Diphenyl Dimethicone (CAS# 68083-14-7) GreenScreen® for Safer Chemicals (GreenScreen®) Assessment

Prepared for:

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GreenScreen® Executive Summary for Diphenyl Dimethicone (CAS #68083-14-7)

Diphenyl dimethicone is a chemical that functions as a heat-exchange fluid, dielectric coolant, impregnant for sintered metal bearing, base oil for high temperature fluids, and lubricating oil.

Diphenyl dimethicone was assigned a GreenScreen® Benchmark Score of 2 ("Use but Search for Safer Substitutes") as it has Very High persistence (P) and Moderate Group II Human Toxicity (eye irritation (IrE)). This corresponds to GreenScreen® benchmark classification 2c (High P + Moderate T (Ecotoxicity or Group I, II, or II* Human)) in CPA (2011). Data gaps (DG) exist for endocrine activity (E) and respiratory sensitization (SnR*). As outlined in CPA (2013) Section 12.2 (Step 8 – Conduct a Data Gap Analysis to assign a final Benchmark score), diphenyl dimethicone meets requirements for a GreenScreen® Benchmark Score of 2 despite the hazard data gaps. In a worst-case scenario, if diphenyl dimethicone were assigned a High score for the data gaps endocrine activity (E) or respiratory sensitization (SnR*), it would be categorized as a Benchmark 1 Chemical.

GreenScreen® Benchmark Score for Relevant Route of Exposure:
As a standard approach for GreenScreen® evaluations, all exposure routes (oral, dermal, and inhalation) were evaluated together, so the GreenScreen® Benchmark Score of 2 ("Use but Search for Safer Substitutes") is applicable for all routes of exposure.

GreenScreen® Hazard Ratings for Diphenyl Dimethicone

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*										
L	**L**	**L**	**L**	DG	**L**	**L**	**L**	**L**	**L**	**L**	DG	**L**	*M*	**L**	**L**	**vH**	**L**	*L*	**L**

Note: Hazard levels (Very High (vH), High (H), Moderate (M), Low (L), Very Low (vL)) in *italics* reflect estimated 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 Diphenyl Dimethicone (CAS #68083-14-7)

Method Version: GreenScreen® Version 1.2[1]
Assessment Type[2]: Certified

Chemical Name: Diphenyl dimethicone

CAS Number: 68083-14-7

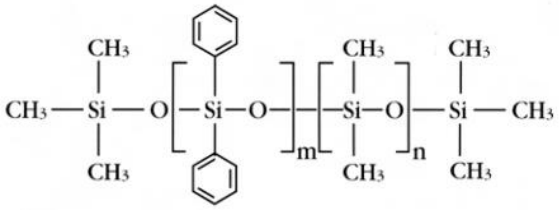
GreenScreen® Assessment Prepared By:
Name: Bingxuan Wang, Ph.D.

Title: Toxicologist
Organization: ToxServices LLC
Date: October 3, 2014
Assessor Type: Licensed GreenScreen® Profiler

Quality Control Performed By:
Name: Dr. Margaret H. Whittaker, Ph.D., M.P.H., CBiol., F.S.B., E.R.T., D.A.B.T.
Title: Managing Director and Chief Toxicologist
Organization: ToxServices LLC
Date: October 17, 2014

Confirm application of the *de minimus* rule[3]: N/A

Chemical Structure(s):



(Gelest Undated)

Also called: Diphenyl dimethicone (100 cst); Diphenyl dimethicone (170 cst); Diphenyl dimethicone (3000 cst); Diphenyl dimethicone (1000 cst); Diphenyl dimethicone (300 cst); Diphenyl dimethicone (400 cst); Siloxanes and silicones, di-Me, di-Ph; Polydimethyldiphenyl siloxane copolymer (ChemIDplus 2014)

For Polymers:
Identify Monomers and Corresponding Properties

1. % of Each Monomer: Not Provided
2. Are the monomers blocked? (Y/N): Not provided
3. Molecular Weight (MW) of Polymer: Not Provided
4. % of Polymer with
   a) MW <500: Not Provided
   b) MW <1,000: Not provided

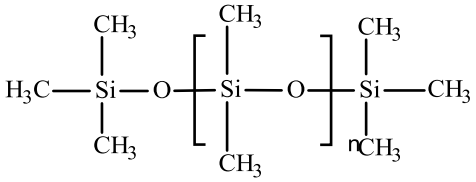
[1] Use GreenScreen® Assessment Procedure (Guidance) V1.2

[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

5. % Weight Residual Monomers: Not Provided
6. Solubility/Dispersability/Swellability: Not Provided
7. Particle Size: Not Provided
8. Overall Polymer Charge: Not Provided

Chemical Structure(s) of Chemical Surrogates Used in the GreenScreen®:
Limited toxicological data were identified for diphenyl dimethicone. Therefore, data on a structurally similar polymer, polydimethylsiloxane (PDMS) (CAS #63148-62-9, 9016-00-6, 9006-65-9) are used to support the evaluation of diphenyl dimethicone. For these PDMS chemicals, the molecular weights determine their viscosities, and the number of repeating units (n) governs the molecular weights. PDMS chemicals are high molecular weight silica polymers with viscosities ranging from 10 to > 100,000 cs, which correspond to the molecular weight of approximately 1,125 – 74,000, or n ≥ 13 (ECETOC 2011).



Polydimethylsiloxane (PDMS) (CAS #63148-62-9, 9016-00-6, 9006-65-9) (n≥13)

Identify Applications/Functional Uses:
1. Heat-exchange fluids
2. Dielectric coolants
3. Impregnants for sintered metal bearing
4. Base oils for high temperature fluids
5. Lubricating oils
(Gelest Undated)

GreenScreen® Summary Rating for Diphenyl Dimethicone[4]: Diphenyl dimethicone was assigned a GreenScreen® Benchmark Score of 2 ("Use but Search for Safer Substitutes") as it has Very High persistence (P) and Moderate Group II Human Toxicity (eye irritation (IrE)). This corresponds to GreenScreen® benchmark classification 2c (High P + Moderate T (Ecotoxicity or Group I, II, or II* Human)) in CPA (2011). Data gaps (DG) exist for endocrine activity (E) and respiratory sensitization (SnR*). As outlined in CPA (2013) Section 12.2 (Step 8 – Conduct a Data Gap Analysis to assign a final Benchmark score), diphenyl dimethicone meets requirements for a GreenScreen® Benchmark Score of 2 despite the hazard data gaps. In a worst-case scenario, if diphenyl dimethicone were assigned a High score for the data gaps endocrine activity (E) or respiratory sensitization (SnR*), it would be categorized as a Benchmark 1 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 Diphenyl Dimethicone

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*										
L	L	L	L	DG	L	L	L	L	L	L	DG	L	*M*	L	L	vH	L	*L*	L

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]

Polyphenylmethylsiloxanes such as diphenyl dimethicones are stable in closed oxygen-free systems for thousands of hours at 250ºC (Gelest Undated). Almost all PDMS are expected to be removed during sewage treatment. When released into the environment, PDMS will strongly sorb to particulate matter in water and soil, where they are immobilized. Abiotic break down will occur slowly to produce dimethylsilanediol (CAS #1066-42-8), a water soluble compound which can ultimately biodegrade to carbon dioxide, water and inorganic silicate, as demonstrated in the laboratory (ECETOC 2011). Based on the molecular formula of diphenyl dimethicone, possible combustion products are CO, CO_2 and silicon dioxide. All three chemicals (i.e., CO, CO_2 and silicon dioxide) are naturally occurring, ambient substances that are not relevant with respect to the GreenScreen® score for diphenyl dimethicone.

Functional Use	Life Cycle Stage	Transformation Pathway	Transformation Products	CAS #	Feasible and Relevant?	GreenScreen® List Translator Score or Benchmark Score[6,7]
Non-known	Intermediate	Abiotic Degradation	Dimethylsilanediol	1066-42-8	Yes	LT-U

Introduction

Diphenyl dimethicone is a copolymer of diphenylsiloxane and dimethylsiloxane. It is a thermal silicone fluid. The phenyl groups in the polymer structure improve the oxidation resistance, thermal stability and shear resistance. The compressibility of phenyl-containing siloxanes is reduced compared to dimethyl siloxanes (Gelest Undated).

[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.
[6] The GreenScreen® List Translator identifies specific authoritative or screening lists that should be searched to screen for GreenScreen® benchmark 1 chemicals (CPA 2012b). Pharos (Pharos 2014) is an online list-searching tool that is used to screen chemicals against the lists in the List Translator electronically.
[7] The way you conduct assessments for transformation products depends on the Benchmark Score of the parent chemical (See Guidance).

ToxServices assessed diphenyl dimethicone against GreenScreen® Version 1.2 (CPA 2013) following procedures outlined in ToxServices' SOP 1.69 (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 2014) is an online list-searching tool that is used to screen chemicals against the List Translator electronically. It checks all of the lists in the List Translator with the exception of the U.S. Department of Transportation (U.S. DOT) lists (U.S. DOT 2008a,b) and these should be checked separately in conjunction with running the Pharos query. The output indicates benchmark or possible benchmark scores for each human health and environmental endpoint. The output for diphenyl dimethicone can be found in Appendix C and a summary of the results can be found below:

- Diphenyl dimethicone is not listed in the Pharos database.

PhysicoChemical Properties of Diphenyl Dimethicone

Diphenyl dimethicone is a colorless, transparent liquid at room temperature. It is not volatile and not soluble in water. No further data are available.

Table 1: Physical and Chemical Properties of Diphenyl Dimethicone (CAS #68083-14-7)

Property	Value	Reference
Molecular formula	N/A	
SMILES Notation	N/A	
Molecular weight	N/A	
Physical state	Liquid	Clearco 2012
Appearance	Colorless, transparent	Clearco 2012
Melting point	-55ºC	Roth 2011
Vapor pressure	Negligible at 25ºC	Clearco 2012
Water solubility	Not soluble	Clearco 2012
Dissociation constant		
Density/specific gravity	1.07 at 25ºC	Clearco 2012
Partition coefficient	N/A	

Hazard Classification Summary Section:

Group I Human Health Effects (Group I Human)

Carcinogenicity (C) Score (H, M, or L): L

Diphenyl dimethicone was assigned a score of Low for carcinogenicity based on negative findings in rodents on PDMS. GreenScreen® criteria classify chemicals as a Low hazard for carcinogenicity when adequate negative data are available, the chemical does not have structural alerts for carcinogenicity, and it is not classified under GHS (CPA 2012a).

- Authoritative and Screening Lists
  - *Authoritative:* not on any authoritative lists
  - *Screening:* not on any screening lists
- ECETOC 2011
  - *Oral: PDMS (10 cs)* – In a combined chronic toxicity and carcinogenicity study, PDMS was

given to Fischer 344 rats (90/sex/dose) in the diet at doses of 0, 100, 300 or 1,000 mg/kg/day for 24 months. Ten animals/sex/group were killed at 12 months and 20 animals/sex/group were treated for 12 months followed by a 12-month recovery period. Clinical observations, body weight and food consumption were recorded during the study. Ophthalmoscopy and necropsies were performed on all animals, and select organ and tissue weights and microscopic examinations were obtained from all animals. Survival was not affected by the treatment, nor was the occurrence of palpable masses. No treatment related changes were observed on body weight, food consumption, clinical pathology parameters, ophthalmic findings, organ weights and macroscopic and microscopic findings. Slightly increased (statistical significance not reported) incidences of ocular opacities were found in the 300 mg/kg/day females and the 1,000 mg/kg/day males and females, which were most probably the result of local irritation from contacting PDMS-containing food. Increased (statistical significance not reported) incidences of eye opacity were found in the chronic recovery group without dose-response in males, which may be treatment-related. The eye opacity correlated with the microscopic findings of keratitis and with the incidental microscopic findings of corneal dystrophy, but these effects were not considered directly related to the ingestion of PDMS. No indication of carcinogenicity was observed for PDMS.

  - *Oral: KS66 (a mixture containing 92% PDMS and 8% silica)* – Fischer 344 rats (50/sex/dose) received KS66 in the diet at doses of 0%, 1.25% or 5% (average intakes were 0, 444.9, and 1893.9 mg/kg/day in females and 0, 530.1 and 2,233.9 mg/kg/day for males) for 104 weeks. Parameters examined included general health, signs of toxicity, body weight and food intake. At necropsy, hematological measurements were performed, including red blood cell/white blood cell counts, hemoglobin concentration, hematocrit values and platelet counts. Blood smears were checked for leukemia. Gross pathology was done and organ weights were measured for the brain, liver, kidneys, spleen, heart, adrenals and testes/ovaries. Full histopathology was performed on the control and highest dose groups. No changes were observed on physical appearance and behavior of the rats. No treatment-related effects were seen on survival, food consumption and hematology. Some rats in the low dose group died or became moribund and therefore were killed during the study. Body weight increase was found in all dosed females and in low dose males (statistical significance not reported). Relative liver weights in males receiving the high dose were significantly decreased (statistical significance not specified). A significant (statistical significance not reported) increase in the incidence of thyroid C-cell adenomas was observed in high dose females, but the authors considered this change spontaneous based on historical data. The incidence of prostate carcinomas was significantly decreased in the high dose males (statistical significance not reported). No differences in the incidence of other neoplastic and non-neoplastic lesions were found between the treated and control animals. It was concluded that KS66 is not carcinogenic in Fischer 344 rats of either sex.

- HSDB 2011
  - *Oral: Silicone antifoam agent (94% PDMS and 6% finely divided silica)* – Male and female Carshalton bred mice (number not reported) received the test material in the diet at doses of 9.25 and 2.5% (up to 3,750 mg/kg/day (ECETOC 2011)) for 76 weeks from weaning. No increase in malignant or benign tumor and no treatment-related toxic effects were found.

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

Diphenyl dimethicone was assigned a score of Low for mutagenicity/genotoxicity based on negative *in vitro* and *in vivo* test results on PDMS. GreenScreen® criteria classify chemicals as a Low hazard for mutagenicity/genotoxicity when adequate negative data are available for both chromosomal aberrations and gene mutations, the chemical does not have structural alerts, and they are not GHS-classified (CPA 2012a).

- Authoritative and Screening Lists
  - *Authoritative:* not on any authoritative lists
  - *Screening:* not on any screening lists
- ECETOC 2011
  - *In vitro: PDMS (60,000 cs)* – Negative in Bacterial Reverse Mutation Assays using *S. typhimurium* tester strains TA98, TA100, TA1535 and TA1537, and *E. coli* strains WP2 uvrA and WP2 uvrA (pKM 101) with and without metabolic activation at concentrations of up to 5,000 µg/plate.
  - *In vitro: PDMS (350 cs)* – Negative for mutagenicity in a plate incorporation assay (Ames test) using *S. typhimurium* tester strains TA98, TA100, TA1535, TA1537 and TA1538 with and without metabolic activation at concentrations up to 100 µl/plate.
  - *In vitro: PDMS (50 cs)* – Negative for mutagenicity in Ames tests using *S. typhimurium* tester strains TA98, TA100, TA1535, TA1537 and TA1538 with and without metabolic activation at concentrations of up to 500 µl/plate.
  - *In vitro: PDMS (0.65, 100 and 1,000 cs)* – Negative for mutagenicity in Ames tests using *S. typhimurium* tester strains TA98, TA100, TA1535, TA1537 and TA1538 with and without metabolic activation (concentrations not reported).
- Isquith et al. 1988a,b
  - *In vitro: 12 organosilicon compounds representing potential intermediates in the synthesis and degradation of PDMS (identity not reported in the abstract)* – In a battery of assays, including Ames bacterial mutation assay in *S. typhimurium*, mitotic gene conversion in *S. cerevisiae* D4 and DNA repair in *E. coli pol* $A^{+/-}$, forward gene mutation, sister-chromatic exchange, DNA alkaline elution and chromosome aberration potential in mouse lymphoma L5178Y cells with and without metabolic activation, none of the 12 organosilicon compounds were mutagenic. However, 6 demonstrated potential clastogenic activity.
  - *In vivo: 6 organosilicon compounds with clastogenic activity tested in vitro as above (identity not reported in the abstract)* – In rat bone marrow cytogenetic assays and rat dominant lethal tests, none of the 6 compounds showed *in vivo* clastogenic activities. It was concluded that organosilicon compounds involved in the synthesis and degradation of PDMS were not genotoxic in these *in vivo* clastogenicity tests.
- Gene-Tox 1992
  - *In vivo: PDMS DC 360* – Negative for chromosome effects in a dominant lethal test in mammalian germ cells in male rodents (species not specified). No further details were provided.

Reproductive Toxicity (R) Score (H, M, or L): L

Diphenyl dimethicone was assigned a score of Low for reproductive toxicity based on negative findings in male rodents on PDMS. GreenScreen® criteria classify chemicals as a Low hazard for reproductive toxicity when adequate negative data are available, the chemicals do not have any structural alerts and are not classified under GHS (CPA 2012a).

- Authoritative and Screening Lists
  - *Authoritative:* not on any authoritative lists

  - *Screening:* not on any screening lists
- ECETOC 2011
  - *Oral: PDMS (350 cs)* – Male Sprague-Dawley rats (10/dose) received PDMS at the concentrations of 0 (water) or 1,000 mg/kg/day for 5 days/week for 4 weeks. Body weights, food consumption, and clinical observations were monitored throughout the study. At sacrifice, the weights of testes, epididymides and prostate were recorded. No adverse effects were seen on any of the parameters measured. As a result, no treatment related effects were observed on male reproductive organs. The NOAEL was established at over 1,000 mg/kg/day.
  - *Dermal: PDMS (350 cs)* – Five male albino rabbits received PDMS at 3,000 mg/kg/day on the shaved backs for 5 days /week for 4 weeks (the equivalent dose for a 7-day week is 2,143 mg/kg/day). Following each dosing, the animals were immobilized in restrainers for 6-7 hours, before the test material was gently swabbed from them. Control animals received water or "white's A&D ointment" without hexachlorophene. Body weight was monitored during the study and semen samples were collected weekly. At necropsy, testes and epididymides were removed, weighed and examined microscopically. Semen samples were evaluated for volume, viscosity and color, sperm number, motility and morphology. No effects were seen on any of the measured parameters and the NOAEL was considered to be >2,143 mg/kg/day.

Developmental Toxicity incl. Developmental Neurotoxicity (D) Score (H, M, or L): L
Diphenyl dimethicone was assigned a score of Low for developmental toxicity based on negative findings in rabbits on PDMS. GreenScreen® criteria classify chemicals as a Low hazard for developmental toxicity when adequate negative data are available, the chemicals do not have structural alerts and are not GHS-classified (CPA 2012a).

- Authoritative and Screening Lists
  - *Authoritative:* not on any authoritative lists
  - *Screening:* not on any screening lists
- ECETOC 2011
  - *Oral: PDMS (10 or 350 cs)* – Pregnant New Zealand White rabbits (23/dose) were treated with PDMS at dose levels of 0, 33, 300 or 1,000 mg/kg/day by gavage from days 6 – 19 after mating. None of the reproductive parameters (not specified in the summary) were significantly affected. No significant changes in the incidence of abnormalities in the offspring (not specified in the summary) were observed. The NOAEL was established at 1,000 mg/kg/day.

Endocrine Activity (E) Score (H, M, or L): DG
Diphenyl dimethicone was assigned a score of Data Gap for endocrine disruption based on lack of data.

- Authoritative and Screening Lists
  - *Authoritative:* not on any authoritative lists
  - *Screening:* not on any 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): L

Diphenyl dimethicone was assigned a score of Low for acute toxicity based on measured data. GreenScreen® criteria classify chemicals as a Low hazard for acute toxicity when oral LD_{50} values > 2,000 mg/kg and inhalation LC_{50} > 5 mg/L (dust/mist/fumes) (CPA 2012a).

- Authoritative and Screening Lists
  - *Authoritative:* not on any authoritative lists
  - *Screening:* not on any screening lists
- RTECS 2006
  - 1h-inhalation LC_{50} = 18,000 mg/m^3 = 18 mg/L in rats
  - Oral LD_{Lo} = 16,380 mg/kg in rats
- TSCATS 2014
  - Oral LD_{50} > 65,600 mg/kg in rats
- Clearco 2012
  - Oral LD_{50} > 5,000 mg/kg in rats

Systemic Toxicity/Organ Effects incl. Immunotoxicity (ST)

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

Diphenyl dimethicone was assigned a score of Low for systemic toxicity (single dose) based on lack of systemic toxicity at single exposure of less than 24 mg/L (inhalation) and at 65, 500 mg/kg (oral). GreenScreen® criteria classify chemicals as a Low hazard for systemic toxicity (single dose) when no systemic toxicity is observed at doses of 5 mg/L (inhalation) and 2,000 mg/kg (oral), and no respiratory irritation is observed (CPA 2012a).

- Authoritative and Screening Lists
  - *Authoritative:* not on any authoritative lists
  - *Screening:* not on any screening lists
- TSCATS 2014
  - In the acute inhalation toxicity study that established the LC_{50} of 18 g/m^3 in rats, animals showed labored respiration at the end of the exposure period (dose not specified). Deaths (1/dose) during exposure were found at 42 and 101 mg/L. Deaths that occurred post exposure generally occurred within the first 24 hours. Deaths were mainly the results of severe pulmonary hemorrhages. Granular livers were observed in 30% of the animals at doses greater than 24 mg/L, and enlarged and hyperemic lymph nodes were found in several rats at each dose (not specified). Pulmonary consolidation varying from small pinkish orange petechial to major involvement were found at unspecified doses.
  - In the acute oral toxicity study that established the oral LD_{50} of > 65,500 mg/kg in rats, abdominal pain, subsequent excessive laxation and urinary incontinence were observed at unspecified doses. One rat died at each of the three highest doses (not specified), which occurred 3 or more days after exposure. Necropsy did not find gross abnormalities 14 days after exposure. Animals that died during the study had diffuse pulmonary hemorrhage and petechial hepatic hemorrhage.

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

Diphenyl dimethicone was assigned a score of Low for systemic toxicity (repeated dose) based on limited data on diphenyl dimethicone via dermal exposure supported by data on PDMS. GreenScreen® criteria classify chemicals as a Low hazard for systemic toxicity (repeated dose) when oral effect levels are greater than 100 mg/kg/day and/or dermal effect levels are greater than 200 mg/kg/day (for 90-day studies) (CPA 2012a).

- Authoritative and Screening Lists
  - *Authoritative:* not on any authoritative lists
  - *Screening:* not on any screening lists
- TSCATS 2014
  - A 28-day dermal biological activity study was conducted in rabbits. 10 males received the undiluted test material at 200 mg/kg/day. No adverse effects were observed regarding mortality, behavioral effects, local skin reactions, body weight changes, gross pathology, histology of testes, and absolute and relative testes weights. ToxServices identified the NOAEL at 200 mg/kg/day based on the lack of adverse effects observed.
    - For 28-day studies, the GHS guidance values are tripled from 200 mg/kg/day to 600 mg/kg/day for category 2 classification. The NOAEL of 200 mg/kg/day is below the threshold and no data were available at 600 mg/kg/day.
- Oral and dermal pharmacokinetic studies on PDMS (10 and 350 cs) indicate that this inert polymer has essentially no potential for absorption (ECETOC 2011). Oral studies conducted in animals consistently found ocular opacity at doses as low as 300 mg/kg/day in a chronic dietary study (no such effects were observed at 100 mg/kg/day) and microscopic changes and keratitis. Although the study authors attributed the effect to direct eye contact with food, a 90-day oral study revealed that ocular effects were found in animals exposed to PDMS via gavage and diet in a dose-dependent manner (it should be noted that this effect was also found in control animals). No explanation was provided for the ocular results in controls or in treated animals dosed by gavage. Human oral studies revealed that PDMS at doses up to 2% (580 mg/kg/day) did not cause any adverse effects. At higher doses, however, flatulence and some changes in hematology were found, with unknown clinical significance. The weight of evidence suggests that no adverse systemic effects are expected to happen with PDMS at the oral dose of 100 mg/kg/day and greater. Dermal studies in rabbits did not find any adverse effects at doses of up to 1,000 mg/kg/day. Inhalation exposure to PDMS did not induce any adverse effects at doses tested up to 0.45 mg/L.

Neurotoxicity (N)

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

Diphenyl dimethicone was assigned a score of Low for neurotoxicity (single dose) based on lack of neurotoxicity after PDMS exposure. GreenScreen® criteria classify chemicals as a Low hazard for neurotoxicity (single dose) when adequate negative data are available, chemicals have no structural alerts, and are not GHS-classifiable (CPA 2012a).

- Authoritative and Screening Lists
  - *Authoritative:* not on any authoritative lists
  - *Screening:* not on any screening lists
- Not classified as a developmental neurotoxicant (Grandjean and Landrigan 2006, 2014).
- ECETOC 2011
  - None of the single dose acute toxicity studies described under Systemic Toxicity Single Dose section reported any adverse neurological effects. It was not clear, however, if neurological endpoints were examined in all the studies. Those that specified some neurological examinations are described again below:

  - *Dermal: PDMS (350cs)* – Sprague-Dawley rats (5/sex) received PDMS on the skin at 2,008 mg/kg according to OECD Test Guideline 402. No behavioral abnormalities were noted during the test period (up to 14 days post dosing).
  - *Inhalation: PDMS (100,000 cs)* – Wistar rats (5/sex/group) received PDMS dissolved in dichloromethane via aerosol inhalation accordance with OECD Test Guideline 403. Exposure concentrations were 0, 153.5, 322.0, 334.6 and 694.8 mg/m^3. The top dose was the highest technically achievable concentration. A 14-day observation period followed the exposure. No changes in reflexes were observed with treatment.
- Based on the weight of evidence and the non-absorption of PDMS, no neurotoxicity is expected to happen as a result of diphenyl dimethicone exposure at oral dose of 2,008 mg/kg and inhalation dose of 0.695 mg/L (highest technically achievable concentration). These data indicate that diphenyl dimethicone is not classifiable under GHS.

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

Diphenyl dimethicone was assigned a score of Low for neurotoxicity (repeated dose) based on limited data on diphenyl dimethicone supported by data on PDMS. GreenScreen® criteria classify chemicals as a Low hazard for neurotoxicity (repeated dose) when adequate negative data are available, the chemicals have no structural alerts, and they are not GHS-classified (CPA 2012a).

- Authoritative and Screening Lists
  - *Authoritative:* not on any authoritative lists
  - *Screening:* not on any screening lists
- Not classified as a developmental neurotoxicant (Grandjean and Landrigan 2006, 2014).
- TSCATS 2014
  - A 28-day dermal biological activity study was conducted in rabbits. 10 males received the undiluted test material at 200 mg/kg/day. No adverse behavioral effects were observed. ToxServices identified the NOAEL at 200 mg/kg/day for neurotoxicity.
    - For 28-day studies, the GHS guidance values are tripled from 200 mg/kg/day to 600 mg/kg/day for category 2 classification. The NOAEL of 200 mg/kg/day is below the threshold and no data were available at 600 mg/kg/day.
- ECETOC 2011
  - None of the repeat dose toxicity studies identified reported any adverse neurological effects. It was not clear, however, if neurological endpoints were examined in all the studies. Those that specified some neurological examinations are described again below:
  - *Oral*: *PDMS (35, 350 or 1,000 cs)* – In a subchronic oral toxicity study, male rats (100/group, strain not specified) received PDMS in the diet at 10% (equivalent to 9,600 mg/kg/day[8]) for 90 days. No treatment-related behavioral changes were seen in any group.
  - *Oral: KS66 (a mixture containing 92% PDMS and 8% silica)* – Fischer 344 rats (50/sex/dose) received KS66 in the diet at doses of 0, 1.25% or 5% (average intakes were 0, 444.9, and 1893.9 mg/kg/day in females and 0, 530.1 and 2,233.9 mg/kg/day for males) for 104 weeks. No changes were observed on the behavior of the rats.

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

Diphenyl dimethicone was assigned a score of Low for skin sensitization based on data on PDMS. GreenScreen® criteria classify chemicals as a Low hazard for skin sensitization when adequate negative data are available, the chemicals have no structural alerts, and are not GHS-classified (CPA 2012a).

[8] Average food factor for rats in subchronic studies is 0.096 kg/kg/day (U.S. EPA 1988). 10% in the diet is therefore 10% x 96 g/kg/day = 9.6 g/kg/day = 9,600 mg/kg/day.

- Authoritative and Screening Lists
  - *Authoritative:* not on any authoritative lists
  - *Screening:* not on any screening lists
- ECETOC 2011
  - The sensitization potential for PDMS of different viscosities (10 to 60,000 cs) was tested in multiple studies in mice, guinea pigs and 83 human subjects, and no evidence of cutaneous allergenic potential was displayed.
  - *PDMS (12,500 cs):* In a repeated insult patch test in humans, PDMS was used as a solvent control to dissolve a not specified substance at 5% (v/v). The study population consisted of 115 subjects between 18 and 70 years old. Aliquots of 0.2 ml study material and PDMS were applied under semi-occlusive conditions. The induction phase included 9 consecutive applications. The challenge phase was initiated during the 6th week of the study. Under the conditions of this study, no evidence of sensitization was found.

Respiratory Sensitization (SnR) Group II* Score (H, M, or L): DG
Diphenyl dimethicone was assigned a score of Data Gap for respiratory sensitization based on lack of data.

- Authoritative and Screening Lists
  - *Authoritative:* not on any authoritative lists
  - *Screening:* not on any screening lists
- No data were identified.

Skin Irritation/Corrosivity (IrS) Group II Score (vH, H, M, or L): L
Diphenyl dimethicone was assigned a score of Low for skin irritation/corrosivity based on being not classifiable under GHS. 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 classifiable under GHS (CPA 2012a).

- Authoritative and Screening Lists
  - *Authoritative:* not on any authoritative lists
  - *Screening:* not on any screening lists
- TSCATS 2014
  - A primary dermal irritation study was conducted in rabbits. Very slight erythema was noted in 5/6 abraded sites and 2/6 intact sites for up to 96 hours. This effect was reversible by day 7. It was concluded that the primary irritation score was 0.58. The concentration tested was not specified.
- Based on the weight of evidence, diphenyl dimethicone did not induce skin irritation with severities that warrant GHS classification.

Eye Irritation/Corrosivity (IrE) Group II Score (vH, H, M, or L): *M*
Diphenyl dimethicone was assigned a score of Moderate for eye irritation/corrosivity based on limited available data. GreenScreen® criteria classify chemicals as a Moderate hazard for eye irritation/corrosivity when classified as GHS category 2B (CPA 2012a).

- Authoritative and Screening Lists
  - *Authoritative:* not on any authoritative lists
  - *Screening:* not on any screening lists
- RTECS 2006
  - Diphenyl dimethicone produced mild irritating effects in the eyes of rabbits when applied at 100 µL for 24 hours. No further details were provided.

- TSCATS 2014
    - When applied undiluted to the eyes of rabbits, diphenyl dimethicone produced slight and transient irritation, with the maximum score of no more than 8/110 observed on day 1. All the effects were reversible within 2 or 3 days, regardless of rinsing status. It was concluded that this compound was only slightly and transiently irritating to the eyes.
    - In a primary eye irritation study in rabbits, only conjunctival redness (grade 1) was noted in four eyes 24 hours after application, which persisted in two eyes to 48 hours. No effects were observed regarding corneal opacity, iritis, and conjunctival chemosis or discharge. All effects were reversible by 72 hours.
- ECHA 2014
    - Diphenyl dimethicone is self-classified to H319: causes serious eye irritation by 35 of 118 total notifiers.
- Based on the weight of evidence, available studies did not report sufficient details for accurate classification under GHS. However, based on the qualitative descriptions, diphenyl dimethicone is at most a GHS category 2B irritant, which corresponds to a score of Moderate. Some industries classified this diphenyl dimethicone to H319, which corresponds to a score of High. ToxServices assigned a Moderate score based on available limited data. Confidence level was reduced due to lack of study details.

Ecotoxicity (Ecotox)

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

Diphenyl dimethicone was assigned a score of Low for acute aquatic toxicity based on data on PDMS. GreenScreen® criteria classify chemicals as a Low hazard for acute aquatic toxicity when L/EC_{50} values are > 100 mg/L (CPA 2012a).

- Authoritative and Screening Lists
    - *Authoritative:* not on any authoritative lists
    - *Screening:* not on any screening lists
- ECETOC 2011
    - *Fish:* Early studies conducted with PDMS concentrations far in excess of their low water solubility (<1 ng/L) demonstrated that PDMS has very low acute toxicity to fish. Nominal LD_{50} values were generally greater than 1,000 mg/L.
    - *Daphnia:* PDMS fluids have been tested in daphnia at concentrations above water solubility. Physical entrapment of daphnia may be observed when excess undissolved PDMS form a surface film. Therefore, these early studies are not relevant to the assessment of aquatic toxicity for PDMS.
    - *Daphnia: PDMS (50, 350 and 1,000 cs)* – Using a water soluble fraction and water accommodated fraction techniques, PDMS fluids were tested at concentrations of 50 – 100 ng/L. No mortalities were observed after 48 hours. According to ECETOC, as most of the water extractable silicon was lost probably due to evaporation from the test system, water accommodated fractions and water soluble fractions, these tests cannot be used to determine an accurate LC_{50} or NOEC value.
    - *Marine copepod: PDMS (10 cs)* – 48 h LC_{50} (immobilization) > 88,865 mg/L (the concentration refers to PDMS-water mix from which the water accommodated fraction was derived, rather than the final solution).

  - *Marine algae: PDMS (10 cs)* – EC_{50} (growth and biomass) > 100,000 mg/L (nominal) in the diatom alga *Skeletonema costatum*. A slight effect on biomass was seen at 33,900 mg/L.
- Based on the weight of evidence, no adverse effects or even mortality were seen in aquatic organisms exposed to PDMS at concentrations far exceeding its water solubility. Therefore, the acute aquatic toxicity of diphenyl dimethicone is expected to be low.

Chronic Aquatic Toxicity (CA) Score (vH, H, M, or L): L
Diphenyl dimethicone was assigned a score of Low for chronic aquatic toxicity based on data on PDMS. GreenScreen® criteria classify chemicals as a Low hazard for chronic aquatic toxicity when ChV/NOEC are greater than 10 mg/L (CPA 2012a).

- Authoritative and Screening Lists
  - *Authoritative:* not on any authoritative lists
  - *Screening:* not on any screening lists
- ECETOC 2011
  - *Fish: PDMS (50 cs)* – In a fish early life-stage test, sheepshead minnow (*Cyprinodon variegatus*) embryos and larvae were exposed to PDMS emulsion for 33 days. Adverse effects on hatchability were observed at 212 mg/L. However, the emulsion control without PDMS also induced significant mortality and reduction in larval weight and length compared to the blank, and therefore emulsion components at least partially contributed to the adverse effects seen.
  - *Fish: PDMS (350 cs)* – In a 28-day feeding study, rainbow trout (*Oncorhynchus mykiss*, 10 in total) received PDMS at an estimated dose of 10,000 mg/kg/day. Fish were allowed a 14-day recovery after exposure. No mortality or changes in behavior or growth were observed. No abnormalities were found upon histopathologic examination of skin, muscle, liver, bile, adrenal, stomach and gut.
  - *Daphnia: PDMS (350 cs)* – As most PDMS in water is absorbed to particulate matter, aquatic organisms are most likely exposed to PDMS through sediment. In a 21-day life-cycle study, sediments with a medium (2-4%) organic carbon content were treated with 572 ± 23 mg/kg (measured) radiolabelled PDMS. Daphnids (60/group) were exposed to PDMS in flow-through test chambers for 21 days. The number of immobilized parental daphnids, cumulative number of offspring produced per adult female, and growth of offspring were evaluated. No adverse effects were observed in the study, and no radioactivity was detected in the overlying water during the study.
- Based on the weight of evidence, no adverse effects or even mortality were seen in aquatic organisms exposed to PDMS at concentrations exceeding water solubility. Therefore, the chronic aquatic toxicity of diphenyl dimethicone is expected to be low.

Environmental Fate (Fate)

Persistence (P) Score (vH, H, M, L, or vL): vH
Diphenyl dimethicone was assigned a score of Very High for persistence based on data on PDMS. GreenScreen® criteria classify chemicals as a Very High hazard for persistence when the degradation half-lives are greater than 60 days in water and 180 days in soil/sediment (CPA 2012a).

- Authoritative and Screening Lists
  - *Authoritative:* not on any authoritative lists
  - *Screening:* not on any screening lists
- HSDB 2011
  - *PDMS (300 cs):* No biodegradation was seen for C^{14}-labelled PDMS exposed to activated

sludge for 70 days.
    - *PDMS (viscosity not specified):* Less than 10% biodegradation was observed when PDMS were incubated with activated sludge under aerobic and anaerobic conditions for approximately 2 months.
    - *PDMS (viscosity not specified):* In a 4-year field study, biodegradation half-life ranged from 876 days (in the top 10 cm of soil) to 1443 days, and over 50% loss was observed in the 0 – 2 cm layer over a 6-month growing season. The data suggest that biodegradation is not an important environmental fate process for PDMS.
    - *PDMS (204 cs):* C^{14}-labelled PDMS was added to moist soil and allowed to dry in order to generate silanols; fresh soil was then added and incubated for 4 months. Volatilization, oxidation, covalent bonding with the soil, and microbial mediated mineralization were responsible for the generation of small quantities of $C^{14}O_2$.
- PDMS compounds have measured biodegradation half-life of greater than 70 days in water, and greater than 180 days in soil.

Bioaccumulation (B) Score (vH, H, M, L, or vL): L
Diphenyl dimethicone was assigned a score of Low for bioaccumulation based on data on PDMS. GreenScreen® criteria classify chemicals as a Low hazard for bioaccumulation when BCFs are between 100 – 500 (CPA 2012a).

- Authoritative and Screening Lists
    - *Authoritative:* not on any authoritative lists
    - *Screening:* not on any screening lists
- HSDB 2011
    - *PDMS (MW 1,200 – 56,000):* Bioconcentration of PDMS fluids were measured in silver carp. Following a 72-hour incubation period, fish had mean BCF values of 2.9, 7.1, 386 and 1,250 for molecular weights of 1,200, 6,000, 25,000 and 56,000, respectively.
    - *PDMS (viscosity not specified):* Phytoplankton (*Tetraselmis sp.*) exposed to PDMS for 9 days and then fed to mollusks (*Mytilis edulis*) for 12 days showed no evidence of bioconcentration.
    - *PDMS (viscosity not specified):* Phytoplankton and crustacean (*Artemia salina*) were exposed to PDMS for 8 days before being fed to gold fish (*Carassius auratus*) for 15 days. No bioconcentration was observed.
    - *PDMS (viscosity not specified):* Annelids (*Nereis diversicolor*) were exposed to PDMS for 8 days before being fed to fish (*Scorpaena porcus*) or crabs (*Carcinus maenas*) for 15 days. A BCF of less than 1 was observed.
- ECETOC 2011
    - PDMS fluids with viscosities > 10 cs are expected to have log K_{ow} values greater than 10. Measuring log K_{ow} is difficult due to extremely low water solubility (< 1 ng/L). Using reverse phase HPLC, PDMS with up to 14 repeating ($Si[CH_3]_2$) units were measured. Log K_{ow} increased with molecular weight and PDMS with 14 repeating siloxy units had a log K_{ow} of 12.5. The number of repeating units in PDMS of viscosity > 10 cs is greater than 14 and therefore log K_{ow} of linear PDMS (viscosity > 10 cs) is expected to be greater than 14.
    - *Linear PDMS with 2 – 7 repeating siloxy groups:* No detectable uptake (detection limit 0.3 mg/kg) was seen in rainbow trout after 56 days of exposure to water containing 24 µg/L colloidal dispersion.
    - *PDMS (5cs, with an average of 12 siloxy repeating units):* Dietary exposure of gold fish for 67 days and guppy (*Poecilia reticulata*) for 20 days resulted in the detection of lower molecular weight PDMS in some fish tissue samples but no PDMS molecules more than 12

siloxy units (MW > 1,050) were found. Linear siloxanes with MW > 1,050 showed no bioconcentration or bioaccumulation in fish.
    - *PDMS (200 and 350 cs):* In two benthic macro-invertebrates, the midge larva of *Chironomus tentans* and the sediment worm *Lumbriculus variegatus*, no or limited bioaccumulation was found when they were exposed to up to 560 mg/kg (dry weight) PDMS in the sediment.
    - *PDMS (350 cs):* In an uptake-depuration study, no bioaccumulation potential was found in earthworms (*Eisenia foetida*) at nominal soil concentrations of 100 or 1,000 mg/kg after a 28-day exposure phase followed by a 14-day depuration period.
- Only one study reported that PDMS may have high bioaccumulation potentials, for which limited details were provided for examination. Measured data from other studies in aquatic, soil and sediment organisms on PDMS revealed that diphenyl dimethicone is not expected to be bioavailable and hence unlikely to have any bioaccumulation potential.

Physical Hazards (Physical)

Reactivity (Rx) Score (vH, H, M, or L): *L*
Diphenyl dimethicone was assigned a score of Low for reactivity based on lack of explosiveness. GreenScreen® criteria classify chemicals as a Low hazard for reactivity when they are not explosive, and there are no data indicating that they are reactive otherwise (CPA 2012a). Confidence level was adjusted due to lack of data and authoritative listings.

- Authoritative and Screening Lists
    - *Authoritative:* not on any authoritative lists
    - *Screening:* not on any screening lists
- Clearco 2012
    - A commercial preparation of diphenyl dimethicone (100%) is considered stable with no hazardous polymerization expected to occur.
- Roth 2011
    - Diphenyl dimethicone does not present an explosion hazard.

Flammability (F) Score (vH, H, M, or L): L
Diphenyl dimethicone was assigned a score of Low for flammability based on not being classifiable under GHS as a flammable liquid. GreenScreen® criteria classify chemicals as a Low hazard for flammability when flash points > 93ºC for liquids (CPA 2012a).

- Authoritative and Screening Lists
    - *Authoritative:* not on any authoritative lists
    - *Screening:* not on any screening lists
- Clearco 2012
    - Flashpoint of a 100% diphenyl dimethicone preparation is > 94ºC as determined by the closed cup method, and > 300ºC as determined by the open cup method.
- Roth 2011
    - Diphenyl dimethicone has a flash point of 315ºC.

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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 Diphenyl Dimethicone (CAS #68083-14-7)

TOXSERVICES
TOXICOLOGY RISK ASSESSMENT CONSULTING

GreenScreen® Score Inspector

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									S	R *	S	R *	*	*								
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**
No	**Diphenyl Dimethicone**	**68083-14-7**	**L**	**L**	**L**	**L**	DG	**L**	**L**	**L**	**L**	**L**	**L**	DG	**L**	*M*	**L**	**L**	**vH**	**L**	*L*	**L**

Table 3: Hazard Summary Table

Benchmark	a	b	c	d	e	f	g
1	No	No	No	No	No		
2	No	No	Yes	No	No	No	No
3	STOP						
4	STOP						

Table 4

Chemical Name	Preliminary GreenScreen® Benchmark Score
Diphenyl Dimethicone	2

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

Table 6

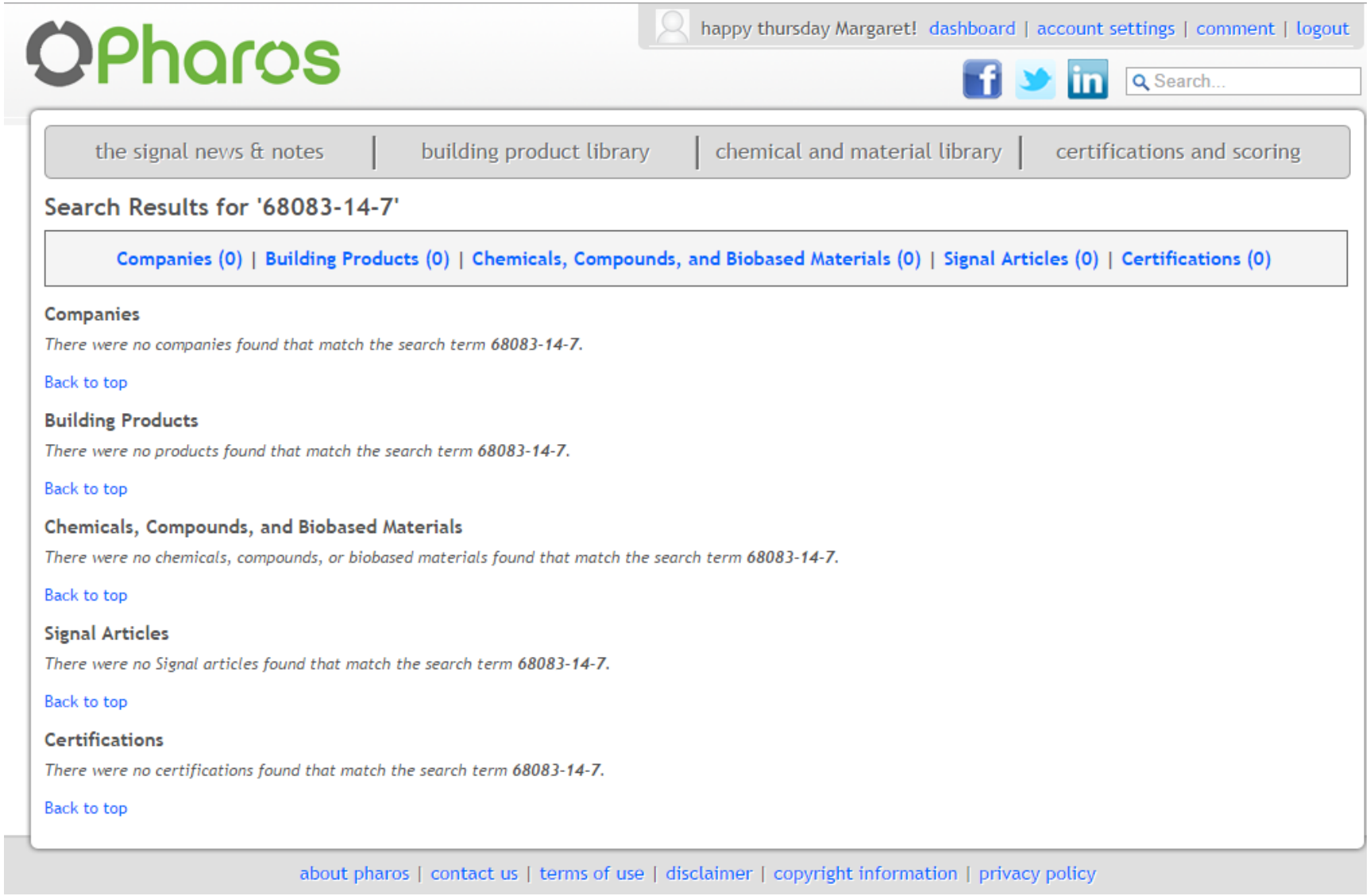
Chemical Name	Final GreenScreen® Benchmark Score
Diphenyl Dimethicone	2

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

Table 5: Data Gap Assessment Table

Datagap Criteria	a	b	c	d	e	f	g	h	i	j	bm4	End Result
1												
2	Yes	Yes	Yes	Yes	Yes							2
3												
4												

APPENDIX C: Pharos Output for Diphenyl Dimethicone (CAS #68083-14-7)



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/OECDSIDS/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/

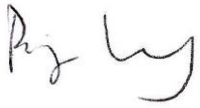
International Agency for the Research on Cancer:
http://monographs.iarc.fr/ENG/Classification/index.php

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/

Licensed GreenScreen® Profilers

Diphenyl Dimethicone GreenScreen® Evaluation Prepared by:



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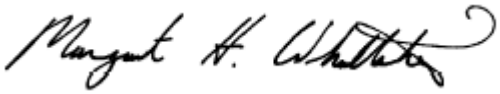
ToxServices LLC

Diphenyl Dimethicone GreenScreen® Evaluation QC'd by:



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