Summary of Public Comments received on MDM (CAS RN 107-51-7) Draft Screening Assessment Report and Draft Risk Management Scope for Batch 12

Comments on the original draft screening assessment and risk management scope for MDM to be addressed as part of the Chemicals Management Plan Challenge were provided by Canadian Cosmetic, Toiletry and Fragrance Association (CCTFA); Canadian Environmental Law Association (CELA) and Chemical Sensitivities Manitoba (CSM); Department of National Defence and Canadian Forces (DND/CF); an individual from the Department of Chemistry and Chemical Biology, McMaster University; Inuit Tapiriit Kanatami (ITK); Johnson & Johnson, Inc.; Keepers of the Athabasca; and Silicones Environmental, Health and Safety Council (SEHSC), North America.

A summary of comments and responses is included below, organized by topic:

TOPIC	COMMENT	RESPONSE
Physical–Chemical Properties	More recent and accurate values for the Henry's Law constant, log K_{oa} and log K_{oc} are now available and should be used in the screening assessment.	Newly provided values for physical and chemical properties have been incorporated into the screening assessment.
Bioaccumulation	The biomagnification factor (BMF) and trophic magnification factor (TMF) are considered more appropriate and precise metrics for the bioaccumulation behaviour of chemicals in the environment than bioconcentration factor (BCF) or bioaccumulation factor (BAF). In light of this, a refined lipid-adjusted dietary BMF of 0.86 should be used to help evaluate the bioaccumulation potential of MDM.	Since the BMF and TMF both provide a measure of the potential for transfer of a substance through food webs, they are important lines of evidence in the evaluation of bioaccumulation potential. As such, the screening assessment has been revised to reflect the refined lipid-adjusted BMF value of 0.86. The BCF and BAF, however, consider bioaccumulation at the level of the individual organism, making them important metrics for evaluating both bioaccumulation within species and the potential for adverse effects through accumulation within an organism (i.e., critical body burdens).
	A study by Opperhuizen et al. (1987) on the	The study by Opperhuizen et al. (1987) was reviewed, but since exposures in the study were

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	bioconcentration and biomagnification behaviour of MDM in fish should be included in the weight-of-evidence evaluation of bioaccumulation potential.	conducted using a mixture of cyclic and linear siloxanes (i.e., PDMS), it was impossible to isolate uptake from MDM alone. For this reason, the study was not included in the analysis of bioaccumulation potential of MDM.
	The modeling approach used to estimate the BAF and BCF of MDM is not appropriate for this substance.	MDM meets all parameters to be “in the domain” of the models. In addition, the BCF value obtained using this approach is comparable to empirically derived values reported by Drottar (2006). For these reasons, the predicted BCF and BAF values are considered to be reliable.
	We support the finding that MDM is bioaccumulative and persistent; virtual elimination of MDM should be the ultimate goal. Additional empirical studies should be undertaken to decrease uncertainty in the determination of toxicity and bioaccumulation potential of this substance.	While further biomonitoring and ecotoxicity data would reduce uncertainties, their absence did not preclude a decision regarding the potential for ecological harm of this substance in Canada.
	MDM has not been proposed to constitute a danger to human life or health in Canada, but its potential to bioaccumulate and biomagnify up the food chain could affect the traditional foods and diets of northern remote communities.	The screening assessment is based on consideration of available data and includes various conservative exposure scenarios considered to be protective of general and vulnerable populations in Canada. Monitoring studies show very low exposure levels in the environment and the empirical BMF of less than one indicates that MDM is unlikely to biomagnify through food webs.
Persistence	Since silicones efficiently degrade to silica in the environment, most MDM would be expected to do the same within a few months, and there is no data to support the notion that these compounds will be widespread.	Empirical and modelled data were used in the analysis of the persistence of MDM. MDM has a significant atmospheric transport potential but is unlikely to be deposited from air into water or soil in remote regions. The available monitoring data support that MDM can distribute into some environmental media, but at very low levels.
	The screening assessment does not consider the environmental impact of degradation products.	Information on degradation and transformation products was considered during preparation of the assessment, and some discussion of that is included in the assessment report.
	A modelled half-life in air of 8.94 days was identified as the pivotal value in the assessment of MDM’s persistence in air. This model was based on an estimated rate constant for the reaction with atmospheric hydroxyl radicals, and it is recommended that the half-life of MDM in air be re-assessed using the measured rate constant.	Calculated atmospheric half-life values of 5.79 days and 8.77 days—as well as a modeled value of 8.9 days—were all used in the analysis of the persistence of MDM in air.

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	Abiotic transformation processes (such as acid-base catalytic hydrolysis) should be considered in the prediction of MDM's half-life in water and soil to best evaluate its persistence in the environment.	Empirical and modelled data were used to analyse the persistence of MDM in air, water and soil. No empirical degradation data were found for MDM in sediment, and biodegradation was determined based on a calculated biodegradation half-life for an analogous substance. It was also recognized, however, that an analysis of persistence in sediment based only on biodegradation data would underestimate the potential for removal in this medium.
	There is no empirical evidence to support the supposition that MDM does not persist in water and soil.	Abiotic degradation processes, such as hydrolysis, have been empirically demonstrated to play an important role in the environmental fate of substances like MDM. Based on empirical hydrolysis data, it is believed that MDM does not remain in water and soil for long periods of time.
Long-range transport potential	Newer modelling tools are available and should be used to estimate the long-range transport potential (LRTP) of MDM, using measured values (rather than estimated ones) whenever possible.	The LRTP modeling of MDM has been re-run using the latest version of the software (OECD POPs Screening Model; version 2.2) and empirical data as inputs to the model. The updated results are included in the screening assessment.
	Although the detection of MDM in two cod liver samples from the Norwegian Arctic was presented as evidence of MDM's long-range transport potential, the validity of the monitoring data should be re-evaluated, and the speculative conclusion that they provide evidence of atmospheric transport and deposition of MDM should be removed.	MDM was measured in some fish samples collected from northern regions, but it was not detected in other biota samples from the same regions or found in concurrently collected samples of surface water and sediment. Since there is no evidence for the natural production of MDM, the detection of MDM in the fish samples indicates contamination from anthropogenic sources; however, the nature of these sources is unclear.
	Since there are no empirical data for MDM in the Canadian Arctic, it cannot be assumed that the substance will have a low Arctic Contamination Potential. The possible local sources of MDM contamination found in remote locations are not clear, and determining the origin of MDM in remote regions (such as the Norwegian Arctic) is important with respect to potential long-term effects on Arctic fish and wildlife, as well as people who rely on these animals for food.	The risk of environmental exposure to MDM is considered to be low since available information indicates that MDM is only occasionally measured in environmental samples and, when detected, the substance is present at only low concentrations. MDM was found in a small number of fish samples collected in remote northern locations; however, this may be evidence of contamination from local sources such as nearby human settlement rather than of long-range transport.

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Inherent toxicity and health effects	In the draft screening assessment, modeled aquatic toxicity values are inappropriately determined and incorrectly interpreted in the assessment of MDM's toxicity to pelagic organisms.	Given the substantial empirical database of aquatic toxicity values available for MDM—particularly new toxicity data received following publication of the draft assessment—modeled toxicity data are no longer included in the assessment.
	Although the draft screening assessment states that there is empirical evidence of adverse effects in some sediment species, the available data suggest that MDM is not toxic to benthic organisms in natural sediment when the limit of solubility in organic carbon is considered.	Laboratory toxicity testing results are available for three species of sediment organisms. No adverse effects were seen in two of the species, while one species showed adverse effects in one test but not in a second test. It is likely that test conditions used in the toxicity studies, including differences in the organic carbon content of the test sediments, influenced the test results. Results from all sediment toxicity studies were considered in determining the potential for adverse effects in sediment organisms.
	The Robust Study Summary for chronic effects in fish should be included in the screening assessment.	The Robust Study Summary for this and all pivotal studies used in the screening assessment is available upon request.
	Evidence that MDM was detected in breast milk, potentially exposing breast-fed infants, is highly disturbing and supports reconsideration of the health effects from exposure to MDM, both in infancy and over a long term.	A comparison of the lowest observed adverse effect level (LOAEL) for short-term oral exposure and the largest estimate of daily intake of MDM for breast-fed infants results in a margin of exposure of several orders of magnitude. This is considered adequately protective and sufficient to account for uncertainties in the health effects and exposure database.
	There is no evidence that siloxanes like MDM do not have genotoxicity potential. There are no in vivo or in vitro studies for L4 (an MDM analogue) listed in the assessment and the only in vivo study listed was for HMDS, another analogue. As a result, the evidence for the conclusion that MDM and its analogues are not genotoxic appears weak, particularly given the positive result for mouse lymphoma in an MDM and an HMDS test.	A weight of evidence approach was used to assess the genotoxic potential of MDM, and assessment of the overall data on MDM and its analogues indicates that the substance is not likely to be genotoxic.
	Given that confidence in health effects are acknowledged to be low, one cannot exclude the probability of adverse human health effects. In fact, given the acknowledged uncertainty associated with the use of analogues, the reliance on their use to characterize health effects may lead to erroneous	While uncertainty associated with gaps in MDM specific data has been addressed through the use of analogues—especially HMDS—these analogues were considered suitable due to chemical similarity and the availability of empirical health effects data. Although there are gaps in the MDM hazard database, assumptions used in the estimate of exposure are conservative, and confidence is high that the derived margins of exposure are adequately protective of human health for the general population of Canada.

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	conclusions.	
	The assessment notes that at a level of 10 640 mg HMDS/m^3, several renal tubular adenomas and carcinomas occurred in males. This result—combined with the absence of chronic/carcinogenicity information on MDM, L4 and L5—makes it difficult to accept the approach of basing characterization of risk to human health on non-cancer effects.	A recent study demonstrated that kidney neoplasia observed in rats following administration of HMDS is due to a species-specific mechanism (Dow Corning Corporation 2007b). It is therefore unlikely to be relevant to humans. Since no carcinogenicity data considered relevant to humans were identified for MDM or its analogues, it was considered appropriate to characterize the human health risk based on non-cancer critical effects.
Data gaps and deficiencies	Given the amount of environmental data available, it is inappropriate for the Government of Canada to be formulating regulations that rely on models that are not (or may not be) valid.	The Screening Assessment is based on the collective information and considers both empirical and modelled lines of evidence.
	Due to the absence of a quality control program and uncertainties about elements of the analytical method, the Nordic dataset on animal and plant life does not support a conclusion that MDM is present at detectable levels in the environment or that it has the potential to bioaccumulate.	All reports that provided monitoring data – including those for the Nordic regions ––were reviewed critically, and were included in the assessment if the data were deemed to be of acceptable quality. These reports are well-documented and appeared to be procedurally sound.
	Data gaps relating to the environmental presence and health effects of MDM should be filled.	Screening assessments are based on considerations of the available data. In the case of MDM, limitations in the health effects and exposure databases are recognized as an uncertainty in the screening assessment report, but margins of exposure were based on conservative assumptions and are considered adequate to take into consideration these limitations. The available data were considered sufficient to support the proposed conclusion that MDM does not meet criteria under section 64 of CEPA 1999. Based on this, further data is not required at this time.
	Health Canada has reported that “in a mammalian cell mutation assay, positive results were reported in mouse lymphoma in absence of metabolic activation, but negative results were reported in presence of metabolic activation (Seifried et al. 2006).” The Industry is not aware of such a study on MDM.	The mouse lymphoma assay cited in Seifried et al. (2006) was conducted on MDM by the U.S. National Cancer Institute (NCI). This is explained in the “Materials and Methods” section of the article.

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	Since one of the commenters was not aware that MDM was under assessment by Health Canada, additional data were not provided under the Challenge to Industry Program on the mammalian health endpoints. There are additional studies on MDM—such as a 28-day oral and a 90-day inhalation study—that should be considered.	Data from the two submitted repeated-dose studies have now been incorporated into the assessment. Characterization of risk for the general population from oral exposure to MDM was originally based on an MDM analogue, but the newly submitted oral 28-day study for MDM was deemed more appropriate and is now used in the risk characterization. The outcome of the risk characterization, however, remains unchanged.
	For the calculation of exposure estimates from consumer products, Health Canada has assumed a 100% dermal absorption, but analogues of MDM have shown more limited dermal absorption (<0.1 %). Since these analogues were considered adequate for the health effects assessment, it is recommended that they are also used for dermal absorption.	References supporting lower dermal absorption in analogues (namely HMDS and L4) were not found. However, a 100% dermal absorption for the analogues was not assumed in the risk characterization of MDM since margins of exposure have been calculated by comparing external dermal doses (critical effect levels) for HMDS and L4 with estimates of dermal exposure to MDM from use of cosmetics. The resulting margins of exposure were considered adequately protective of human health.
	The study by Kaj et al. (2005a) that was presented in the screening assessment reported detection of MDM in breast milk. Breast milk samples in that study, however, were collected for the analysis of another group of compounds that are dissimilar to MDM, while other important considerations (such as sample handling, analysis and experimental methodology) were not reported. As a result, this study has limitations that may preclude its use in the estimation of exposure from this source.	No major limitations in the experimental methodology were identified that would prevent the use of these data in the exposure assessment. The presence of MDM in breast milk therefore cannot be excluded, and exposure from this source was estimated using data from the study. The estimate of exposure to MDM from breast milk for infants was compared to critical effects, and the margin of exposure was adequate to determine that exposure from this source was not a concern.

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Uses	The use ranges reported via section 71 of CEPA 1999, do not provide a real indication of the amounts of MDM that are actually used, nor do they reveal the relative proportion or amounts of it that are imported in any form. As a result, the impact of exposure to MDM in products cannot be determined, and claims of confidentiality about how much MDM is used are an impediment to attempts to determine the extent and prevalence of this substance.	The Government of Canada continually works with stakeholders to ensure a balance between protection of proprietary information and presenting information in the most transparent manner possible in the interest of public health, public safety and for the protection of the environment. In the case of MDM, while important quantities and certain aspects of its use are treated as confidential business information (CBI) and are therefore unavailable to the public, that information is used by the Government of Canada when evaluating risk.
	It is not evident whether all products containing MDM imported into Canada are accounted for or notified on Health Canada's Cosmetic Notification System (CNS).	The CNS is the primary source of information pertaining to ingredients used in cosmetic and personal care products sold in Canada. The CNS database was searched for MDM, its other chemical names, and all raw materials and trade names containing MDM that were reported under section 71 of CEPA 1999. While it is possible that a company might not notify Health Canada about the chemical composition of a cosmetic and personal care product, that would be a contravention of the *Food and Drugs Act* and liable to punishment under the Act. The CNS search performed for this assessment is considered both to have captured the majority of usage categories and to reflect typical concentration ranges of substances used in cosmetics and personal care products in the Canadian market.
Partitioning in the environment	Since silicones are relatively insoluble in alkanes, they are not highly affiliated with organic matter in sludge and soil. The high volatility, efficient hydrolytic degradation on soil and efficient oxidation of MDM in the air all seem to be at variance with the conclusions drawn.	The high log K_{oc} of MDM suggests that it will tend to adsorb to organic matter present in soil, suspended solids and sediment. Modelling using measured and modelled chemical property data predicts that MDM released into soil will distribute primarily into air, while MDM released into water will distribute into both sediment and water. Empirical and modelled data also indicate that MDM will undergo abiotic degradation processes (such as hydrolysis and photodegradation) that are expected to contribute significantly to the removal of MDM from the environment.
	Exports of MDM should not be considered a "loss" in the section on releases—which should be described by quantities rather than percentages—unless the export operations contributed to releases (perhaps through transportation or a similar process). The estimation of life-cycle losses may provide an indication of releases to the environment, but it cannot be considered a first approximation for emission patterns.	In a mass balance model (such as the one used here), the export of products containing MDM reduces the initial quantity of the substance that is the starting point of the estimates. As a result, the model is meant to estimate the proportion of the substance lost throughout its lifecycle (and where it may be released) in order to provide information on patterns of release.

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	It is not possible to reproduce the emission scenarios for MDM as presented in Table 3 of the draft screening assessment.	The mass balance model used gives an overview of the releases of a substance, but it does not provide information that is used directly in estimating exposure. Some of the information used for primary input data has been requested to be treated as confidential business information (CBI) and, for this reason, the more detailed information that is used in modelling cannot be included in the screening assessment report.
Exposure	The exposure of soil organisms to MDM through biosolid application was proposed without any estimation of the possible concentrations. Although low concentrations of MDM may exist in sludge, its concentration in biosolids (treated sludge) should be very low. It is recommended that a more realistic assessment of the exposure and a more accurate hazard assessment be made.	MDM has been detected in some Nordic wastewater treatment plant sludges, suggesting that the substance could be applied to soil during land application of biosolids (treated sludge). No concentrations data were found, however, and a more quantitative evaluation of exposure to soil organisms from this source could not be done. It is agreed that levels of MDM in biosolids are likely to be very low due to processes such as hydrolysis and volatilization.
	Risk management measures on MDM should not be delayed by the lack of monitoring data.	Based on the available information—including new information provided following publication of the draft assessment—it is now proposed that MDM does not meet any of the criteria set out in section 64 of CEPA 1999. As a result, it is proposed not to subject MDM to risk management actions under CEPA 1999
	Environment Canada should improve exposure estimates for MDM, determine its levels in the environment and establish a monitoring program.	Recent Canadian monitoring data and new chemical property information for MDM have made it possible to produce more refined exposure estimates and characterization of this substance in the environment. The results indicate that levels in the Canadian environment are well below those expected to cause adverse effects in representative organisms.
Risk assessment conclusion	The conclusion that MDM is not harmful to health has been formed without adequate exposure data and is not in keeping with a precautionary approach.	The conclusions from the screening assessment adhere to a precautionary approach, because where there are uncertainties, conservative approaches are used. For example, exposure estimates were determined using environmental monitoring and product concentration data, and they incorporated conservative assumptions. Therefore, there is confidence that exposure estimates are upper bounding and sufficiently conservative to account for limitations in the exposure database, which is in keeping with the precautionary approach under CEPA 1999.
	We support the finding that MDM is toxic under section 64 of CEPA 1999.	Recent information relating to environmental levels and hazard potential has now been incorporated into the screening assessment. While MDM has the potential to significantly bioaccumulate in organisms, there is an absence of adverse effects in organisms exposed for prolonged periods to MDM concentrations up to the solubility limit of the substance. On the basis of limited environmental presence, MDM is expected to pose low hazard to aquatic and terrestrial

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		species at levels occurring in the environment. As a result, it is now proposed that MDM does not meet any of the criteria set out in section 64 of CEPA 1999.
	A comprehensive evaluation of available data using a weight of evidence approach does not support a characterization of MDM as Persistent or Bioaccumulative. As such, MDM should not be a candidate for addition to Schedule 1 of CEPA 1999, or virtual elimination under subsection 65(3) of that Act.	The analysis of persistence and bioaccumulation potential of MDM suggests that this substance may remain in some environmental media for significant periods of time and has the potential to accumulate in organisms, however it is not expected to biomagnify in foodwebs. Overall, based on the available information – including new information provided following publication of the draft assessment - the low exposure and hazard potential for MDM indicate that this substance poses a low risk of harm to organisms or the boarder integrity of the environment. For this reason, it is now proposed that MDM does not meet the definition of "toxic" as defined in CEPA 1999, and the substance is not proposed to be added to Schedule 1.
Proposed risk management	Several comments were submitted on the Risk Management Scope document, which outlined considerations for risk management should MDM have been concluded toxic under CEPA 1999.	Based on the available information—including new information provided as a result of the Public Comment period—it is now proposed that MDM does not meet any of the criteria set out in section 64 of CEPA 1999. As such, it is proposed not to subject MDM to any restrictions under CEPA 1999.
Overarching comments	The use of log K_{ow} values to categorize substances originated with compounds like PCBs, which have exceptionally long lifetimes in the environment and no efficient mechanism for degradation, and is not appropriate for low molecular weight silicones (like MDM).	Categorization of the Domestic Substance List under CEPA 1999 considered data from both modelling and experimental studies in order to determine whether the substance met categorization criteria for persistence, bioaccumulation potential and inherent toxicity. Categorization decisions considered all relevant physical and chemical properties of a substance and were not restricted to only the log K_{ow}. Substances which met categorization criteria are subject to more detailed assessment activities.
	The determination of degradation rate has a built-in bias that compounds with a low molecular weight are not undergoing efficient degradation in the environment.	All substances categorized were subject to the same regulatory criteria regarding environmental persistence and degradation (i.e., the *Persistence and Bioaccumulation Regulations* of CEPA 1999). These criteria do not distinguish between compounds of different molecular weights.
	The values used for the calculation of the half-life in air should be defined and consistently applied to all chemicals.	A number of values for the average atmospheric hydroxyl radical concentration are available in the published literature. In order to ensure the greatest transparency, the screening assessment presents all relevant information relating to a reported atmospheric half-life value, including the atmospheric hydroxyl radical concentration used by the researchers to determine the value.
	Cumulative (including synergistic) effects of MDM in conjunction with similar substances should be considered. Methods for estimating cumulative effects should be further developed and applied in risk	Consideration of cumulative and synergistic effects is part of the screening assessment when sufficient information to undertake such analyses is present. Typically, the information available for screening assessments only represents the inherent ability that a substance has to produce adverse effects.

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	assessments.	
	The potential impact on vulnerable population groups is not being considered.	The screening assessments are based on considerations of the available data and include various conservative exposure scenarios considered to account for both the general and vulnerable populations in Canada. If information was available that suggested a specific sub-population would be particularly vulnerable, it would be considered in the assessment.
	Although workers are typically the population groups most directly exposed to chemicals, there is no consideration of occupational exposure.	The exposure scenarios used for the Chemicals Management Plan are focussed on exposures to the general population. When available, hazard information obtained from occupational settings—in particular from epidemiological investigations—is considered in Challenge screening assessments. In the case of MDM, however, no such information was identified.