

HI-Q ENVIRONMENTAL PRODUCTS COMPANY

Air Sampling Equipment, Systems & Accessories

TEST CERTIFICATION

Cartridge P/N:	TCGA-30
Media Type:	20 x 30 Mesh, 5% TEDA Impregnated Carbon
Media Lot #:	I-22032

The enclosed data is provided for HI-Q Environmental Products Company's analytical cartridges, Catalog Number TCGA-30, containing 5% TEDA Impregnated, 20 x 30 mesh, Carbon filter media, Lot # I-22032.

This filter media was tested in the most commonly used cartridge form by Environmental Engineering & Testing, Inc., an independent laboratory, according to the American Society for Testing of Material's retention efficiency test method ASTM-D-3803-98, Sect 12. The tests were performed at **5 individual flow rate points** (0.5, 1.0, 2.0, 3.0, & 4.0 SCFM), at both a **18-Hour** Pre-Equilibration & a **168-Hour** (7 day) Pre-Equilibration for a total of **10 tests**, with one duplicate confirmation test point at 2.0 SCFM, through 11 separate carbon cartridges manufactured from a random sampling of HI-Q's latest batch of 20 x 30 mesh TEDA impregnated carbon, LOT# I-22032. A cumulative performance curve is included with this report. Copies of each lot specific, individual test reports are available from HI-Q.

QUALITY ASSURANCE:

HI-Q Environmental Products Company manufacturers all of its cartridges under an **ISO 9001:2000 Certified** quality assurance program (see www.HI-Q.net for a copy of HI-Q's certificate). Following the procedures set forth in their Quality Assurance Program ensures repeatable performance and dimensions of each cartridge manufactured. HI-Q specifically has each individual lot of carbon and silver zeolite, from which the individual cartridges are made, randomly tested and certified by an independent testing laboratory at multiple sample flow rate points through the most common geometry of cartridges utilized in the nuclear industry. The Lot-Specific test results are included with each customer order.

SHELF LIFE:

The individually labeled cartridges are heat-sealed in airtight 6 mil polyethylene packages or sleeves. If left unopened, the shelf life of each cartridge is 10 years from the date of manufacture.

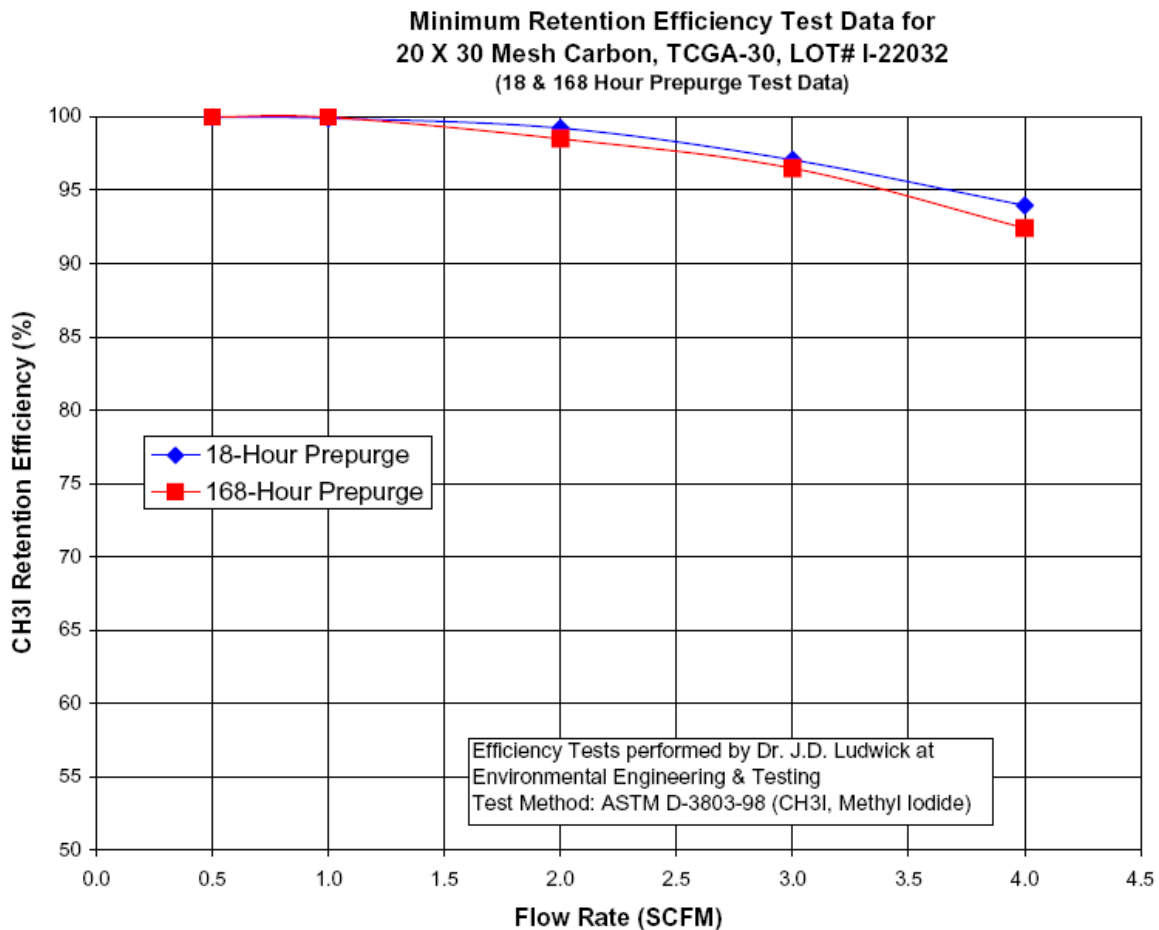
Certified by: _____

Date: _____

Important Note: The following retention efficiency results are those of the smaller TCAL-30 cartridge. Being that the TCGA-30 has twice the carbon capacity of the TCAL-30, one can assume, from historical data, that the retention efficiency results shown below can be considered a “minimum/worst-case performance curve”. Basically the TCGA-30 cartridges will produce retention efficiency results better than that of the TCAL-30 depicted below.

Minimum Performance Curve of the TCGA-30, Lot# I-22032

Flow Rate (CFM)	Methyl Iodide Retention Efficiency %	
	18-Hour Prepurge	168-Hour Prepurge
0.5	99.96	99.98
1.0	99.89	99.96
2.0	99.22, (99.28)	98.17
3.0	97.06	96.48
4.0	93.95	92.41



TCGA-30 Carbon Volume = 6.5 inches³
TCAL-30 Carbon Volume = 3.6 inches³

ENVIRONMENTAL ENGINEERING & TESTING

P. O. BOX 1012

RICHLAND, WASHINGTON 99352

CERTIFICATE OF PERFORMANCE

CARTRIDGE TYPE: **HI-Q** **TCAL-30**

BATCH NUMBER: LOT I-22032

These cartridges have been tested by Environmental Engineering & Testing, Inc. The quality control and quality assurance programs for cartridge testing meet the requirements of Appendix B of 10 CFR Part 50 and are available for inspection. Test results are summarized on the attached data sheet. This certifies that the retention efficiencies for methyl iodide at 30 C and 95% RH ASTM D-3803-89, Sect 12 for this batch meet the following minimum requirements.

Flow Rate	Minimum Retention Efficiency
0.5	99%
1.0	99%
2.0	98%
3.0	96%
4.0	92%

Pressure Drop does not exceed: 1.3" Hg

CERTIFIED: _____

J. D. LUDWICK PhD

DATE: APRIL 13, 2006

ENVIRONMENTAL ENGINEERING & TESTING

4000 BEACH LOOP
BANDON, OR 97411

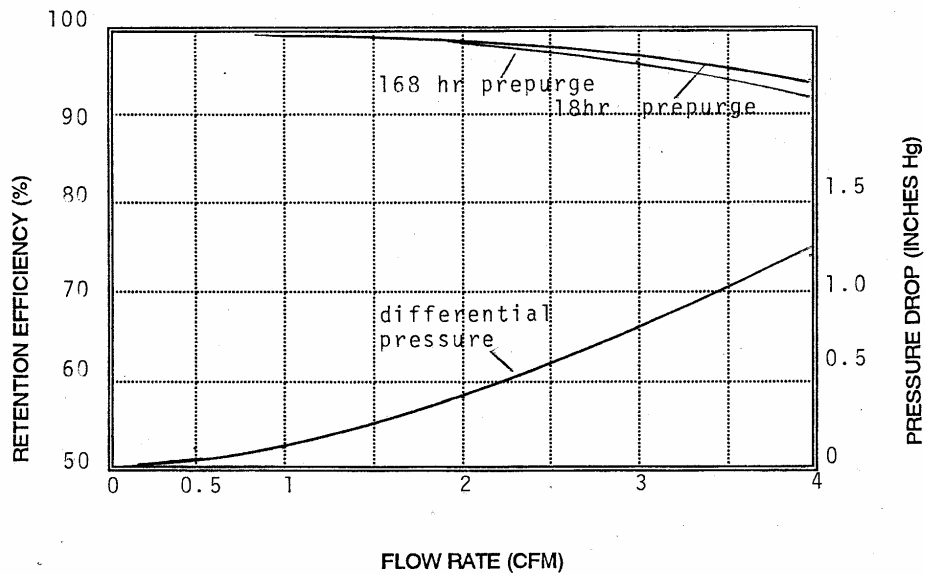
P.O. BOX 1012
RICHLAND, WA 99352

RETENTION EFFICIENCY TEST DATA

CARTRIDGE TYPE: HI-Q TCAL-30

BATCH NUMBER: LOT I-22032 DATE: APRIL 13, 2006

FLOW RATE (CFM)	METHYL IODIDE RETENTION EFF. (%)		PRESS. DROP (INCHES Hg)
	18-HOUR PREPURGE	168-HOUR PREPURGE	
0.5	99.96	99.98	0.09
1.0	99.89	99.96	0.12
2.0	99.22, 99.28	98.17	0.42
3.0	97.06	96.48	0.77
4.0	93.95	92.41	1.20



EFFICIENCY TESTING OF RADIOIODINE ANALYTICAL CARTRIDGES

INTRODUCTION

The testing of adsorbent media such as activated carbon and silver zeolite for use in analytical testing cartridges is done by using the test procedures outlined by the American Society for Testing and Materials - ASTM. This procedure uses a tagged gaseous compound called methyl iodide as to determine the collection and retention efficiencies of the filter media. This ASTM method designated as D-3803, methods A-E, 1998 utilizes a fixed volume of media, 2" bed depth and the following conditions;

The conditions for analysis for the ASTM-D-3803-1998 are briefly stated as follows:

1) Pressure:	1 Atmosphere
2) Temperature:	30°C
3) Relative Humidity:	95% RAH.
4) Pre-Equilibration (Standard Test)	18 Hours
5) Pre-Equilibration (Extra Test for HI-Q)	168 Hours (7 Days)
6) Mass concentration	CH ₃ I: 1.75mg/M ³
7) Loading period:	60 Minutes
8) Elution Period (post sweep):	60 Minutes
9) Bed Size:	2"
10) Flow Rate:	0.5 to 4.0 SCFM

Filter media can be of various mesh sizes, be impregnated with various amounts of chemical such as the chelating agent TEDA or with various amounts of silver in the silver zeolite media. This variability requires that extensive tests be conducted to define what the performance of a specific media might be under sampling conditions. The standard ASTM D3803 procedures are intended only for comparison of fixed quantities of media under constant laboratory conditions. The results can then be compared to determine such things as pass or fail for established minimum adsorption efficiencies.

ADDITIONAL TESTING

While the ASTM D-3803 method A is a good comparative indicator of collection efficiency, additional tests are conducted by HI-Q that give indications of what one might expect to achieve in actual field test conditions.

Environmental air sampling is never conducted under the same conditions as those used in a laboratory. This is due to the fact that one cannot control most environmental conditions. Media holding cartridges are of variable sizes, volumes and thicknesses than that of the test container used in the ASTM benchmark analysis. In actual use of the analytical cartridges, there is no set pre-humidification for 18 hours, no fixed loading concentration or duration, no control of temperature, and most importantly, collection at a varied flow rate dependent on the scientists requirements.

In an effort to provide its' customers with realistic and usable data and estimates that can predict potential collection efficiencies at sampling conditions found in the field, HI-Q has instigated testing of its' cartridges beyond the ASTM D-3803 method A test point. These tests are conducted on the media under conditions that more closely approximated general sampling procedures. HI-Q has each batch of its TEDA impregnated carbon and silver impregnated zeolite tested in actual cartridge configuration, at individual flow rates of 0.5, 1.0, 2.0, 3.0 & 4.0 SCFM at both an 18 and 168 Hour Pre-Equilibration, for a total of 10 tests, through 10 individual, randomly chosen, cartridges, by an approved outside consulting laboratory for retention efficiencies of methyl iodide using the ASTM method A, 1998 procedure. Each lot is provided with a collection efficiency certification showing the two individual retention efficiency curves of flow rate (0.5 to 4.0 SCFM) vs. collection efficiency for both 18 hour and 168 hour (7-day) pre-equilibration. Additionally, HI-Q has the testing laboratory randomly duplicate a single test point (11th test) to confirm consistency of performance.

One other major aspect of sampling that HI-Q finds necessary for consideration, is that methyl iodide is used as the test gas because it is volatile at ambient temperatures and is the smallest molecule with the poorest collection efficiency. Results then are close to a worst case scenario. Every other specie of iodine including molecular sublimed iodine has a higher retention efficiency. In fact molecular iodine can and does condense on dust particles or cold surfaces which is termed particulate iodine. Methyl iodide is a rare specie, if found at all, in the nuclear power generation environment.

QUALITY ASSURANCE:

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HI-Q uses the highest quality coconut shell activated carbon impregnated with 5% TEDA distributed by gas phase dispersion. The silver zeolite media is made by exchange of photographic grade 99.99% silver nitrate on 13X molecular sieve substrate. Moisture levels are maintained at 10% in the AGX media.

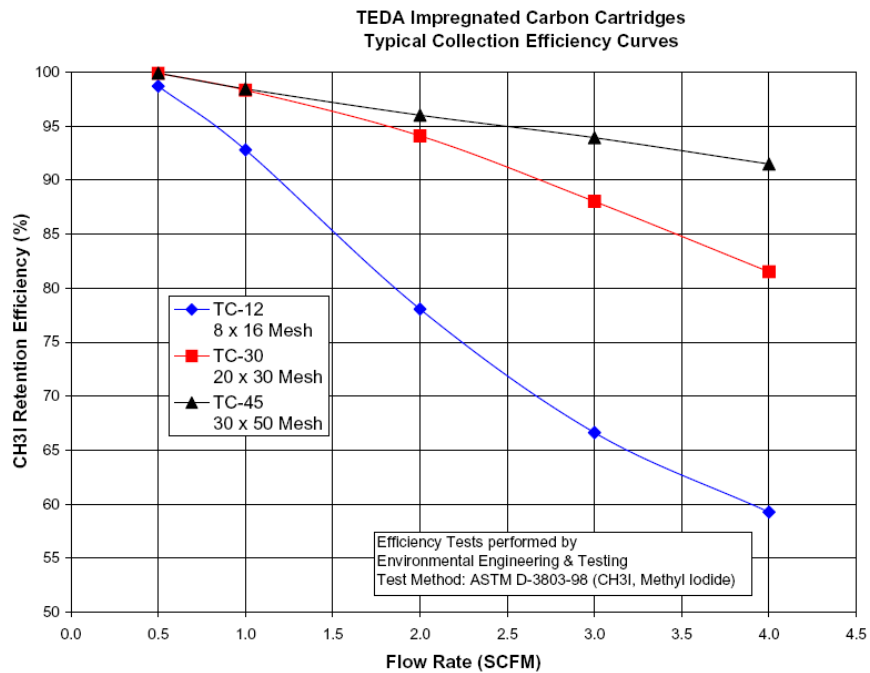
TECHNICAL DATA

5% TEDA IMPREGNATED COCONUT SHELL CARBON MEDIA

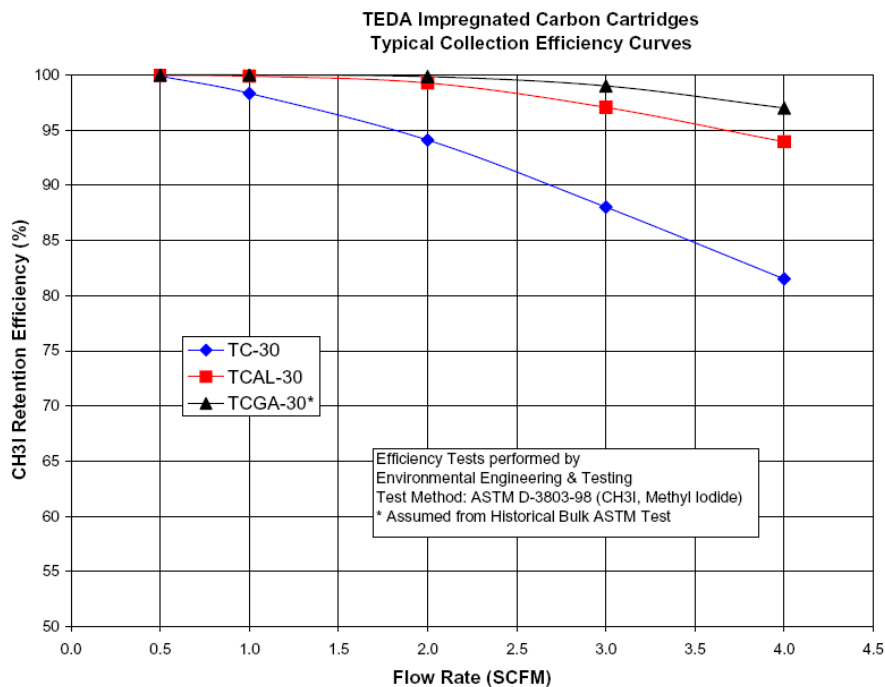
This data represents the typical analysis of the TEDA impregnated carbon media used in the analytical cartridges of all configurations.

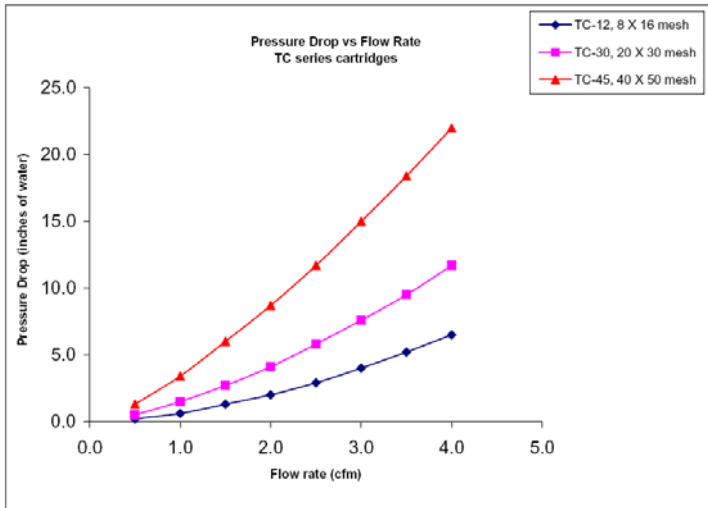
Raw Material	Coconut Shell Carbon
Activation Method	High Temperature Steam
Particle Type	Natural Grain
Carbon Adsorptive Properties	ASTM-D3467 Carbon-Tetra-Chloride Activity = 60% ASTM-D2862, Three mesh sizes are used:8-16 mesh, 20-30mesh and 30-50 mesh.
Impregnant	Triethylene Diamine (Tertiary Amines) 5%
Impregnant Disbursion	Vapor Diffusion
Hardness	ASTM D3802, <u>95% min.</u>
Apparent Density	ASTM D2854, <u>0.38 gm/ml min.</u>
Ash content	ASTM D2866, <u>4% max.</u>
Moisture content	ASTM D3466, <u>5% Average</u>
Ignition Temperature	ASTM D3466,at 100 FPM <u>240°C min.</u>
Surface Area	Typical, 1200/1300 m ² /gram

The following graph contains typical performance curves of three types of carbon cartridges (Plastic, TC-Series) available from HI-Q. Each cartridge is of the same configuration, yet contains a different mesh size of Carbon. The following graph was derived from historical data for comparison purposes. You will notice that the higher number (finer physical mesh carbon) cartridges, have higher per-flow-rate collection efficiency.



Due to the pure volume of carbon contained in the cartridge, the TCAL & TCGA Series (larger volume metal cans) cartridges offer even higher per-flow-rate point collection efficiency results when compare to the TC-Series (smaller volume, plastic) cartridges. Volumes listed below.





Pressure Drop vs. Flow Rate Data

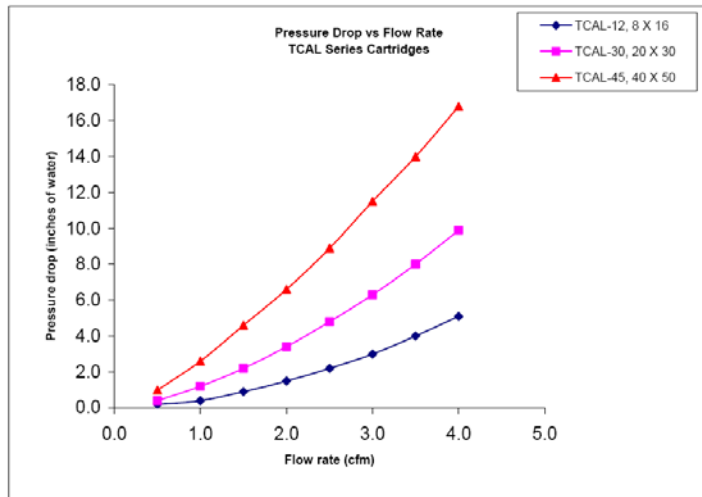
TC-Series

2.25" x 1" Plastic Cartridge (yellow)

TC-12: 8 x 16 mesh

TC-30: 20 x 30 mesh

TC-45: 40 x 50 mesh



Pressure Drop vs. Flow Rate Data

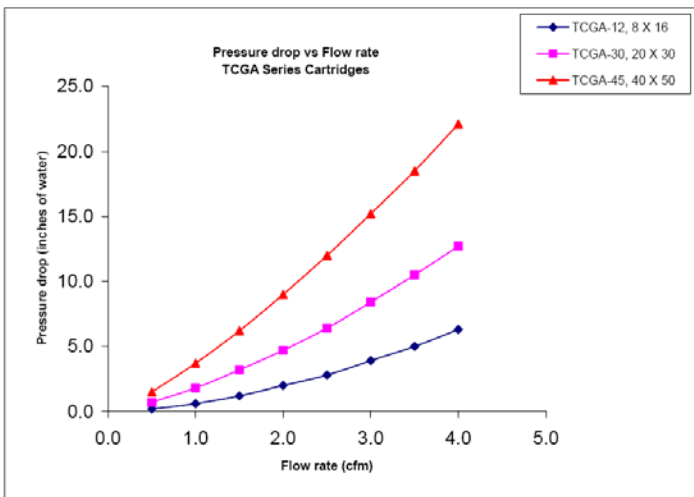
TCAL-Series

2.50" x 1" Metal Can Cartridge

TCAL-12: 8 x 16 mesh

TCAL-30: 20 x 30 mesh

TCAL-45: 40 x 50 mesh



Pressure Drop vs. Flow Rate Data

TCGA-Series

2.50" x 1.5" Metal Can Cartridge

TCGA-12: 8 x 16 mesh

TCGA-30: 20 x 30 mesh

TCGA-45: 40 x 50 mesh

Material Safety Data Sheet



Date: 10/13/2004
Product: 74722030 - 208C 5TEDA 8X16
Customer: HI-O ENVIRONMENTAL PRODUCTS
Delivery No.: 80202189

SECTION I - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Manufacturer: Calgon Carbon Corporation
P.O. Box 717
Pittsburgh, PA 15230-0717
Emergency Phone Number: (412) 787-6700
Date Prepared: 6/24/2002
Prepared By: S. Liller

Chemical Name and Synonyms: Carbon
Formula: C

SECTION II - COMPOSITION/INFORMATION ON INGREDIENTS

Nonhazardous components are listed at 3% or greater; acute hazards are listed when present at 1% or greater and chronic hazards are listed when present at 0.01% or greater. This is not intended to be a complete compositional disclosure.

<u>INGREDIENT</u>	<u>% (BY WEIGHT)</u>	<u>CAS#</u>
CARBON	100	7440-44-0

SECTION III - HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW: Black particulate solid, pellet or powder. Contact may cause eye irritation. Dust may be slightly irritating to eyes and respiratory tract.

CAUTION!! Wet activated carbon removes oxygen from air causing a severe hazard to workers inside carbon vessels and enclosed or confined spaces. Before entering such an area, sampling and work procedures for low oxygen levels should be taken to ensure ample oxygen availability, observing all local, state and federal regulations.

POTENTIAL HEALTH EFFECTS:

Effects and Hazards of Eye Contact: The physical nature of the product may produce eye irritation.

Effects and Hazards of Skin Contact: The product is not a primary skin irritant. The primary skin irritation index (Rabbit) is 0.

Effects and Hazards of Inhalation (Breathing): The product is practically non-toxic through inhalation. The acute inhalation LC₅₀ (Rat) is >64.4 mg/l (nominal concentration) for activated carbon.

Effects and Hazards of Ingestion (Swallowing): The product is non-toxic through ingestion. The acute oral LD₅₀ (RAT) is >10g/kg.

Primary Routes of Entry: Inhalation, ingestion, skin contact, eye contact.

Chronic Effects: The effects of long-term, low-level exposures to this product have not been determined. Safe handling of this material on a long-term basis should emphasize the avoidance of all effects from repetitive acute exposures.

CARCINOGENICITY: NTP: N/A IARC: N/A OSHA REGULATED: NO

SECTION IV - FIRST AID MEASURES

Treatment for Eye Contact: Flush with plenty of water for at least 15 minutes.

Treatment for Skin Contact: Wash with soap and water.

Treatment for Inhalation (Breathing): N/A

Treatment for Ingestion (Swallowing): N/A

Material Safety Data Sheet



SECTION V - FIRE FIGHTING MEASURES

Flash Point: N/A
Limits Lel: N/A
Uel: N/A
Extinguishing Media: FLOOD WITH PLENTY OF WATER.
Special Firefighting Procedures: NONE
Unusual Fire and Explosion Hazards: Contact with strong oxidizers such as ozone, liquid oxygen, chlorine, permanganate, etc., may result in fire.
NFPA RATING: HEALTH = 0 REACTIVITY = 0 FLAMMABILITY = 1

SECTION VI - ACCIDENTAL RELEASE MEASURES

Steps to be Taken in Case Material is Released or Spilled: Sweep up unused carbon and discard in refuse container or repackage.
Waste Disposal Method: Dispose of unused carbon in refuse container. Dispose of in accordance with local, state, and federal regulations.

SECTION VII - HANDLING AND STORAGE

Precautions for Handling and Storage: CAUTION!! Wet activated carbon removes oxygen from air causing a severe hazard to workers inside carbon vessels and enclosed or confined spaces. Before entering such an area, sampling and work procedures for low oxygen levels should be taken to ensure ample oxygen availability, observing all local, state, and federal or national regulations.
Other Precautions: Wash thoroughly after handling. Exercise caution in the storage and handling of all chemical substances.

SECTION VIII - EXPOSURE CONTROLS, PERSONAL PROTECTION

Exposure Guidelines:
OSHA PEL* 5 mg/M³ (Respirable)
ACGIH TLV* 10 mg/M³ (Total)
*PELs and TLVs are 8-hour TWAs unless otherwise noted.

Respiratory Protection: A NIOSH approved particulate filter respirator is recommended if excessive dust is generated.
Ventilation: Local Exhaust Ventilation: Recommended
Mechanical Ventilation: Recommended
Protective Gloves: Recommended
Eye Protection: Safety Glasses or Goggles Recommended
Other Protective Equipment: Not Required

SECTION IX - PHYSICAL AND CHEMICAL PROPERTIES

Boiling Point: N/A
Specific Gravity: 2.3 g/cc real density
Vapor Pressure: N/A
Melting Point: N/A
Vapor Density: N/A
Evaporation Rate: N/A
Solubility in Water: NEGLIGIBLE
Packing Density: 0.4 to 0.7 g/cc
Appearance and Odor: Black particulate solid, pellet, or powder

Material Safety Data Sheet



SECTION X - STABILITY AND REACTIVITY

Stability: STABLE
Conditions to avoid: NONE
Incompatibility (Materials to avoid): Strong oxidizers such as ozone, liquid oxygen, chlorine, permanganate, etc.
Hazardous Decomposition Products: Carbon monoxide may be generated in the event of a fire.
Polymerizing Conditions to Avoid: NONE

SECTION XI - TOXICOLOGICAL INFORMATION

See HEALTH EFFECTS SECTION III

SECTION XII - ECOLOGICAL INFORMATION

Not determined

SECTION XIII - DISPOSAL CONSIDERATIONS

WASTE DISPOSAL METHOD: Dispose of unused carbon in refuse container. Dispose of in accordance with local, state, and federal or national regulations.

SECTION XIV - TRANSPORT INFORMATION

Proper Shipping Name: NOT REGULATED
Hazard Class: N/A
Identification Number: N/A
Packing Group: N/A
This product has been tested according to the United Nations Transport of Dangerous Goods test protocol for spontaneously combustible materials. It has been specifically determined that this product does not meet the definition of a self heating substance or any hazard class, and therefore is not a hazardous material and not regulated.

SECTION XV - REGULATORY INFORMATION

SARA TITLE III: N/A
TSCA: The ingredients of this product are on the TSCA Inventory List.
OSHA: Nonhazardous according to definitions of health hazard and physical hazard provided in the Hazard Communication Standard (29 CFR 1910.1200)
CANADA
WHMIS CLASSIFICATION: Not Classified
DSL#: 6798
EEC Council Directives relating to the classification, packaging and labeling of dangerous substances and preparations.
Risk (R) and Safety (S) phrases: May be irritating to eyes (R36).

SECTION XVI - OTHER INFORMATION

Intended Use: Generally used for treatment of liquids and gases.
While this information and recommendations set forth herein are believed to be accurate as of the date hereof, CALGON CARBON CORPORATION MAKES NO WARRANTY WITH RESPECT AND DISCLAIMS ALL LIABILITY FROM RELIANCE THEREON.

*** END OF MATERIAL SAFETY DATA SHEET ***