOCs wose case	1%	
Safety factor	2	
VOCs weight	91.036	kg/year
VOCs weight	0.1003	tons/year

*Based on client provided calculations using estimated volume of potting from benchscale pilot plant operations and estimated 50MW production.

Note: Assumed the potting is occurring and welding is not occurring yet.

Central Energy Plant

Emissions Factors from AP-42, Section 1.4, Table 1.4-1 for Natural Gas					
lb/Mmbtu					
VOC	PM	CO	Nox	SO2	Lead
0.00539	0.00745	0.08235	0.09804	0.00059	4.90E-07

Emissions Factor from AP-42, Section 13.4, Table 13.4-1 for Wet
lb/103 gal
PM
0.019

Emissions Factors from AP-42, Section 3.3, Table 3.3-1 for Diesel					
kg/kw-hr					
VOC	PM	CO	Nox	SO2	HAPs
0.00153	0.00134	0.00406	0.01885	0.00125	1.6E-05

Central Energy Plant Emissions for 50 MW with Control

Equipment	Emissions Unit ID	Throughput (GPM)	Rating		Hours*	PM	VOC	CO	Nox	SO2	Lead	HAPs	Calculation Methodology
			MMBtu	kW		lb/yr	lb/yr	lb/yr	lb/yr	lb/yr	lb/yr	lb/yr	
Open Cooling Towers 1 and 2	5S-1, 5S-2	4,100	N/A	N/A	8760	81888.48	N/A	N/A	N/A	N/A	N/A	N/A	Calculations made by multiplying emissions factors from AP-42, Section 13.4, Table 13.4-1 with the equipment rating, from client-provided information, and hours run.
Chiller Cooling Towers Closed Circuit 1 and 2	5S-3, 5S-4	1,800	N/A	N/A	8760	35951.04	N/A	N/A	N/A	N/A	N/A	N/A	Calculations made by multiplying emissions factors from AP-42, Section 13.4, Table 13.4-1 with the equipment rating, from client-provided information, and hours run.
Boilers 1-3 (6MMBtu/hr each)	5S- 5 TO 7	N/A	18	N/A	8760	1174.871	850.235	12985.412	15458.824	92.753	7.73E-02	N/A	Calculations made by multiplying emissions factors from AP-42, Section 1.4, Table 1.4-1 with the equipment rating, from client-provided information, and hours run.
Emergency Diesel Generator (1500kW)	5S-1	N/A	N/A	1500	100	442.33	504.66	1343.08	6232.85	412.17	N/A	5.36	Calculations made by multiplying emissions factors from AP-42, Section 3.3, Table 3.3-1 with the equipment rating, from client-provided information, and the emergency generator run hours limit of 100 hours.*
					Total (tons/year)	59.7283608	0.6774473	7.1642447	10.8458343	0.2524625	0.0000386	0.0026787	

*Based on 7 days/week and 24 hr/day, 52 weeks/year

Notes:
Throughput numbers and ratings are based on estimates from call with Client team.

Confidential

Emission Unit #:	3S-2	
	IPA Bulk Storage	
Description:	Tank	
Capacity:	6,000	gallons
Actual Throughput:	79,125	gallons

Standing Loss Calculations

Ls=365*VV*WV*KE (AP-42, Chap 7.1, eq. 1-2)

Vapor Space Volume Vv			
Tank Size	6,000	gallons	
Tank Size	401	ft3	
Tank Diameter	8	ft	assumed size
Tank Height	16	ft	
Average Fill	5,800	gallons	
VV	27	ft3	

Vapor Density Wv (at average liquid temperature)							
WV=(MV*PVA)/(R*TLA) (AP-42, 7.1, eq. 1-21)							
Average liquid temp	51	°F					
Calculate Mv & Pv							
Chemical	Wt%1	Molecular Wt1	g. Liquid Temp (TLA	Moles	Mole %	@ Avg. Liquid Temp	ar Weight of the Vapor (Mv)
Isopropyl Alcohol	100%	60.09	0.36	60.1	100%	0.36	60.09
				60.1		0.36	
Average Mv	60.09						
Average Pv	0.36						
R	10.731	psia-ft3/lbmole-°R					
TLA	51	°F =	511	°R			
Average Wv	0.0039	lb/ft3					

1 Molecular weights are taken from AP-4

2 Vapor pressues are interpolated from

Vapor Space Expansion Factor (Ke)

KE=ΔTv/TLA+((ΔPV-42, Chap 7.1, eq. 1-7)

Symbols	Description	Values	Units	
ΔTv	Daily Temperature Range	19.48	°F	ΔTv=0.72*ΔTA+0.028*α*I
TAX	Avg. Daily Maximum Temperature	61.5	°F	From AP-42 Table 7.1-7
TAN	Avg. Daily Minimum Temperature	39	°F	From AP-42 Table 7.1-7
α	Paint Solar Absorption Factor	0.1		Assume white paint/good condition (or AP-42 Table 7.1-6)
I	Daily Total Solar Insulation Factor	1173	Btu/ft2 day	From AP-42 Table 7.1-7
ΔPv	Daily Vapor Pressure Range	0.018	psia	ΔPV=(0.5*B*PVA*ΔTV)/TLA2
B Value	B Constant from Vapor Pressure Equation	1357.4		From AP-42 Table 7.1-5
TLA	Average Liquid Temperature	511	°R	TLA=0.44*TAA+0.56*TB+0.0079*α*I
TAA	Daily Average Ambient Temperature	510.25	°R	TAA=(TAX+TAN)/2
TB	Bulk Liquid Temperature	509.9	°R	TB=TAA+6*α-1
ΔPB	Vent Pressure Range (usually 0.06 psia)	0.06	psia	
PA	Atmospheric Pressure (14.7 psia)	14.7	psia	
PVA	Vapor Pressure at Average Temperature of Liquid	0.36	psia	
	KE =	0.0352		

Vented Vapor Saturation Factor (Ks)

Ks=1/(1+(0.053*Pva*Hvo)) (AP-42, Chap 7.1, eq. 1-20)

Symbol	Description	Values	Units
Pva	Vapor pressure at average liquid temperature	0.36	psia
Hvo	vapor space outage	0.5	ft
	Ks =	0.9911	

Standing Loss (Ls	**1.34**	**lbs/year**

Working Loss Calculations

Lw=0.001*Mv*Pva*KN*Kp (AP-42, Chap 7.1, eq. 1-29)

Symbol	Desription	Value	Units
Mv	Vapor molecular weight	60.09	lb/lb-mole
Pva	Vapor pressure at average liquid temperature	0.36	psia
KN	Turnover factor	1	
Kp	working loss product factor (0.75 for crude, 1 for all others)	1	
Working Loss (Lw	**40.75**	**lbs/year**	

Total Emissions (L	**42.1**	**lbs/yr**

Attachment O:
Monitoring/Recordkeeping/Reporting/Testing Plans

ATTACHMENT O

MONITORING/RECORDKEEPING/REPORTING/TESTING PLANS

Form Energy plans to perform stack testing at the controlled emissions points in the facility within 1 year of start-up to demonstrate compliance. Form Energy will report results to the West Virginia Department of Environmental Protection Air Quality division within 30 days of testing. Stack testing will be monitored for a full workday, at maximum production possible, at each emission point to test for SO2 – method 6, NOx – method 7E, PM – method 5, VOCs – method 204E, and CO – method 10B.

Attachment P:
Public Notice

ATTACHMENT P

AIR QUALITY PERMIT NOTICE

Notice of Application

Notice is given that Form Energy, Inc. has applied to the West Virginia Department of Environmental Protection, Division of Air Quality, for a Construction Permit for an Iron-Air Battery Manufacturing Facility located on 1725 Main Street in Weirton, in Hancock County, West Virginia 26062. The latitude and longitude coordinates are: 40.420222, 80.592611.

The applicant estimates the potential to discharge the following Regulated Air Pollutants will be: Particulate Matter (PM) of 86.028 tpy, VOCs of 61.825 tpy, CO of 93.755 tpy, NOx of 28.749 tpy, SO2 of 10.518 tpy, Hazardous Air Pollutants (HAPs) of 0.004 tpy, and Lead of 0.00009 tpy.

Startup of operation is planned to begin on or about the First day of March 2024. Written comments will be received by the West Virginia Department of Environmental Protection, Division of Air Quality, 601 57th Street, SE, Charleston, WV 25304, for at least 30 calendar days from the date of publication of this notice. Written comments will also be received via email at DEPAirQualityPermitting@WV.gov.

Any questions regarding this permit application should be directed to the DAQ at (304) 926-0499, extension 41281, during normal business hours.
Dated this the **(Day)** day of **(Month)**, 2023.

By: Form Energy, Inc.
Soufiane Halily
Vice President
1725 Main Street,
Weirton, WV 26062

Attachment Q:
Business Confidential Claims