

Carbon Black (CAS# 1333-86-4)
GreenScreen® for Safer Chemicals (GreenScreen®) Assessment

Prepared for:

Washington State Department of Ecology

Prepared by:

ToxServices LLC

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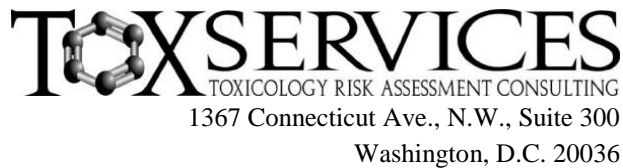


TABLE OF CONTENTS

GreenScreen® Executive Summary for Carbon Black (CAS #1333-86-4).....	i
Chemical Name.....	1
GreenScreen® Summary Rating for Carbon Black	2
Transformation Products and Ratings.....	3
Introduction.....	3
PhysioChemical Properties of Carbon Black.....	4
Group I Human Health Effects (Group I Human)	5
Carcinogenicity (C) Score	5
Mutagenicity/Genotoxicity (M) Score	7
Reproductive Toxicity (R) Score.....	7
Developmental Toxicity incl. Developmental Neurotoxicity (D) Score	8
Endocrine Activity (E) Score	8
Group II and II* Human Health Effects (Group II and II* Human).....	9
Acute Mammalian Toxicity (AT) Group II Score.....	9
Systemic Toxicity/Organ Effects incl. Immunotoxicity (ST)	9
Group II Score (single dose)	9
Group II* Score (repeated dose)	10
Neurotoxicity (N)	11
Group II Score (single dose)	11
Group II* Score (repeated dose)	11
Skin Sensitization (SnS) Group II* Score	12
Respiratory Sensitization (SnR) Group II* Score	12
Skin Irritation/Corrosivity (IrS) Group II Score.....	12
Eye Irritation/Corrosivity (IrE) Group II Score.....	13
Ecotoxicity (Ecotox)	13
Acute Aquatic Toxicity (AA) Score.....	13
Chronic Aquatic Toxicity (CA) Score.....	14
Environmental Fate (Fate)	14
Persistence (P) Score	14
Bioaccumulation (B) Score	14
Physical Hazards (Physical).....	14
Reactivity (Rx) Score	14
Flammability (F) Score.....	15
References.....	16
APPENDIX A: Hazard Benchmark Acronyms	18
APPENDIX B: Results of Automated GreenScreen® Score Calculation for Carbon Black (CAS #1333-86-4)	19
APPENDIX C: Pharos Output for Carbon Black (CAS #1333-86-4)	23

Sources to Check for GreenScreen® Hazard Assessment	24
Licensed GreenScreen® Profilers	25

TABLE OF FIGURES

Figure 1: GreenScreen® Hazard Ratings for Carbon Black	3
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TABLE OF TABLES

Table 1: Physical and Chemical Properties of Carbon Black (CAS #1333-86-4)	4
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GreenScreen® Executive Summary for Carbon Black (CAS #1333-86-4)

Carbon black is a chemical that functions as a reinforcing filler for rubber, and a colorant and performance additive for plastics, inks and paints.

GreenScreen® Benchmark Score for Relevant Route of Exposure:

Inhalation: Carbon black was assigned a GreenScreen® Benchmark Score of 1 as it has High Group I Human Toxicity due to a High score for carcinogenicity (C). This corresponds to GreenScreen® benchmark classification 1e in CPA 2011. Data gaps (DG) exist for endocrine activity (E), acute toxicity (AT), and neurotoxicity (single dose (Ns) and repeated dose (Nr*)). As outlined in CPA (2013) Section 12.2 (Step 8 – Conduct a Data Gap Analysis to assign a final Benchmark score), carbon black meets requirements for a GreenScreen® Benchmark Score of 1 despite the hazard data gaps. In a worst-case scenario, if carbon black were assigned a High score for endocrine activity (E) or repeated dose neurotoxicity (Nr*), or a Very High score for acute toxicity (AT) or single dose neurotoxicity (Ns), it would still be categorized as a Benchmark 1 Chemical.

Oral and Dermal: Carbon black was assigned a GreenScreen® Benchmark Score of 3 as it has moderate Group II Human Toxicity due to Moderate eye irritation (IrE) score, and Moderate reactivity (Rx) score. This corresponds to GreenScreen® Benchmark classification 3c and 3d in CPA 2011. Data gaps (DG) exist for endocrine activity (E) and neurotoxicity (single dose (Ns) and repeated dose (Nr*)). As outlined in CPA (2013) Section 12.2 (Step 8 – Conduct a Data Gap Analysis to assign a final Benchmark score), carbon black meets requirements for a GreenScreen® Benchmark Score of 3 despite the hazard data gaps. In a worst-case scenario, if carbon black were assigned a High score for the data gaps endocrine activity (E) or repeated dose neurotoxicity (Nr*), it would be categorized as a Benchmark 1 Chemical. If it were assigned a Very High score for single dose neurotoxicity (Ns), it would be a Benchmark 2 chemical.

GreenScreen® Hazard Ratings for Carbon Black by Route of Exposure

Route of Exposure	Group I Human					Group II and II* Human								Ecotox		Fate		Physical		
	C	M	R	D	E	AT	ST		N		SnS*	SnR*	IrS	IrE	AA	CA	P	B	Rx	F
							single	repeated*	single	repeated*										
Inhalation	H		L	L	DG	DG	vH	H	DG	DG										
Oral	L	L	L	L		L	L	L	DG	DG	L	L	L	M	L	L	vH	L	M	L
Dermal	L		L	L		L	L	L	DG	DG										

Note: Hazard levels (Very High (vH), High (H), Moderate (M), Low (L), Very Low (vL)) in *italics* reflect estimated (modeled) values, authoritative B lists, screening lists, weak analogues, and lower confidence. Hazard levels in **BOLD** font are used with good quality data, authoritative A lists, or strong analogues. Group II Human Health endpoints differ from Group II* Human Health endpoints in that they have four hazard scores (i.e., vH, H, M, and L) instead of three (i.e., H, M, and L), and are based on single exposures instead of repeated exposures. Please see Appendix A for a glossary of hazard acronyms.

GreenScreen® Assessment for Carbon Black (CAS #1333-86-4)

Method Version: GreenScreen® Version 1.2¹
Assessment Type²: Certified

Chemical Name: Carbon Black

CAS Number: 1333-86-4

GreenScreen® Assessment Prepared By:

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Title: Toxicologist

Organization: ToxServices LLC

Date: October 24, 2013

Assessor Type: Licensed GreenScreen® Profiler

Quality Control Performed By:

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Title: Managing Director and Chief

Toxicologist

Organization: ToxServices LLC

Date: October 14, 2014

Confirm application of the *de minimus* rule³: Reported impurities in carbon black include polyaromatic hydrocarbons (PAH) (HSDB 2011). The level of impurities in this particular ingredient is not disclosed by the supplier.

Chemical Structure(s):

C

(v0)

(CAS # 1333-86-4)

Also called:

Acetylene black, Animal bone charcoal, Aroflow, Arogen, Arotone, Arovel, Arrow, Atlantic, Black Kosmos 33, Black pearls, C.I. 77266, C.I. Pigment Black 6, C.I. Pigment Black 7, CCRIS 7235, CI 77266, CI Pigment black 7, CK3, Cancarb, Carbodis, Carbolac, Carbolac 1, Carbomet, Carbon black BV and V, Carbon black, Carbon black, acetylene, Carbon black, channel, Carbon black, furnace, Carbon black, lamp, Carbon black, thermal, Carbon, amorphous, Channel Black, Char, from refuse burner, Collocarb, Columbia carbon, Conductex 900, Continex, Corax A, Corax P, Croflex, Crolac, Degussa, Delussa Black FW, Durex O, EINECS 215-609-9, ELF 78, Eagle Germantown, Elftex, Essex, Excelsior, Explosion Acetylene Black, Explosion Black, Farbruss, Fecto, Flamruss, Furnace black, Furnal, Furnex, Furnex N 765, Gas Black, Gas-furnace black, Gastex, HSDB 953, Huber, Humenegro, Impingement Black, Impingement carbons, Ketjenblack EC, Kosmink, Kosmobil, Kosmolak, Kosmos, Kosmotherm, Kosmovar, Lamp black, Lampblack, Magecol, Metanex, Micronex, Miike 20, Modulex, Mogul, Mogul L, Molacco, Monarch 1300, Monarch 700, Neo Spectra Beads AG, Neo-Spectra Mark II, Neo-spectra II, Neotex, Niteron 55, Oil-furnace Black, P 33 (Carbon black), P1250, P68, Peach black, Pelletex, Permablak 663, Philblack, Philblack N 550,

¹ Use GreenScreen® Assessment Procedure (Guidance) V1.2

² GreenScreen® reports are either “UNACCREDITED” (by unaccredited person), “AUTHORIZED” (by Authorized GreenScreen® Practitioner), “CERTIFIED” (by Licensed GreenScreen® Profiler or equivalent) or “CERTIFIED WITH VERIFICATION” (Certified or Authorized assessment that has passed GreenScreen® Verification Program)

³ Every chemical in a material or formulation should be assessed if it is:

1. intentionally added and/or
2. present at greater than or equal to 100 ppm

Philblack N 765, Philblack O, Pigment Black 7, Printex, Printex 60, Raven, Raven 30, Raven 420, Raven 500, Raven 8000, Rebonex, Regal, Regal 300, Regal 330, Regal 400R, Regal 600, Regal 99, Regal SRF, Regent, Royal spectra, Sevacarb, Seval, Shawinigan Acetylene Black, Shell carbon, Special Black 1V & V, Special Schwarz, Spheron, Spheron 6, Statex, Statex N 550, Sterling MT, Sterling N 765, Sterling NS, Sterling SO 1, Super-carbovar, Super-spectra, Superba,[®] 30, Therma-atomic Black, Thermal Acetylene Black, Thermal black, Theratomic, Thermax, Thermblack, Tinolite, Toka Black 4500, Toka Black 5500, Toka Black 8500, UNII-4XYU5U00C4 (ChemIDplus 2013).

Chemical Structure(s) of Chemical Surrogates Used in the GreenScreen[®]:

Structural surrogate was not sought, as available data are sufficient to meet the requirements for the specified benchmark.

Identify Applications/Functional Uses: (HSDB 2011)

1. Use 1: Reinforcing filler for rubber (>90%)
2. Use 2: Colorant and performance additive for plastics, inks and paints

GreenScreen[®] Summary Rating for Carbon Black⁴:

Inhalation: Carbon black was assigned a GreenScreen[®] Benchmark Score of 1 as it has High Group I Human Toxicity due to a High score for carcinogenicity (C). This corresponds to GreenScreen[®] benchmark classification 1e in CPA 2011. Data gaps (DG) exist for endocrine activity (E), acute toxicity (AT), and neurotoxicity (single dose (Ns) and repeated dose (Nr*)). As outlined in CPA (2013) Section 12.2 (Step 8 – Conduct a Data Gap Analysis to assign a final Benchmark score), carbon black meets requirements for a GreenScreen[®] Benchmark Score of 1 despite the hazard data gaps. In a worst-case scenario, if carbon black were assigned a High score for endocrine activity (E) or repeated dose neurotoxicity (Nr*), or a Very High score for acute toxicity (AT) or single dose neurotoxicity (Ns), it would still be categorized as a Benchmark 1 Chemical.

Oral and Dermal: Carbon black was assigned a GreenScreen[®] Benchmark Score of 3 as it has moderate Group II Human Toxicity due to Moderate eye irritation (IrE) score, and Moderate reactivity (Rx) score. This corresponds to GreenScreen[®] Benchmark classification 3c and 3d in CPA 2011. Data gaps (DG) exist for endocrine activity (E) and neurotoxicity (single dose (Ns) and repeated dose (Nr*)). As outlined in CPA (2013) Section 12.2 (Step 8 – Conduct a Data Gap Analysis to assign a final Benchmark score), carbon black meets requirements for a GreenScreen[®] Benchmark Score of 3 despite the hazard data gaps. In a worst-case scenario, if carbon black were assigned a High score for the data gaps endocrine activity (E) or repeated dose neurotoxicity (Nr*), it would be categorized as a Benchmark 1 Chemical. If it were assigned a Very High score for single dose neurotoxicity (Ns), it would be a Benchmark 2 chemical.

⁴ For inorganic chemicals with low human and ecotoxicity across all hazard endpoints and low bioaccumulation potential, persistence alone will not be deemed problematic. Inorganic chemicals that are only persistent will be evaluated under the criteria for Benchmark 4.

Figure 1: GreenScreen® Hazard Ratings for Carbon Black

Route of Exposure	Group I Human					Group II and II* Human								Ecotox		Fate		Physical		
	C	M	R	D	E	AT	ST		N		SnS*	SnR*	IrS	IrE	AA	CA	P	B	Rx	F
							single	repeated*	single	repeated*										
Inhalation	H		L	L	DG	DG	vH	H	DG	DG										
Oral	L	L	L	L		L	L	L	DG	DG	L	L	L	M	L	L	vH	L	M	L
Dermal	L		L	L		L	L	L	DG	DG										

Note: Hazard levels (Very High (vH), High (H), Moderate (M), Low (L), Very Low (vL)) in *italics* reflect estimated (modeled) values, authoritative B lists, screening lists, weak analogues, and lower confidence. Hazard levels in **BOLD** font are used with good quality data, authoritative A lists, or strong analogues. Group II Human Health endpoints differ from Group II* Human Health endpoints in that they have four hazard scores (i.e., vH, H, M, and L) instead of three (i.e., H, M, and L), and are based on single exposures instead of repeated exposures. Please see Appendix A for a glossary of hazard acronyms.

Transformation Products and Ratings:

Identify feasible and relevant fate and transformation products (i.e., dissociation products, transformation products, valence states) **and/or moieties of concern**⁵

Combustion of carbon black may generate carbon monoxide and carbon dioxide gases. These chemicals are naturally occurring in the environment and are therefore not relevant to this assessment. There are no other known environmental transformation products for carbon black.

Introduction

Carbon black is a generic term for a particulate form of elemental carbon. It is manufactured by gas-phase pyrolysis and partial combustion of hydrocarbons. Based on different production processes, carbon blacks are categorized into acetylene black, channel black, furnace black, lampblack or thermal black (HSDB 2011).

ToxServices assessed carbon black against GreenScreen® Version 1.2 (CPA 2013) following procedures outlined in ToxServices' SOP 1.37 (GreenScreen® Hazard Assessment) (ToxServices 2013).

GreenScreen® List Translator Screening Results

The GreenScreen® List Translator identifies specific authoritative or screening lists that should be searched to identify GreenScreen® benchmark 1 chemicals (CPA 2012b). Pharos (Pharos 2013) is an online list-searching tool that is used to screen chemicals against the List Translator electronically. The output indicates benchmark or possible benchmark scores for each human health and environmental endpoint. The output for carbon black can be found in Appendix C and a summary of the results can be found below:

- Cancer
 - NIOSH-C: Occupational carcinogen
 - Prop 65: Cancer (airborne particles of respirable size – occupational setting)

⁵ A moiety is a discrete chemical entity that is a constituent part or component of a substance. A moiety of concern is often the parent substance itself for organic compounds. For inorganic compounds, the moiety of concern is typically a dissociated component of the substance or a transformation product.

- IARC: Group 2B – Possibly carcinogenic to humans – inhaled from occupational sources
- MAK: Carcinogen group 3B – Evidence of carcinogenic effects but not sufficient for classification
- GHS-New Zealand: 6.7B – Suspected human carcinogens
- GHS-Japan: Carcinogenicity category 2
- Mammalian
 - GHS-Japan: Specific target organs/systemic toxicity following repeated exposure category 1
 - WHMIS: Class D2A – Very toxic material causing other toxic effects
- Eye irritation
 - GHS-New Zealand: 6.4A – Irritating to the eye
- Skin irritation
 - GHS-New Zealand: 6.3B – Mildly irritating to the skin
- Exempt
 - VwVwS: Non-hazardous to water (water hazard class 0 NWG)

PhysioChemical Properties of Carbon Black

Carbon black is a fine powder with a black color. It is insoluble in any solvents. It is not volatile, and sublimates before melting.

Table 1: Physical and Chemical Properties of Carbon Black (CAS #1333-86-4)		
Property	Value	Reference
Molecular formula	C	ChemIDplus 2013
SMILES Notation	C	ChemIDplus 2013
Molecular weight	12.011	ChemIDplus 2013
Physical state	Solid	HSDB 2011
Appearance	Fine black powder	HSDB 2011
Melting point	Sublimes	HSDB 2011
Vapor pressure	Negligible at 20°C	HSDB 2011
Water solubility	Insoluble	HSDB 2011
Dissociation constant	N/A	
Density/specific gravity	1.8 – 2.1	HSDB 2011
Partition coefficient	N/A	
Particle size	5 – 500 nm	HSDB 2011
Structure	Similar to, but less regular than graphite, spherical	HSDB 2011
Bioavailability	Not bioavailable, but inhaled particles can deposit in the lung	HSDB 2011

Hazard Classification Summary Section:

Group I Human Health Effects (Group I Human)

Carcinogenicity (C) Score (H, M, or L): H (Inhalation), L (oral and dermal)

Carbon black was assigned a score of High for carcinogenicity via inhalation based on authoritative listings, equivocal evidence in humans and positive results in animal studies. It was assigned a score of Low for carcinogenicity via oral and dermal exposures, based on lack of tumor induction in animal studies. GreenScreen® criteria classify chemicals as a high hazard for carcinogenicity when they are listed by authoritative bodies, and as a low hazard when adequate data are available and negative, there are no structural alerts, and they are not classified under GHS (CPA 2012a).

- **Authoritative and Screening Lists**
 - *Authoritative:* NIOSH-C: Occupational carcinogen
 - *Authoritative:* Prop 65: Cancer (airborne particles of respirable size – occupational setting)
 - *Authoritative:* Group 2B – Possibly carcinogenic to humans – inhaled from occupational sources
 - *Authoritative:* Carcinogen group 3B – Evidence of carcinogenic effects but not sufficient for classification
 - *Screening:* GHS-New Zealand: 6.7B – Suspected human carcinogens
 - *Screening:* GHS-Japan: Carcinogenicity category 2
- **Inhalation**
 - IARC 2010
 - Several epidemiological studies on occupational exposure to carbon black were identified. A few suggested an association between exposure and excess incidences of lung cancer, while others did not find such associations. Isolated results showed excess risks for urinary bladder, kidney, stomach, and esophagus cancer, but they are not sufficient to support an evaluation of human carcinogenicity. There is sufficient evidence of carcinogenicity in the lung in animals. The mechanism of carcinogenesis involves lung overload of fine insoluble particles, impaired clearance by alveolar macrophages, and chronic inflammation.
 - UNEP 2006
 - Female Wistar rats were exposed to doses of 7.4 mg/m³ 18 hours a day, five days a week for four months, 12.2 mg/m³ for 20 months, and then clean air for six months (study duration of 30 months). Lung tumor formation was seen.
 - Female NMRI mice were exposed to doses of 7.4 mg/m³ for four months, 12.2 mg/m³ for 9.5 months, and then clean air for 9.5 months (study duration of 23 months). There was no tumor formation seen.
 - Male and female Fischer 344 rats were exposed to doses of 2.5 or 6.5 mg/m³ 16 hours a day, five days a week for up to 24 months. Malignant lung tumor formation was seen.
 - Male and female Fischer 344 rats were exposed to doses of 2.5 or 6.5 mg/m³ 16 hours a day, five days a week for 24 months. Malignant or benign lung tumor formation was seen in females; no tumor formation was seen in males.
- **Oral**
 - UNEP 2006
 - In a study evaluating the effect of carbon black on carcinogenic compounds, three

carbon blacks were either fed alone at 18, 12, or 9% in the diet or in combination with p-dimethylaminoazobenzene (0.06%) to Harlan rats (24/group, sex not reported) for 15 months. Complete autopsy and histological examination was performed on each animal at the end of the study. None of the animals treated with carbon black showed any evidence of neoplasm.

- Mice (10-50/group, sex or strain not reported) were fed 16 different whole or extracted carbon blacks of various types (oil furnaces, gas furnace, furnace, channel, channel special, thermal combustion) mixed in water or oil for 12-18 months. No significant gross or microscopical changes were found in any of the organs of tissues.
- In female Sprague-Dawley rats and female CF1 mice (28-31 animals/group), carbon black (furnace black) were fed in the diet at 2,050 mg/kg diet for 2 years. Incomplete histopathological examination was performed, and there was no increase in tumor incidences.

- *Dermal*

- UNEP 2006

- Twice weekly applications of 6-60% carbon black suspended in acetone to 240 mice (strain and sex not reported) for 9 months did not induce skin tumor in these animals.
- Twice weekly application of pure carbon black rubbed on the skin of 72 Swiss mice (sex not specified) for 24 months did not induce any skin tumor in the animals.
- Organic carbon black extracts (1%) dissolved in acetone and croton oil were applied (frequency not reported) to the skin of 212 Swiss mice (sex not specified) for 315 days. Six tumors occurred on the skin (squamous cell carcinomas). Painting with unextracted carbon black in acetone produced no neoplastic effect. The authors concluded that the carcinogenic material can be extracted from commercial carbon blacks.
- Carbon black (3-13 g/application suspended in water or mineral oil) was applied to the skin of mice (number, sex, and strain not reported) three times/week for 12-18 months. No observable harmful effects were seen. Adsorbed material on carbon black, when free and applied to the skin, produced skin cancer. The authors concluded that carbon blacks can effectively adsorb organic carcinogens and eliminate or reduce their carcinogenic potentials.
- Rabbits (number and sex not reported) were given 116-324 g carbon black suspended in water or cottonseed or mineral oils three times/week for 8.5, 9, 10, or 25 months. No significant changes were found on the skin.
- Rhesus monkeys were painted with carbon black at 327, 563, or 938 g/animal on four areas of the skin for 17.5 (whole carbon black) and 26.5 months (extracted carbon black). No significant changes were found in the animals.

- Based on the weight of evidence, carbon black has carcinogenic potential in the lung after inhalation exposure due to a mechanism related to insoluble particle deposition and chronic inflammation. Carbon black was not carcinogenic when ingested. Although a few studies showed carcinogenic activity on the skin when carbon black extract was applied dermally, these are attributed to the PAH contaminants in the material, while carbon black adsorbs and reduces the carcinogenic potentials of these organics.

Mutagenicity/Genotoxicity (M) Score (H, M, or L): L

Carbon black was assigned a score of Low for mutagenicity/genotoxicity based on lack of genotoxicity *in vitro* and *in vivo*. GreenScreen® criteria classify chemicals as a low hazard for mutagenicity/genotoxicity when adequate data are available and negative both for chromosomal aberrations and gene mutations, there are no structural alerts, and they are not classified under GHS (CPA 2012a).

- Authoritative and Screening Lists
 - Not present on any authoritative or screening lists.
- JECFA 1988
 - Commercially produced carbon black containing 194 ppm PAHs (determined on a benzene extract) was used in an Ames assay on *Salmonella typhimurium* tester strains TA98, TA100, TA1535, TA1537, and TA1538. All strains were tested in the presence and absence of metabolic activation at concentrations up to 7,500 µg/plate and were determined to be negative for mutagenicity.
 - A mouse lymphoma cell assay was performed on tester strain L5178 in the presence and absence of metabolic activation at concentrations of up to 15,000 µg Carbon black (rubber grade)/L and determined to be negative for mutagenicity.
 - A sister-chromatid exchange assay in Chinese hamster ovary cells in the presence and absence of metabolic activation was performed at concentrations of up to 1,000 µg Carbon black (rubber grade)/L and determined to be negative.
- GeneTox 1988
 - A sister-chromatid exchange assay was positive.
- UNEP 2006
 - *In vitro*, carbon black was non-mutagenic in Ames tests, although organic extracts exhibited a variety of activity, depending on the conditions of extraction. These are the results of PAH impurities in the carbon black materials. Carbon black tested negative in a mouse lymphoma assay and a sister chromatid exchange assay in Chinese hamster ovary cells.
 - *In vivo*, carbon black produced mutation in the hprt gene in alveolar type II epithelial cells isolated from rat lungs, which was associated with significant inflammation after inhalation. Addition of catalase inhibited mutation frequencies, indicating the direct mutant was cell-derived oxidants released during inflammation. Other studies demonstrated that repeated exposure to carbon black did not produce PAH-DNA adducts in rats, consistent with the hypothesis that PAHs were not bioavailable when adsorbed onto carbon black.
- Available evidence indicates that carbon black is not directly mutagenic. Inhalation exposure to carbon black may produce mutation through secondary mechanisms such as oxidative stress triggered by inflammatory processes, which is a threshold effect.

Reproductive Toxicity (R) Score (H, M, or L): L (inhalation, oral and dermal)

Carbon black was assigned a score of Low for reproductive toxicity for inhalation, oral, and dermal routes of exposure, based on weight of evidence and expert judgment. The level of confidence was reduced due to lack of study data. GreenScreen® criteria classify chemicals as a low hazard for reproductive toxicity when adequate data are available and negative, there are no structural alerts, and they are not classified under GHS (CPA 2012a).

- Authoritative and Screening Lists
 - Not present on any authoritative or screening lists.

- UNEP 2006
 - Carbon black has not been tested for this endpoint. Based on toxicokinetics and information obtained from repeated dose and developmental toxicity studies, it is highly unlikely that carbon black particles will reach the reproductive organs under *in vivo* conditions:
 - *Inhalation*: Carbon black particles deposited in the respiratory tract are cleared by bronchial tree with some transepithelial passage of free particles to the interstitium. Some were found in the hilar lymph nodes, but overall clearance from the lung is low.
 - *Oral*: Only minimal amounts of carbon black were found in Peyer's patches after oral exposure.
 - *Dermal*: Insoluble carbon black particles are not capable of skin penetration.
 - Therefore, it was concluded that carbon black is unlikely to pose a reproductive hazard.

Developmental Toxicity incl. Developmental Neurotoxicity (D) Score (H, M, or L): L (inhalation, oral, and dermal).

Carbon black was assigned a score of Low for developmental toxicity for inhalation, oral, and dermal routes of exposure based on weight of evidence and expert judgment. The level of confidence was low due to lack of study data. GreenScreen® criteria classify chemicals as a low hazard for developmental toxicity when adequate data are available and negative, there are no structural alerts, and they are not classified under GHS (CPA 2012a).

- Authoritative and Screening Lists
 - Not present on any authoritative or screening lists.
- UNEP 2006
 - No guideline studies were found on carbon black for this endpoint.
 - *Inhalation*: Diesel exhaust, which consists of similarly sized carbonaceous particles with a higher content of organic extractable matter, did not affect the development of Sprague-Dawley rat and New Zealand white rabbit fetuses when administered by the inhalation route during gestational days 6-15 (rat) or 6-18 (rabbit).
 - Based on available toxicokinetic data, repeated dose toxicity and developmental toxicity studies (on diesel exhaust), it is very unlikely that carbon black particles administered via any route will reach the embryo and/or fetus under *in vivo* conditions. Therefore, it is not expected to adversely affect development.

Endocrine Activity (E) Score (H, M, or L): DG

Carbon black was assigned a score of Data Gap for endocrine disruption based on lack of data.

- Authoritative and Screening Lists
 - Not present on any authoritative or screening lists.
- Not listed as a potential endocrine disruptor on the EU Priority List of Suspected Endocrine Disruptors.
- Not listed as a potential endocrine disruptor on the OSPAR List of Chemicals of Possible Concern.
- No data were identified.

Group II and II* Human Health Effects (Group II and II* Human)

Note: Group II and Group II* endpoints are distinguished in the v 1.2 Benchmark system. For Systemic Toxicity and Neurotoxicity, Group II and II* are considered sub-endpoints and test data for single or repeated exposures may be used. If data exist for single OR repeated exposures, then the endpoint is not considered a data gap. If data are available for both single and repeated exposures, then the more conservative value is used.

Acute Mammalian Toxicity (AT) Group II Score (vH, H, M, or L): DG (inhalation), L (oral and dermal)

Carbon black was assigned a score of Data Gap for acute toxicity for inhalation exposure based on insufficient data available, and a score of Low for oral and dermal exposures based on LD₅₀ values of > 2000 mg/kg in animals. GreenScreen® criteria classify chemicals as a low hazard for acute toxicity when inhalation LC₅₀ (dust) > 5 mg/L or oral or dermal LD₅₀ > 2,000 mg/kg (CPA 2012a).

- Authoritative and Screening Lists
 - Not present on any authoritative or screening lists.
- *Inhalation*
 - ECHA 2013
 - Inhalation LC₅₀ (4h) > 4.6 mg/m³ in Wistar rats
 - Inhalation LC₅₀ (7h) > 1 mg/m³ for 20 nm and 200 nm carbon black in rats
- *Oral*
 - UNEP 2006
 - LD₅₀ > 10,000 mg/kg in rats
 - ChemIDplus 2013
 - LD₅₀ > 15,400 mg/kg in rats
- *Dermal*
 - ChemIDplus 2013
 - LD₅₀ > 3,000 mg/kg in rabbits

Systemic Toxicity/Organ Effects incl. Immunotoxicity (ST)

Group II Score (single dose) (vH, H, M, or L): vH (inhalation), L (oral), L (Dermal)

Carbon black was assigned a score of Very High, Low, and Low for systemic toxicity (single dose) for inhalation, oral, and dermal routes of exposure, respectively, based on an inhalation LOAEL of 0.001 mg/L, an oral NOAEL of > 10,000 mg/kg, and expert judgment for dermal exposure (hence the lower level of confidence). GreenScreen® criteria classify chemicals as a low hazard for systemic toxicity (single dose) when adequate data are available and negative, there are no structural alerts, and they are not classified under GHS. The criteria classify chemicals as a very high hazard when inhalation LOAELs are less than 1 mg/L/4h for dusts (CPA 2012a).

- Authoritative and Screening Lists
 - Not present on any authoritative or screening lists.
- *Inhalation*
 - UNEP 2006
 - In an acute toxicity study in Wistar rats, 5-hour exposure to 4.6 mg/m³ carbon black had no effects on lung, blood pressure, body temperature, or activity. No effects were found on vasopressor and vasodilator compounds, endothelins, and nitric oxide-related metabolites. ToxServices established the NOAEL at 0.0046 mg/L for this study.
 - In an acute toxicity in rats, 7-hour exposure to 1 mg/m³ carbon black nano particles (20 nm), but not larger particles (200 nm), produced a 1% increase in

neutrophil influx in the lung ($p < 0.01$). Twenty nm carbon black, but not 200 nm carbon black, also increased epithelial permeability, measured as total protein (mainly due to albumin) in bronchoalveolar lavage (BAL) fluid, which peaked 16 hours after inhalation. A transient, but statistically significant fluctuation in lung glutathione level was also reported after 20 nm carbon black, but not 200 nm carbon black, exposure. ToxServices established the LOAEL at 0.001 mg/L for 20 nm carbon black, and the NOAEL at 0.001 mg/L for 200 nm carbon black.

- *Oral*
 - UNEP 2006
 - In an acute toxicity study in rats, no mortality or clinical signs of toxicity were observed when gavaged with 10,000 mg/kg carbon black. ToxServices established the NOAEL at 10,000 mg/kg for this study.
- *Dermal*
 - UNEP 2006
 - After 4-hour exposure to 0.5 g (125 mg/kg, assuming a body weight of 4 kg based on U.S. EPA 1988) moistened carbon black in a skin irritation study in rabbits, no systemic toxicity was observed. Similarly, no signs of systemic toxicity were noted in rabbits treated with 0.5 ml carbon black dissolved in olive oil (27%) or water (20%) (approximately 25 mg/kg) under occlusive conditions for 4 hours.
 - Insoluble carbon black particles are not likely to be capable of skin penetration.
- Based on the weight of evidence, there is insufficient information available to classify carbon black for the inhalation route of exposure. Acute oral toxicity studies demonstrate lack of systemic toxicity at high doses. Although available data from dermal exposure are insufficient to classify carbon black, its lack of skin penetration ability makes systemic toxicity from dermal exposure unlikely.

Group II* Score (repeated dose) (H, M, or L): H (inhalation), L (oral), L (dermal)

Carbon black was assigned a score of **H** for systemic toxicity (repeated dose) for inhalation exposure based on the LOAEL of 0.001 mg/L in humans; a score of **L** for oral exposure based on NOAELs > 100 mg/kg/day; and a score of **L** for dermal exposure based on insufficient data and expert judgment (hence the lower level of confidence). GreenScreen® criteria classify chemicals as a high hazard for systemic toxicity (repeated dose) when inhalation LOAEL < 0.02 mg/L; as a low hazard when oral LOAELs > 100 mg/kg/day, and dermal LOAELs > 200 mg/kg/day (CPA 2012a).

- Authoritative and Screening Lists
 - *Authoritative:* Not present on any authoritative lists.
 - *Screening:* GHS-Japan: Specific target organs/systemic toxicity following repeated exposure category 1
- *Inhalation*
 - UNEP 2006
 - Under occupational settings, epidemiological studies demonstrated that repeated exposure to carbon black could cause decrements in pulmonary functions, increases in respiratory symptoms, and possibly chest film changes. Computer models predict that exposure to 1.0 mg/m³ (inhalable fraction, 8-hr TWA) for 40 years would lead to minimal effects on lung function parameters. It was estimated that exposure to carbon black for 40 years at 1, 2, and 3.5 mg/m³ would lead to mean decreases in FEV₁ of 49, 91, and 169 mL, respectively. ToxServices established the LOAEL at 0.001 mg/L for humans, based on the information above. As this information is sufficient to classify carbon black for

this endpoint, further animal studies via the inhalation route are not described in this report.

- *Oral*
 - UNEP 2006
 - In a 12-18 month carcinogenicity study in mice, various types of carbon blacks were fed to the animals at 10% (equivalent to 18,500 mg/kg/day⁶). No changes were observed in organs or tissues. ToxServices established the NOAEL at 18,500 mg/kg/day for this study.
 - In female Sprague-Dawley rats and female CF1 mice (28-31 animals/group), carbon black (furnace black) were fed in the diet at 2,050 mg/kg diet (equivalent to 164 and 355 mg/kg/day, respectively, for rats and mice⁷) for 2 years. No systemic toxicity was found. ToxServices established the NOAEL at 164 and 355 mg/kg/day for female rats and mice, respectively.
- *Dermal*
 - UNEP 2006
 - Male C3H mice were treated with carbon black (20% suspended in cotton seed oil, mineral oil or 1% in aqueous carboxymethylcellulose) on the skin (painted onto the backs) 3 times/week for 41 weeks. No changes in organs or tissues were found. Dosage conversion to mg/kg/day was not possible due to lack of information provided.
 - As insoluble particles, carbon black is unlikely to penetrate the skin.
- Based on the weight of evidence, sufficient data are available for inhalation and oral routes of exposure to classify carbon black. For dermal exposure, although available data are insufficient to derive a NOAEL or LOAEL, the negative findings in chronic carcinogenicity studies as described in the carcinogenicity section and the lack of skin penetration ability render carbon black unlikely to induce systemic toxicity.

Neurotoxicity (N)

Group II Score (single dose) (vH, H, M, or L): DG

Carbon black was assigned a score of Data Gap for neurotoxicity (single dose) based on lack of data.

- Authoritative and Screening Lists
 - Not present on any authoritative or screening lists.
- Not classified as a developmental neurotoxicant (Grandjean and Landrigan 2006).
- No data were identified.

Group II* Score (repeated dose) (H, M, or L): DG

Carbon black was assigned a score of Data Gap for neurotoxicity (repeated dose) based on lack of data.

- Authoritative and Screening Lists
 - Not present on any authoritative or screening lists.
- Not classified as a developmental neurotoxicant (Grandjean and Landrigan 2006).
- No data were identified.

⁶ According to U.S. EPA 1988, food factor for mice on average in a chronic study is 185 g/kg/day. Therefore, 10% in the diet is equivalent to 10% x 185 g/kg/day x 1,000 mg/g = 18,500 mg/kg/day

⁷ Food factors for female Sprague-Dawley rats and female B6C3F1 mice in chronic studies are 0.08 kg/kg/day and 0.173 kg/kg/day, respectively. Therefore, 2,050 mg/kg diet is equivalent to 2,050 mg/kg x 0.08 kg/kg/day = 164 mg/kg/day for rats. Similarly, it is equivalent to 2,050 mg/kg x 0.173 kg/kg/day = 355 mg/kg/day for mice (U.S. EPA 1988).

Skin Sensitization (SnS) Group II* Score (H, M, or L): L

Carbon black was assigned a score of Low for skin sensitization based on lack of sensitization potential in guinea pigs and mice. GreenScreen® criteria classify chemicals as a low hazard for skin sensitization when adequate data are available and negative, there are no structural alerts, and they are not classified under GHS (CPA 2012a).

- Authoritative and Screening Lists
 - Not present on any authoritative or screening lists.
- ECHA 2013
 - Carbon black was not sensitizing in a GLP-compliant Buehler test performed according to OECD Guideline 406 in guinea pigs.
 - Carbon black was not sensitizing in a mouse local lymph node assay (LLNA) conducted similar to OECD TG 429, using female Balb/c mice.

Respiratory Sensitization (SnR) Group II* Score (H, M, or L): L

Carbon black was assigned a score of Low for respiratory sensitization based on weight of evidence. The level of confidence was reduced due to the weight of evidence approach with conflicting data. GreenScreen® criteria classify chemicals as a low hazard for respiratory sensitization when adequate data are available and negative, there are no structural alerts, and they are not classified under GHS (CPA 2012a).

- Authoritative and Screening Lists
 - Not present on any authoritative or screening lists.
- ECHA 2013
 - Ultrafine (diameter < 30 nm) but not fine (diameter > 200 nm) carbon black particles (200 µg) induced airway inflammation and displayed adjuvant activity in female Balb/c mice (6/group) when administered intranasally. Activities were demonstrated by induction of immune sensitization to co-administered ovalbumin, by increased levels of cytokines associated with a Th2 immune response, and by the occurrence of allergic airway inflammation after an intranasal OVA challenge. A systemic antibody response was not detected.
 - In humans, no cases of allergies were reported to the responsible occupational physicians.
- Evidence of respiratory sensitization has been observed in a mice model using a method that has not been validated. Currently, there are no test guidelines for respiratory sensitization. Carbon black is found in the AOEC database but it is not listed as a respiratory sensitizer, and there are no case reports of respiratory sensitization for carbon black. Based on the weight of evidence, carbon black is unlikely to be a respiratory sensitizer.

Skin Irritation/Corrosivity (IrS) Group II Score (vH, H, M, or L): L

Carbon black was assigned a score of Low for skin irritation/corrosivity based on negative findings in animals. GreenScreen® criteria classify chemicals as a low hazard for skin irritation/corrosivity when adequate data are available and negative, there are no structural alerts, and they are not classified under GHS (CPA 2012a).

- Authoritative and Screening Lists
 - *Authoritative:* Not on any authoritative lists.
 - *Screening:* GHS-New Zealand: 6.3B – Mildly irritating to the skin

- UNEP 2006
 - When tested on the intact and scarified skin of 3 rabbits, carbon black did not induce irritation reactions after a 4-hour exposure at the dose of 0.5 g during the 72 hour observation time.
 - Carbon black was not irritating when dissolved in olive oil or distilled water at 20-27% in rabbits under occlusive conditions for 4 hours.
- ECHA 2013
 - Two more animal studies were described and neither showed any evidence of skin irritation.

Eye Irritation/Corrosivity (IrE) Group II Score (vH, H, M, or L): M

Carbon black was assigned a score of Moderate for eye irritation/corrosivity based on a slight chance of mechanical irritation. Level of confidence was low due to the weight of evidence approach for data with conflicting results. GreenScreen® criteria classify chemicals as a moderate hazard for eye irritation/corrosivity when they are classified as GHS category 2B (mildly irritating) (CPA 2012a).

- Authoritative and Screening Lists
 - *Authoritative:* Not on any authoritative lists.
 - *Screening:* GHS-New Zealand: 6.4A – Irritating to the eye
- UNEP 2006
 - As superficial foreign bodies, carbon black particles may be slightly irritating mechanically, and may cause discoloration of lids and conjunctivae. However, they are chemically inert.
 - When undiluted carbon black (100 mg) was instilled to the eyes of rabbits in a Draize test for eye irritancy, no irritation effects were found.
- ECHA 2013
 - Three Draize tests were described, all of which reported that carbon black was not irritating to the eyes in rabbits.
 - In a presumable Draize test in rabbits, carbon black produced slight conjunctiva redness, which cleared within 7 days. Draize score ranged from 10-17/110 (100/110 = maximally irritating).

Ecotoxicity (Ecotox)

Acute Aquatic Toxicity (AA) Score (vH, H, M, or L): L

Carbon black was assigned a score of Low for acute aquatic toxicity based on its insolubility and measured L/EC₅₀ values > 100 mg/L. GreenScreen® criteria classify chemicals as a low hazard for acute aquatic toxicity when L/EC₅₀ values are > 100 mg/L (CPA 2012a).

- Authoritative and Screening Lists
 - Not present on any authoritative or screening lists.
- UNEP 2006
 - In two GLP-compliant studies in zebra fish, carbon black aqueous suspensions were prevented from settling by gentle aeration for 96 hours. Total mortality was observed in one of the 10,000 mg/L suspensions due to asphyxiation, possibly influenced by the rate of particle streaming. No mortality was observed in the filtrate from the 10,000 mg/L suspension.
 - LC₀ = 1,000-10,000 in zebrafish and ide in multiple 48-96 hour studies.
 - 24h EC₅₀ (mobility) = 5,600-10,000 mg/L in daphnia. Toxicity was attributed to the low pH of the solution.

- 24h EC₅₀ > 10,000 mg/L in algae
- Carbon black is not soluble in water, and therefore standard ecotoxicity tests could not be carried out. Due to its low toxicity, high concentrations were tested to identify toxicity, which decreased the pH of some aqueous suspensions, and made the testing protocol more difficult.

Chronic Aquatic Toxicity (CA) Score (vH, H, M, or L): L

Carbon black was assigned a score of Low for chronic aquatic toxicity based on its insolubility in water and a 14-day LC₀ of 5,000 mg/L in fish. GreenScreen® criteria classify chemicals as a low hazard for chronic aquatic toxicity when chronic LOEC > 10 mg/L (CPA 2012a).

- Authoritative and Screening Lists
 - Not present on any authoritative or screening lists.
- UNEP 2006
 - 14-day LC₀ = 5,000 mg/L

Environmental Fate (Fate)

Persistence (P) Score (vH, H, M, L, or vL): vH

Carbon black was assigned a score of Very High for persistence based on expert judgment based on its inorganic nature and insolubility. Level of confidence was low due to lack of measured biodegradation data. GreenScreen® criteria classify chemicals as a very high hazard for persistence when the biodegradation half-lives are > 180 days in soil, >60 days in water, and > 5days in air (CPA 2012a).

- Authoritative and Screening Lists
 - *Authoritative*: Not present on any authoritative lists.
 - *Screening*: DSL: Carbon black is persistent.
- UNEP 2006
 - As an inorganic substance, which is insoluble in water and all biocompatible fluids, carbon black is not biodegradable.

Bioaccumulation (B) Score (vH, H, M, L, or vL): L

Carbon black was assigned a score of Low for bioaccumulation based on expert judgment based on lack of solubility. Level of confidence was low due to the lack of measured data. GreenScreen® criteria classify chemicals as a low hazard for bioaccumulation when BCF or BAF is between 100 and 500 (CPA 2012a).

- Authoritative and Screening Lists
 - *Authoritative*: Not present on any authoritative lists.
 - *Screening*: DSL: not bioaccumulative.
- UNEP 2006
 - Based on its insolubility in organic solvents and water, bioaccumulation of carbon black is not expected

Physical Hazards (Physical)

Reactivity (Rx) Score (vH, H, M, or L): M

Carbon black was assigned a score of Moderate for reactivity based on explosion potential when mixed with air. Level of confidence was reduced due to the weight of evidence approach with

insufficient data. GreenScreen® criteria classify chemicals as a moderate hazard for reactivity when they are classified to GHS Division 1.4 or 1.5 (CPA 2012a).

- Authoritative and Screening Lists
 - Not present on any authoritative or screening lists.
- ECHA 2013
 - Carbon black was tested for explosiveness according to the national guideline VDI 3673. The maximum rate of pressure rise was between 66 and 111 bar m/s (= k-value). The maximum explosion gauge pressure was 9.3-9.4 bar. The lower explosion limit was 60 g/m³. The minimum ignition energy was > 5 kJ, except for a specific type of Monarch 1300 (0.6 kJ). The material did not ignite in the modified Hartmann tube test.
 - In an explosiveness test according to the national guideline VDI 2263 and 2273, carbon black in combination with high energy (>1 kJ) and an appropriate distribution of dust-air mixture can be made to explode. The dust explosion class by this method is ST 1. The maximum rate of pressure rise was 20-129 bar/s (= k-value). The max explosion pressure was 6.4-10.5 bar absolute. The lower dust concentration limit for explosion was < 50 g/m³.
 - In an explosiveness test conducted according to national guideline VDI 3673, carbon black has a maximum explosion pressure of 7.3 bar absolute and a maximum pressure rise of 10 bar/s, and the lower dust concentration limit for explosion was < 125 g/m³.
 - In an explosiveness test conducted according to national guideline VDI 2263, carbon black has a maximum rate of pressure rise of 46 bar m/s (= k-value), a maximum explosion gauge pressure of 6.7 bar, and a lower explosion limit of 250 g/m³.
 - Carbon black reduces strong oxidizers such as chlorates, bromates, and nitrates.
- NIOSH 2010
 - Finely dispersed particles form explosive mixtures in air.
- Available information is insufficient to classify the chemical according to GHS criteria for explosiveness. Due to its potential for explosion, ToxServices assigned a score of Moderate for this endpoint.

Flammability (F) Score (vH, H, M, or L): L

Carbon black was assigned a score of Low for flammability based on lack of flammability, although it is combustible. GreenScreen® criteria classify chemicals as a low hazard for flammability when adequate data are available and negative and they are not classified under GHS (CPA 2012a).

- Authoritative and Screening Lists
 - Not present on any authoritative or screening lists.
- ECHA 2013
 - Carbon blacks will burn slowly (smolder) and sustain combustion that may not be visible in the powder or pellet form. The burning process may be so slow as to not be obvious unless stirred, and sparks are apparent.
 - Combustibility is class 2: brief ignition and rapid extinction.
 - Carbon blacks have relatively high ignition energy (35 J) and do not ignite spontaneously below 640°C. It is classified as not flammable.

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APPENDIX A: Hazard Benchmark Acronyms
(in alphabetical order)

- (AA) Acute Aquatic Toxicity**
- (AT) Acute Mammalian Toxicity**
- (B) Bioaccumulation**
- (C) Carcinogenicity**
- (CA) Chronic Aquatic Toxicity**
- (D) Developmental Toxicity**
- (E) Endocrine Activity**
- (F) Flammability**
- (IrE) Eye Irritation/Corrosivity**
- (IrS) Skin Irritation/Corrosivity**
- (M) Mutagenicity and Genotoxicity**
- (N) Neurotoxicity**
- (P) Persistence**
- (R) Reproductive Toxicity**
- (Rx) Reactivity**
- (SnS) Sensitization- Skin**
- (SnR) Sensitization- Respiratory**
- (ST) Systemic/Organ Toxicity**

APPENDIX B: Results of Automated GreenScreen® Score Calculation for Carbon Black (CAS #1333-86-4)



 			GreenScreen® Score Inspector for Inhalation Exposure																			
			Table 1: Hazard Table																			
			Group I Human					Group II and II* Human								Ecotox		Fate		Physical		
			Carcinogenicity	Mutagenicity/Genotoxicity	Reproductive Toxicity	Developmental Toxicity	Endocrine Activity	Acute Toxicity	Systemic Toxicity	Neurotoxicity	Skin Sensitization*	Respiratory Sensitization*	Skin Irritation	Eye Irritation	Acute Aquatic Toxicity	Chronic Aquatic Toxicity	Persistence	Bioaccumulation	Reactivity	Flammability		
Table 2: Chemical Details																						
Inorganic Chemical?	Chemical Name	CAS#	C	M	R	D	E	AT	STs	STr	Ns	Nr	SNS*	SNR*	IrS	IrE	AA	CA	P	B	Rx	F
Yes	Carbon black	1333-86-4	H	L	L	L	DG	DG	vH	H	DG	DG	L	L	L	M	L	L	vH	L	M	L

Table 3: Hazard Summary Table							
Benchmark	a	b	c	d	e	f	g
1	No	No	Yes	No	Yes		
2	STOP						
3	STOP						
4	STOP						

Table 5: Data Gap Assessment Table												
Datagap Criteria	a	b	c	d	e	f	g	h	i	j	bm4	End Result
1												1
2												
3												
4												

Table 4	
Chemical Name	Preliminary GreenScreen® Benchmark Score
Carbon black	1

Note: Chemical has not undergone a data gap assessment. Not a Final GreenScreen™ Score

Table 6	
Chemical Name	Final GreenScreen® Benchmark Score
Carbon black	1

After Data gap Assessment
Note: No Data gap Assessment Done if Preliminary GS Benchmark Score is 1.



 			GreenScreen® Score Inspector for Oral Exposure																				
			Table 1: Hazard Table																				
			Group I Human					Group II and II* Human										Ecotox		Fate		Physical	
			Carcinogenicity	Mutagenicity/Genotoxicity	Reproductive Toxicity	Developmental Toxicity	Endocrine Activity	Acute Toxicity	Systemic Toxicity		Neurotoxicity		Skin Sensitization*	Respiratory Sensitization*	Skin Irritation	Eye Irritation	Acute Aquatic Toxicity	Chronic Aquatic Toxicity	Persistence	Bioaccumulation	Reactivity	Flammability	
Table 2: Chemical Details			C	M	R	D	E	AT	STs	STr	Ns	Nr	SNS*	SNR*	IrS	IrE	AA	CA	P	B	Rx	F	
Inorganic Chemical?	Chemical Name	CAS#	L	L	L	L	DG	L	L	L	DG	DG	L	L	L	M	L	L	PH	L	M	L	
Yes	Carbon black	1333-86-4																					

Table 3: Hazard Summary Table							
Benchmark	a	b	c	d	e	f	g
1	No	No	No	No	No		
2	No	No	No	No	No	No	No
3	No	No	Yes	Yes			
4	STOP						

Table 4	
Chemical Name	Preliminary GreenScreen® Benchmark Score
Carbon black	3
Note: Chemical has not undergone a data gap assessment. Not a Final GreenScreen™ Score	

Table 5: Data Gap Assessment Table												
Datagap Criteria	a	b	c	d	e	f	g	h	i	j	bm4	End Result
1												
2												
3	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		3
4												

Table 6	
Chemical Name	Final GreenScreen® Benchmark Score
Carbon black	3
After Data gap Assessment Note: No Data gap Assessment Done if Preliminary GS Benchmark Score is 1.	



 			GreenScreen® Score Inspector for Oral Exposure																			
			Table 1: Hazard Table																			
			Group I Human					Group II and II* Human								Ecotox		Fate		Physical		
			Carcinogenicity	Mutagenicity/Genotoxicity	Reproductive Toxicity	Developmental Toxicity	Endocrine Activity	Acute Toxicity	Systemic Toxicity		Neurotoxicity	Skin Sensitization*	Respiratory Sensitization*	Skin Irritation	Eye Irritation	Acute Aquatic Toxicity	Chronic Aquatic Toxicity	Persistence	Bioaccumulation	Reactivity	Flammability	
Table 2: Chemical Details																						
Inorganic Chemical?	Chemical Name	CAS#	C	M	R	D	E	AT	STs	STr	Ns	Nr	SNS*	SNR*	IrS	IrE	AA	CA	P	B	Rx	F
Yes	Carbon black	1333-86-4	L	L	L	L	DG	L	L	L	DG	DG	L	L	L	M	L	L	vH	L	M	L

Table 3: Hazard Summary Table							
Benchmark	a	b	c	d	e	f	g
1	No	No	No	No	No		
2	No	No	No	No	No	No	No
3	No	No	Yes	Yes			
4	STOP						

Table 4	
Chemical Name	Preliminary GreenScreen® Benchmark Score
Carbon black	3

Note: Chemical has not undergone a data gap assessment. Not a Final GreenScreen™ Score

Table 5: Data Gap Assessment Table												
Datagap Criteria	a	b	c	d	e	f	g	h	i	j	bm4	End Result
1												
2												
3	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		3
4												

Table 6	
Chemical Name	Final GreenScreen® Benchmark Score
Carbon black	3

After Data gap Assessment
Note: No Data gap Assessment Done if Preliminary GS Benchmark Score is 1.


			GreenScreen® Score Inspector for Dermal Exposure																			
			Table 1: Hazard Table																			
			Group I Human					Group II and II* Human								Ecotox		Fate		Physical		
			Carcinogenicity	Mutagenicity/Genotoxicity	Reproductive Toxicity	Developmental Toxicity	Endocrine Activity	Acute Toxicity	Systemic Toxicity		Neurotoxicity	Skin Sensitization*	Respiratory Sensitization*	Skin Irritation	Eye Irritation	Acute Aquatic Toxicity	Chronic Aquatic Toxicity	Persistence	Bioaccumulation	Reactivity	Flammability	
Table 2: Chemical Details																						
Inorganic Chemical?	Chemical Name	CAS#	C	M	R	D	E	AT	STs	STr	Ns	Nr	SNS*	SNR*	IrS	IrE	AA	CA	P	B	Rx	F
Yes	Carbon Black	1333-86-4	L	L	L	L	DG	L	L	L	DG	DG	L	L	L	M	L	L	vH	L	M	L

Table 3: Hazard Summary Table							
Benchmark	a	b	c	d	e	f	g
1	No	No	No	No	No		
2	No	No	No	No	No	No	No
3	No	No	Yes	Yes			
4	STOP						

Table 4	
Chemical Name	Preliminary GreenScreen® Benchmark Score
Carbon Black	3


Note: Chemical has not undergone a data gap assessment. Not a Final GreenScreen™ Score

Table 5: Data Gap Assessment Table												
Datagap Criteria	a	b	c	d	e	f	g	h	i	j	bm4	End Result
1												
2												
3	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		3
4												




Table 6	
Chemical Name	Final GreenScreen® Benchmark Score
Carbon Black	3

After Data gap Assessment
Note: No Data gap Assessment Done if Preliminary GS Benchmark Score is 1.

APPENDIX C: Pharos Output for Carbon Black (CAS #1333-86-4)



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CARBON BLACK

CAS RN: 1333-86-4

Synonyms: Acetylene black; Channel black; Furnace black; Lamp black; Thermal black; Carbon, amorphous; CI 77266; Pigment black 6; Pigment black 7

Detailed Direct Hazard Listings [Quickscreen](#)

CANCER	US CDC - Occupational Carcinogens (NIOSH-C) Occupational carcinogen - GreenScreen Benchmark 1 - occupational hazard only - HPD
CANCER	Cal/EPA - Chemicals Known to Cause Cancer & Reproductive Toxicity (Prop 65) Cancer (airborne particles of respirable size - occupational setting) - GreenScreen Benchmark 1 - occupational hazard only - HPD
CANCER	Intl Agency for Rsrch on Cancer - Cancer Monographs (IARC) Group 2b: Possibly carcinogenic to humans - inhaled from occupational sources - GreenScreen Benchmark Unspecified - occupational hazard only - HPD
CANCER	German MAK - List of Substances (MAK) Carcinogen Group 3B - Evidence of carcinogenic effects but not sufficient for classification - GreenScreen Benchmark Unspecified - HPD
CANCER	New Zealand HSNO/GHS (GHS-New Zealand) 6.7B - Suspected human carcinogens - GreenScreen Benchmark Unspecified
CANCER	Japan METI/MOE - GHS Classifications (GHS-Japan) Carcinogenicity - Category 2 - GreenScreen Benchmark Unspecified
MAMMALIAN	Japan METI/MOE - GHS Classifications (GHS-Japan) Specific target organs/systemic toxicity following repeated exposure - Category 1 - GreenScreen Benchmark Unspecified
MAMMALIAN	Québec CSST - WHMIS Classifications (WHMIS) Class D2A - Very toxic material causing other toxic effects - GreenScreen Benchmark Unspecified
EYE IRRITATION	New Zealand HSNO/GHS (GHS-New Zealand) 6.4A - Irritating to the eye - GreenScreen Benchmark Unspecified
SKIN IRRITATION	New Zealand HSNO/GHS (GHS-New Zealand) 6.3B - Mildly irritating to the skin - GreenScreen Benchmark Unspecified
EXEMPT	German FEA - Substances Hazardous to Waters (VwVwS) Non-Hazardous to Water (Water Hazard Class 0 NWG) - Not evaluated by GreenScreen

Compound Group Hazard Listings

[View Products Containing This Chemical](#)

Compound Groups

This chemical is a member of the following compound groups:

[COMPOUNDS WITH WARNINGS RESTRICTED TO RESPIRABLE FORMS](#)

Tags for this chemical

There are no tags for this chemical yet.

[Add a New Tag](#)

Sources

[Hazardous Substances Databank \(HSDB\) \(NHIS\)](#)

[Dow Product Safety Assessment: DOW Carbon Black Feed](#)

CAS Variants

[Carbon Black \(post-consumer\)](#)

Sources to Check for GreenScreen® Hazard Assessment

Note: For a GreenScreen® Hazard Assessment, data queries should be initially limited to the following references. If data gaps exist after these references have been checked, additional references may be utilized.

U.S. EPA High Production Volume Information System (HPVIS):

<http://www.epa.gov/hpvis/index.html>

UNEP OECD Screening Information Datasets (SIDS):

<http://www.chem.unep.ch/irptc/sids/OECDSEIDS/sidspub.html>

OECD Existing Chemicals Database: <http://webnet.oecd.org/hpv/ui/SponsoredChemicals.aspx>

European Chemical Substances Information System IUCLID Chemical Data Sheets:

<http://esis.jrc.ec.europa.eu/index.php?PGM=dat>

National Toxicology Program: <http://ntp.niehs.nih.gov/>

International Agency for the Research on Cancer:

<http://monographs.iarc.fr/ENG/Classification/index.php>

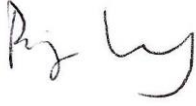
Human and Environmental Risk Assessment (HERA) on ingredients of household cleaning products:

<http://www.heraproject.com/RiskAssessment.cfm>

European Chemicals Agency (ECHA) REACH Dossiers: <http://echa.europa.eu/>

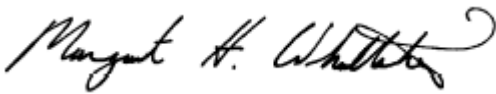
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