Chlorinated Paraffins Industry Association

Evaluation of Environmental Release and Environmental Assessment of Medium Chain Chlorinated Paraffins (C14-C17) and Long Chain Chlorinated Paraffins (C18-C20)

Executive Summary

The Environmental Protection Agency's (EPA) Draft Standard Review Risk Assessments of Medium Chain Chlorinated Paraffins (MCCP) (C14-C17) and Long Chain Chlorinated Paraffins (LCCP) (C18-C20) indicated that these substances may present an unreasonable risk to the environment because of concerns that they are released into the environment, particularly to the water, in amounts that could result in levels in excess of the concentrations of concern (CoC). Additionally, EPA has also concluded that these substances are expected to be persistence, bioaccumulative, and toxic (PBT). EPA specifically notes that its concerns are based upon:

- Release of both MCCP and LCCP to water during processing and use.
- Estimated environmental concentrations of MCCP and LCCP;
- Measured concentrations of MCCP in the environment;

With these concerns in mind, the Chlorinated Paraffins Industry Association (CPIA) conducted an evaluation of the environmental release pathways associated with the use, waste generation, and waste handling of MCCP and LCCP for the following industrial use segments:

- Rubber - Compounding and Converting
- PVC and Plastic - Compounding and Converting
- Coatings, Adhesives, Sealants – Formulation and Use

Additionally, the Independent Lubricant Manufacturers Association (ILMA) is working to develop similar information on use, waste generation and waste handling for metalworking fluids (MWF) formulation and use.

There are only a few companies that use the majority of the total MCCP and LCCP volume going into rubber, PVC, plastic, coating, adhesives and sealant applications. For example, only 3 companies represent approximately 80% of the total MCCP and LCCP volume used in rubber, PVC and plastics. The largest users in the above industries were surveyed for information regarding their use practices. All of the respondents confirmed that they do not have any water releases from the processes involving MCCP or LCCP. None of the rubber, PVC or plastic applications use water in their processes or cleaning at all. The coating, adhesive and sealant manufacturers use water for process equipment cleaning; however, this cleaning water is either recycled into the products (some of which are water-based) or sent to landfill for disposal. Based on this information, CPIA believes that any water release pathways can be completely eliminated for these uses. Eliminating these release pathways will have the effect of eliminating the specific concerns identified by EPA for these applications, namely releases to water and estimated environmental concentrations above the CoCs.

CPIA also hired an exposure expert to review the MCCP environmental monitoring data considered by EPA in its risk assessment. EPA concluded these data helped to support a conclusion of unreasonable risk to the environment for these substances. However, the weight of the evidence presented by these data does not suggest that exceedances of the EPA COC for surface water or sediment are likely. For example, the only exceedance of the aquatic CoC noted in these data is from a study in Norway using a lower resolution analytical method. All of the water samples in the U.S. and North America are below the water CoC and, in particular, those samples developed using higher resolution analytical methods were well below the CoC. Likewise the vast majority of sediment samples are below the CoC and the only U.S. samples above the CoC are from a surface impoundment at a CP manufacturing location, not from the native environment. These monitoring data are also significant because they represent the cumulative impact of all release sources in the environment and also appear to indicate that even after decades of use levels of MCCP in the environment are not accumulating to levels above the CoC.

1. Introduction

This evaluation is intended to inform the U.S. Environmental Protection Agency's (EPA) review of Medium Chain Chlorinated Paraffins (C14-C17) and Long Chain Chlorinated Paraffins (C18-C20) for a series of PMNs that EPA received on these substances from CPIA members[1].

EPA's Draft Standard Review Risk Assessments of MCCP and LCCP indicated that these substances may present an unreasonable risk to the environment. In particular EPA concluded that these substances are: 1) expected to be persistent, bioaccumulative, and toxic (PBT), and 2) released into the environment in amounts that may lead to exceedances in the concentrations of concern (CoC) for aquatic and sediment-dwelling organisms.

In regards to concern #2, EPA specifically notes that its concerns are based upon:

- Estimated environmental concentrations of MCCP and LCCP.
- Measured concentrations of MCCP.
- Release of both MCCP and LCCP to water during processing and use.

This document considers the release pathways for MCCP and LCCP identified by EPA in its risk assessment of the downstream uses. A summary of these release pathways is provided followed by recent information collected from downstream users regarding waste generation and handling practices and the potential for water release. The survey results are considered in an assessment of the relevance of EPA's initially identified release pathways. Finally, a detailed analysis of the available monitoring data is provided to better assess the current understanding of environmental concentrations in the U.S. and the impact sampling location and analytical methods have on those data.

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[1] CPIA members are Dover Chemical, INEOS Chlorvinyls, and Qualice LCC.

2. Physicochemical Parameters Important to the Assessment

The table below presents the physicochemical parameters used by EPA in its assessment of MCCP and LCCP. There are several important physicochemical properties of MCCP and LCCP that impact their environmental risk assessment, including their very low water solubilities and the fact that these substances decompose prior to boiling.

Table 1: Summary of Physiochemical Data EPA used in its Assessment of MCCPs and LCCPs

Substance	%Cl (wt.)	Melting Point	Boiling Point	Vapor Pressure	Water Solubility	Log K$_{OW}$
MCCPs	> 40	< 25 °C (pour point)	> 200 °C (dec)	< 0.036 Pa at 20 °C	27 µg/L at 20 °C	> 5.5 (measured) 8.30 (estimated)
LCCPs	> 40	< 25 °C (pour point)	> 200 °C (dec)	< 2.7×10^{-4} Pa at 20 °C	5 µg/L at 20 °C	> 10

EPA Sources: EURAR (ECB, 2008); EA (2009)

EPA Notes: Value calculated using the KOWWIN Program (v1.68) available in EPA's Estimation Programs Interface (EPI) Suite TM. This estimate was generated using a representative MCCP (*i.e.*, C14H24Cl6, 52 wt % Cl) with the following SMILES notation: CCC(Cl)CC(Cl)CCCl)CC(Cl)CC(Cl)CC(Cl)C. The EURAR (ECB, 2008) cited Renberg's liquid chromatography to measure a log KOW between 5.5 and 8.2 and then chose to use log KOW = 7 as a representative log KOW for MCCP 45 – 52 wt % Cl.

The very low water solubilities noted by EPA for MCCP and LCCP will limit their ability to be released via the dissolved fraction in water, will increase the efficacy of treatment technologies, and will limit the overall mass released to water. As discussed in Section 8, the very low water solubilities of these substances also complicate aquatic testing and the evaluation of aquatic toxicity results.

Furthermore, the decomposition of MCCP and LCCP coupled with their very low vapor pressure will limit any air emissions of MCCP and LCCP. This decomposition is a consideration in high pressure/temperature applications such as found in metalworking, where the substance will de-chlorinate and degrade during use. This de-chlorination is, in fact, the desired chemical phenomenon during high pressure metalworking as the free chloride ions react with the metal surface to reduce friction.

3. Environmental Critical Release Pathways in Draft Standard Review Risk Assessments

The following is a summary of the critical release pathways for the main downstream uses of MCCP and LCCP from EPA's Draft Standard Review Risk Assessment. Sections 4 and 5 review how these release pathways have been evaluated for this report by collecting information from downstream users and how these release pathways can be modified based on this information. The critical pathways summarized below focus on the assumed releases to water, although it should be noted that in many cases EPA assumed a release could occur to water or incineration or landfill. The E-FAST predicted surface water concentrations are based on the release to water.

A) Rubber - Compounding and Converting

The following tables provide the release parameters that EPA assumed for facilities using MCCP or LCCP in the compounding and converting of rubber. These emissions factors assumed that approximately 2 to 3% of the total MCCP or LCCP mass used at a rubber compounding facility is discharged to water mostly from cleaning operations such as equipment cleaning, tank/drum cleaning. Similarly, EPA assumed approximately up to 5 to 6% of the total MCCP or LCCP mass used in already compounded rubber used at subsequent manufacturing locations (rubber converting) to be discharged to the water in one PMN assessment. In both cases, these water discharges do not assume any on-site treatment. It is worth noting that in one of the PMN assessments, EPA assumed most of the release pathways for rubber converting went to landfill and/or incineration not water. There is also a smaller component that is assumed to be released via fugitive emissions, also without onsite treatment.

Table 2: EPA Model Inputs – Rubber Compounding

Source	**Apparent U.S. EPA Emission Factor Used in E-FAST (critical release)**	**Frequency**	**U.S. EPA Basis**
Fugitive emissions	0.025% or 0.001% (Water)	94 or 250 days/year	OECD Emission Scenario Document for Plastic Compounding; 50% to water
Cleaning liquid residuals from drums used to transport raw material	0.7% (Water)	0 or 96 days/year	EPA/OPPT Drum Residual Model
Cleaning liquid residuals from tank or rail cars	0.2% (Water)	33 or 250 days/year	EPA/OPPT Bulk Transport Residual Model
Equipment cleaning losses from multiple vessels	2% (Water)	96 or 250 days/year	EPA/OPPT Multiple Vessel Residual Model
Spillage during raw material handing	0.01% (Water)	96 or 250 days/year	OECD Emission Scenario Document for Plastic Compounding; 0.01% to water

Table 3: EPA Model Inputs – Rubber Converting

Source	**Apparent U.S. EPA Emission Factor Used in E-FAST (critical release)**	**Frequency**	**U.S. EPA Basis**
Fugitive emissions	0.025% or 0.125% (Water)	250 days/year	OECD Emission Scenario Document for Plastic Converting; 50% to water
Dust generation from converting	0.01% (Water)	0 or 250 days/year	OECD Emission Scenario Document
Cleaning solid or powder residuals from containers used to transport raw material	1% (Water or Landfill/Incineration)[a]	250 days/year	EPA/OPPT Solid Residuals in Transport Containers Model
Scrap material	2.5% (Water or Landfill/Incineration)[a]	250 days/year	OECD Emission Scenario Document

Equipment cleaning losses from multiple vessels	2% (Water or Landfill/Incineration)[a]	250 days/year	EPA/OPPT Multiple Vessel Residual Model
Spillage during raw material handing	0.01% (Water)	250 days/year	OECD Emission Scenario Document for Plastic Compounding; 0.01% to water

[a] Water was excluded as a pathway in one EPA assessment for these sources, and water was included in a pathway in a second EPA assessment.

B) PVC/Plastic - Compounding and Converting

The following are release parameters that EPA assumed for facilities using MCCP or LCCP in the compounding and converting of PVC and plastics. These emissions factors assume that approximately 3 to 6% of the total MCCP or LCCP used during the compounding of PVC and plastics is discharged to water, mostly from cleaning operations such as equipment cleaning, tank/drum cleaning. Similarly, EPA assumed approximately 5 to 6% of the total MCCP or LCCP mass used in already compounded PVC/plastic used at subsequent manufacturing locations (PVC/plastic converting) to be discharged to the water. These water discharges do not assume any on-site treatment. There is also a smaller component that is assumed to be released via fugitive emissions.

Table 4: EPA Model Inputs – PVC/Plastic Compounding

Source	**Apparent U.S. EPA Emission Factor Used in E-FAST (critical release)**	**Frequency**	**U.S. EPA Basis**
Fugitive emissions	0.001% (Water)	126 or 288 days/year	OECD Emission Scenario Document for Plastic Compounding; 50% to water
Equipment cleaning losses of liquids from compounding equipment	2% or 3% (Water)	126 or 288 days/year	OECD Emission Scenario Document for Plastic Compounding
Cleaning liquid residuals from drums used to transport raw material	2% or 3% (Water)	126 or 174 days/year	EPA/OPPT Drum Residual Model
Cleaning liquid residuals from rail cars, tank trucks and totes	1% (Water)	0 or 58 days/year	EPA/OPPT Bulk Transport Residual Model; PMN Submission (landfill)
Spillage during raw material handing	0.01% (Water)	126 or 288 days/year	OECD Emission Scenario Document for Plastic Compounding; 0.01% to water

Table 5: EPA Model Inputs – PVC/Plastic Converting

Source	Apparent U.S. EPA Emission Factor Used in E-FAST (critical release)	Frequency	U.S. EPA Basis
Fugitive emissions	0.075% (Water)	250 days/year	OECD Emission Scenario Document for Plastic Converting; 50% to water
Spillage during raw material handing	0.01% (Water)	250 days/year	OECD Emission Scenario Document for Plastic Converting;
Cleaning powders residuals from containers used to transport raw material	1% (Water)	250 days/year	EPA/OPPT Model for Solid Residuals
Equipment cleaning losses from multiple vessels	2% (Water)	250 days/year	EPA/OPPT Multiple Vessel Residual Model
Scrap material	2.5% (Water)	250 days/year	EPA assessment of SCCP (1992)

C) Coatings, Adhesives, Sealants – Formulation and Use

The following are release parameters that EPA assumed for facilities using MCCP or LCCP in the formulation and use of coatings, adhesives and sealants. These emissions factors generally assume that approximately 4 to 5% of the total MCCP or LCCP used in the formulation of coatings, adhesives and sealants is discharged to water, mostly from cleaning operations such as equipment cleaning, tank/drum cleaning. These factors also assume that up to 14% of the total mass of MCCP and LCCP in finished coatings, adhesives and sealants is discharged to the water. These water discharges do not assume any on-site treatment.

Table 6: EPA Model Inputs – Formulation of Coatings, Adhesives, Sealants

Source	Apparent U.S. EPA Emission Factor Used in E-FAST (critical release)	Frequency	U.S. EPA Basis
Spills during raw material transfer	0.01% (Water)	0 or 2 days/year	RM-2 SCCP Assessment (1992)
Equipment cleaning losses of liquids from a blending tank or mixing vessel	2.5% or 4% (Water)	2 or 200 days/year	EPA/OPPT Single Vessel Residual Model or OECD Emission Scenario Document for Adhesives
Cleaning liquid residuals from drums used to transport raw material	2.% or 6% (Water)	1 or 200 days year	EPA/OPPT Drum Residual Model
Discharge of off-specification material	100% (Water)[a]	0 or 4 days/year	OECD Emission Scenario Document for Adhesives

[a] 100% of daily use on days with off-specification material.

Table 7: EPA Model Inputs – Use of Coatings, Adhesives, Sealants

Source	**Apparent U.S. EPA Emission Factor Used in E-FAST (critical release)**	**Frequency**	**U.S. EPA Basis**
Cleaning liquid residuals from drums used to transport raw material	0.9% or 12% (water)	66 or 177 days/year	EPA/OPPT Small Container or Drum Residual Model
Equipment cleaning losses from multiple vessels	2% (water)	250 or 251 days/year	EPA/OPPT Multiple Process Vessel Residual Model

D) Metal Working Fluids Formulation

The following are release parameters that EPA assumed for facilities using MCCP or LCCP in the formulation of metal working fluids. In total these emissions factors assume that approximately 2 to 5% of the total MCCP or LCCP used at the facility is discharged to water mostly from cleaning operations such as equipment cleaning, tank/drum cleaning. These water discharges do not assume any on-site treatment.

Table 8: EPA Model Inputs

Source	**Apparent U.S. EPA Emission Factor Used in E-FAST (critical release)**	**Frequency**	**U.S. EPA Basis**
Equipment cleaning losses of liquids from a mixing tank	2 to 3% (Water)	38 to 240 days/year	EPA/OPPT Single or Multiple Process Vessel Residual Model
Cleaning liquid residuals from drums, totes or tank trucks used to transport raw material	0.2 to 2% (Water)	1 to 89 days/year	EPA/OPPT Drum Residual or Bulk Transport Model

E) Metalworking Fluid Use

The following are release parameters that EPA assumed for facilities using MCCP and LCCP containing metalworking fluids. In total these emissions factors assume that approximately 90% to 93% of the total MCCP or LCCP contained in these metalworking fluids are discharged to water, including mass contained on filter media and cleaning losses. These water discharges do not assume any on-site treatment.

Table 9: EPA Model Inputs

Source	Apparent U.S. EPA Emission Factor Used in E-FAST	Frequency	U.S. EPA Basis
Dragout Losses	11% (water)	247 days/year	Emission scenario document for MWF (2011)
Cleaning liquid residuals from drums used to transport raw material	3% (water)	18 or 218 days/year	EPA/OPPT Drum Residual Model
Filter media and other recycling waste	35% (water)	247 days/year	OECD Emission Scenario document for MWF (2011)
Spent metal working fluid	45% (water)	247 days/year	OECD Emission Scenario Document for MWF (2011)

4. Information Collection Activities from Downstream Users on Release Pathways, and Waste Handling

As detailed in Section 3, for most uses of MCCP and LCCP there are a few key release pathways, almost all to water, that result in the predicted surface water concentrations of these substances used by EPA in Draft Standard Review Risk Assessments. In order to evaluate the appropriateness of these release pathways, information was collected directly from MCCP and LCCP users regarding their use, cleaning and waste handling practices. Surveys were conducted both by the PMN submitters for non-metalworking applications and by the Independent Lubricant Manufacturers Association (ILMA) for metalworking formulators.

A) Information on Releases for Rubber Uses

Rubber compounding and converting were assessed as two separate uses in the Draft Standard Review Risk Assessment, though it appears that these activities may be combined at a single facility where the raw ingredients of the rubber are combined (i.e., compounding) and then the rubber extruded into an article (e.g. belt) as part of the same operation. It should also be noted that releases of MCCP or LCCP in post-compounding use applications are not expected to result in free MCCP or LCCP that could be released since the substances are bound in the polymer matrix.

There are relatively few operations in the U.S. using MCCP or LCCP in rubber applications. A single company uses approximately 70% of the total volume going into rubber applications. Below are the responses from that user to the release pathways

Table 10: Survey of Rubber Compounding and Converting User

Source	Critical Release Media Assumed by EPA	User 1 Response	Release Pathway Results
Fugitive emissions	Air to Water	1 of 2 U.S. plants has thermal oxidizer.	Minor pathway not a significant source of release.
Cleaning liquid residuals from drums used to transport raw material	Water	No delivery via drums. Totes are not cleaned on site.	Pathway not relevant to actual user. Could be eliminated/restricted for future evaluation/regulation.
Cleaning liquid residuals from rail cars	Water	No delivery via rail cars. Trucks are dedicated and not cleaned onsite.	Pathway not relevant to actual user. Could be eliminated/restricted for future evaluation/regulation.
Equipment cleaning losses from multiple vessels	Water	Process equipment are not cleaned with water.	Pathway not relevant to actual user. Could be eliminated/restricted for future evaluation/regulation.
Spillage during raw material handing	Water	No discharge to water. Spills are sent for waste treatment.	Pathway not relevant to actual user. Could be eliminated/restricted for future evaluation/regulation.
Cleaning powders residuals from containers used to transport raw material	Water	Activity does not occur.	Pathway not relevant to actual user. Could be eliminated/restricted for future evaluation/regulation.
Scrap material	Water	Wastes not sent to water.	Pathway not relevant to actual user. Could be eliminated/restricted for future evaluation/regulation.

B) Information on Releases for PVC and Plastic Uses

PVC or plastic compounding and converting were assessed as two separate uses in the Draft Standard Review Risk Assessment, though it appears that these activities may be combined at a single facility where both the raw ingredients of the PVC/plastic are combined (i.e., compounding) and then the compounded polymer extruded into an article (e.g. flooring) as part of the same operation. It should also be noted that releases of MCCP or LCCP in post-compounding use applications are not expected to result in free MCCP or LCCP that could be released as the substances are bound in the polymer matrix.

There are relatively few operations in the U.S. using MCCP or LCCP in PVC and plastic applications. The three companies that have responded to the survey, to date, represent the majority, approximately 80%, of MCCP and LCCP used in PVC, plastic and polymer applications. Their collective responses to the pathways identified by EPA are presented in the table below.

Table 11: Survey of PVC/Polymer Compounding and Converting Users

Source	Critical Release Media Assumed	User 1 Response	User 2 Response	User 3 Response	Release Pathway Results
Fugitive emissions	Air to Water	No air emissions controls	Reciprocal thermal oxidizer used for air emissions control.	Scrubber system used for air emissions control.	Minor pathway; completely eliminated with thermal oxidizer at one facility and scrubber system at another facility.
Cleaning liquid residuals from drums used to transport raw material	Water	No delivery via drums or totes.	No delivery via drums or totes.	Totes are not cleaned on-site but sent to waste handler.	Pathway not relevant to actual user. Could be eliminated/restricted for future evaluation/regulation.
Cleaning liquid residuals from rail cars	Water	No delivery via rail cars. Trucks are dedicated and not cleaned onsite.	No delivery via rail cars. Trucks are dedicated and not cleaned onsite.	No delivery via rail cars. Trucks are dedicated and not cleaned onsite.	Pathway not relevant to actual user. Could be eliminated/restricted for future evaluation/regulation.
Equipment cleaning losses from multiple vessels	Water	No water is used in the process nor in the cleaning of process equipment.	No	No use of water in cleaning operations or in the process itself.	Pathway not relevant to actual user. Could be eliminated/restricted for future evaluation/regulation.
Spillage during raw material handing	Water	No discharge to water. Spills are sent for waste treatment.	Any wastes are sent to waste handler, not to water.	Spills are sent for waste treatment. No discharge to water.	Pathway not relevant to actual user. Could be eliminated/restricted for future evaluation/regulation.
Cleaning powders residuals from containers used to transport raw material	Water	N/A. Activity does not occur.	Any wastes are sent to waste handler, not to water.	Integrated facility, no transport of compound polymer from one site to another.	Pathway not relevant to actual user. Could be eliminated/restricted for future evaluation/regulation.
Scrap material	Water	Wastes not sent to water.	Not addressed, but finished product are solids, flooring and industrial vinyls.	Not addressed, but finished product is solid.	Pathway not relevant to actual user. Could be eliminated/restricted for future evaluation/regulation.

C) Information on Releases for Coating, Adhesive and Sealant Uses

MCCP and LCCP are used is specialized coatings, adhesives and sealants. EPA identified water releases from several pathways during the formulation of these substances. Two of the largest users of these substances in coatings, adhesives, and sealants have responded to the survey, they represent approximately 75% of the total MCCP and LCCP volume going into PVC applications.

Table 12: Survey Coatings, Adhesives, Sealants Formulators

Source	Critical Release Media Assumed	User 1 Response	User 2 Response	Release Pathway Results
Spills during raw material transfer	Water	No discharge to water. Spills are sent for waste treatment.	No discharge to water. Spills are sent for waste treatment.	Pathway not relevant to actual user. Could be eliminated/restricted for future evaluation/regulation
Cleaning liquid residuals from drums used to transport raw material	Water	Empty drums are not cleaned on site. The vast majority of product comes via dedicated tank trucks, which are also not cleaned on site.	All product comes via dedicated tank truck. No onsite cleaning on site	Pathway not relevant to actual user. Could be eliminated/restricted for future evaluation/regulation
Equipment cleaning losses of liquids from a mixing vessel	Water	Water is used in cleaning process equipment. The waste water is not released. It is either recycled into making future batches or sent to a permitted deep well injection.	Water is used in cleaning process equipment. Waste water and paint wastes from cleaning operations are stored in totes and solidified for disposal at local landfill.	Pathway does not involve release to surface water or POTW. Pathway could be eliminated/restricted for future regulation

D) Survey by ILMA of Metalworking Formulators

ILMA has conducted a survey of its members using MCCP and LCCP[2] in metalworking fluid (MWF) formulations. Details of this survey will be provided to EPA directly from ILMA, but ILMA shared the preliminary results of this survey with CPIA.

Key results from the ILMA survey include:

- Survey responses were received from 30 companies representing over 65% of the MCCP and LCCP containing MWF in the U.S. (in 2014).

- MCCP use is much larger in MWFs than LCCP: 7.94 million pounds of MCCP were used in MWFs in 2014 compared to 1.66 million pounds of LCCP (though this includes both C_{18}-C_{20} and C_{20}+ LCCP products).

- There is minimal waste generation of MCCP and LCCP, by all routes, in the formulation of MWFs.

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[2] The ILMA survey did not differentiate C18-20 LCCP from C20+ LCCP, as such the results for LCCP from the survey are not representative of just the C18-20 sub-class of LCCP.

- Those companies that receive shipments of MCCP and LCCP in drums send the empty drums to a waste handler or recycler. None of the survey respondents cleaned their drums with water and released the waste water.

- Out of the more than 9.6 million pounds of MCCP and LCCP used in MWF formulations in 2014, the total water release to POTWs was 750 pounds; these releases were from just two companies.

- Most operations, 28 out of the 30, have no (zero) release to water.

E) Information on Releases from MWF Users

Additional information on the waste generation and handling practices of MWF users is being sought. As CPIA previously indicated in its April 27, 2015 regulatory review, all of these facilities are subject to waste regulations and water discharge restrictions. Recent informal communications with several large metalworking operations indicate that these facilities generally do not discharge waste oils/fluids to surface water or to POTW but rather use regulated hazardous waste handlers to dispose of these wastes. Confirming information is being sought on these practices.

One important information gap on the use MCCP and LCCP in MWFs is how much of the MCCP and LCCP are consumed (i.e. de-chlorinated) by the metalworking process. Based on the chemistry of the process, it appears likely that some portion of the MCCP and LCCP no longer remain at the stage of spent fluid removal.

5. Release Modifications/Pathway Elimination

Considering the responses from MCCP and LCCP users regarding their waste generation and handling practices, CPIA believes that there is sufficient basis to revise the release pathways identified by EPA (summarized in Section 3).

EPA should be able to eliminate the various release pathways to water for rubber, PVC, plastic applications (both compounding and converting) and also the formulation of coatings, adhesives and sealants. With a majority of the total volume of MCCP and LCCP used in these applications having been covered in recent survey questionnaires, there is no indication of water releases from these users. With the elimination of these release pathways to water, CPIA believes that EPA’s initial concerns regarding unreasonable risk to the environment from the release of MCCP and LCCP to water should be eliminated for these applications. Further, as these facilities are already avoiding releases to water, it should be feasible for EPA to craft use restrictions to ensure this practice continues. See Section 7 below for additional discussion on this point. It should also be noted that these U.S. rubber, PVC, and plastic manufacturing operations, who appear to be operating in an environmentally responsible manner, compete directly with foreign manufactured rubber, PVC and plastic goods which will not be held to the same requirements regarding the use of MCCP and LCCP in their manufacturing operations and finished products.

In regards to metalworking formulation and use, it appears that the water releases assumed by EPA for these applications are likely much, much lower than originally estimated. Additional follow-up research and coordination with that industry should help eliminate any remaining discharges or release pathways that might results in excess levels of MCCP and LCCP in the environment.

An enhanced review of the environmental monitoring data in the next section appears to support the conclusion that releases of MCCP to the environment are low. These monitoring results show levels of MCCP in the aquatic environment are largely below the CoCs. Further, these monitoring data capture both current releases and any background levels of the substance demonstrating that even after decades of use levels in the environment remain low.

6. Evaluation of MCCP and LCCP Environmental Monitoring Data

The EPA Draft Standard Review Risk Assessments summarized available literature on measured MCCP and LCCP concentrations between 1980 and 2013. This review considered research where the CP congeners were identified both from the United States and internationally. The EPA draft risk assessments identified three selection criteria, including:

- defined chain length;
- use of "modern analytical techniques"; and
- "at a minimum, general information on sampling location."

The EPA concluded that the data "provide some evidence that MCCPs and LCCPs are released into the environment" at discrete locations and times. The risk assessments for MCCPs and LCCPs concluded that measured concentrations reported in the literature may indicate a risk of acute or chronic injury to aquatic organisms, and a risk of chronic injury to sediment-dwelling organisms. The EPA concentration of concern (COC) for surface water is 1 μg/L (acute and chronic). The acute sediment COC is 374 mg/kg d.w. and the chronic sediment COC is 18.7 mg/kg d.w.

As described below, a review of the complete set of data considered by the EPA does not indicate any systematic exceedance of the COCs in the environment. Furthermore, a comparison of the measured surface water data to the results of EPA modeling demonstrate opportunities for refinement of the EPA modeling inputs to better reflect environmentally plausible surface water concentrations. It is important to note that much of the data were collected outside North America, where historical discharge and pre-treatment standards may be less comprehensive than in the United States. Some of the data reflect impacts not representative of current exposure scenarios in the United States, such as a CP manufacturing facility surface impoundment lagoon, and surface water ponds impacted by uncontrolled electronic waste recovery operations. As explained below, the available analysis methods are subject to interferences which may result in a positive bias (i.e. overestimate) of actual MCCP and LCCP concentrations. The weight of the evidence indicates that the MCCP load in the environment can be well managed by eliminating discharge pathways to water, which is reflective of current practices in the United States.

General Limitations of the Measured Data

The EPA draft reports noted that it is unknown whether the data summarized is representative of the overall distribution of MCCP and LCCP in the environment. EPA also acknowledged that quantification of MCCP and LCCP by "modern techniques" can be positively biased by "detection of low chlorination congeners in samples." The EPA summary also notes that a round-robin study of SCCPs has shown appreciable inter-laboratory variation, and that poor selection of calibration standards may cause errors of up to an order of magnitude. The EPA specifically discussed electron capture negative ion mass spectroscopy (ECNI-MS) as an example of a method capable of detecting specific congeners, but where difficulties with data reliability still persist. Literature reviews of ECNI-MS generally indicate that use of low resolution mass spectroscopy (LRMS) "increases the risk of interferences, which have to be controlled or eliminated" (Kassim and Barcelo, 2009). The use of high resolution mass spectroscopy (HRMS) may address some of these interferences by offering a more selective detection method, but is typically not used for routine analyses.

Surface Water

EPA identified nine references with at least one reported MCCP surface water concentration. A total of 15 concentrations (some of which represent mean or maximum values) were converted to uniform units by EPA and presented in Appendix D of the reports.

Review of Surface Water Data

Of the nine studies identified by EPA, only one study (discussed in more detail below) reported a surface water concentration exceeding the EPA COC of 1 μg/L. The 15 concentrations considered by EPA are summarized in Figure 1 below. The error bars represent the range of concentrations shown in Appendix D, and the circle indicates the mean of the concentrations summarized by EPA in Appendix D for each group. As acknowledged by EPA, the data are insufficient to determine the distribution of MCCPs in the United States. However, three important trends are apparent, including:

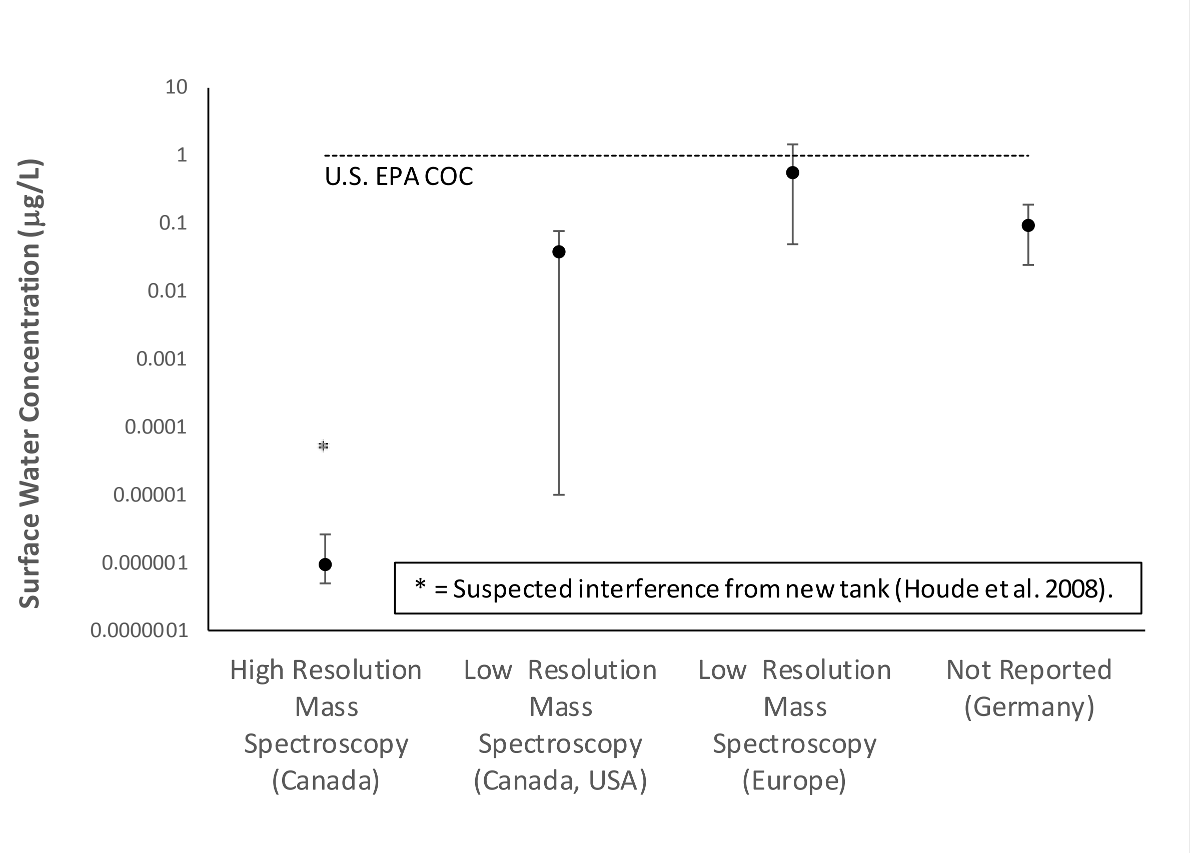
- Lower MCCP concentrations in Canada or the United States as compared to Europe;
- Lower MCCP concentration for analyses based on HRMS as compared to LRMS; and
- Appreciable fraction of the data representing surface water concentrations below the EPA COC.

It is important to note that an example of sample contamination was reported in one of the papers reviewed by the EPA. In an analysis of Lake Ontario water, Houde et al. 2008 reported an outlier "possibly related to the first use of the tank system during the cruise" which "illustrate[d] the potential for field contamination." As described in more detail below, it is unknown whether the single result of 1.49 μg/L reported by Peterson et al. (2006) may have been impacted by sample contamination, because information regarding the general sampling location and materials used to collect the sample were not provided.

In summary, the data do not appear to indicate a high likelihood that MCCP concentrations in surface water exceed the acute or chronic COC for aquatic species, particularly when the higher resolution method is used, and when data from North America is segregated from data in Europe.

The HRMS data suggest that the MCCP concentration may be as much as 5 to 6 orders of magnitude less the EPA COC for surface water.

Figure 1: Summary of Surface Water Data Considered by EPA by Region and Analytical Method



Limitations of Key Study Identified by EPA

In the risk characterizations, EPA choose to focus on the maximum surface water concentration from Petersen et al. (2006) collected in Norway from an undisclosed location of 1.49 µg/L. The draft risk assessments note that for surface water, "…EPA based the aquatic risk findings for MCCPs and LCCPs on the highest concentration reported by Peterson et al. (2006)." This study was the only one reviewed by EPA to report a surface water concentration exceeding the COC of 1 µg/L. This study has several limitations, which call into question whether it should have been considered in the EPA assessment. Most importantly, a general location of the sample (other than the country of origin) was not reported. Therefore, this study did not meet one of the three selection criteria identified by EPA, and the conditions and release scenario that this sample result represents are unknown. Second, while this study did include steps to remove organo-chlorine interferences like PCBS, quantification was by LRMS, which may have confounded the analysis of SCCP and MCCPs in the sample. Third, there was a significant difference between the two water sample results reported in the study, with one MCCP result of 1.49 µg/L, and a second MCCP result that appears to be less than 0.05 µg/L based on the figure presented in the paper. The authors do not offer an explanation for such a significant difference, and it is not possible to rule out that there may have been sample contamination affecting the first sample. As mentioned above, details were not provided regarding the sampling locations, sampling equipment and sampling methods, which are essential attributes necessary for assessing the likelihood of unintended sample contamination. Finally, this work was presented at the 2006 annual Dioxin Symposia in Oslo and, therefore, was subject to a more cursory peer review as compared to a peer-reviewed publication. Taking into account the limitations of this study, as well as the results of the remaining studies indicating surface water concentrations less than the EPA COC, there appears to be a very low likelihood that environmental surface water concentrations in the United States exceed the EPA COC.

Comparison of Measured Concentrations to EPA Model Results

EPA indicated in its summary of the risk findings that the measured data "…were used as supporting information to inform the relevant pathways for estimating potential releases from relevant use categories…" A comparison of the EPA modeling results to measured surface water concentrations indicates significant disagreement between the modeling results and the available surface water data. Figures 2a, 2b and 2c compare the predicted EPA surface water concentrations to measured data from North America for the metrics 7Q10 (10th percentile), harmonic mean (10th percentile) and harmonic mean (50th percentile). Irrespective of the surface water concentration metric selected from the EPA modeling, the measured surface water concentration data reviewed by EPA indicate that the modeled concentrations are not environmental plausible. Furthermore, as noted in the EPA draft risk assessment reports, the water solubility of MCCPs and LCCPs is very low, and less than 5 to 27 μg/L. In contrast, the EPA model results reflect maximum predicted surface water concentrations in some cases exceeding 500 μg/L (7Q10 – 10th percentile).

In summary, considering either water solubility or the available measured concentrations of MCCPs, it is clear that there is systematic bias in the EPA modeling assumptions reflecting the implausible assumption of pervasive down-the-drain discharge of MCCP and LCCP among industrial and commercial facilities. These assumptions of a down-the-drain pathway to municipal treatment and subsequent discharge surface waters for wastes generated in cleaning and equipment transfers do not reflect current waste management practices in the United States. As described previously, the local and federal regulatory framework in the United States prohibits down-the-drain disposal of oil contaminated cleaning wastes or spent fluids. Taking into account MCCP and LCCP solubility, as well as pathway elimination in accordance with current regulations, it is clear that the modeled surface water concentrations presented in the draft risk assessments overstate true environmental surface water concentrations by at least five orders of magnitude, if not more.

Figure 2a: Comparison of Model Result to Measure Data (7Q10 – 10th Percentile)

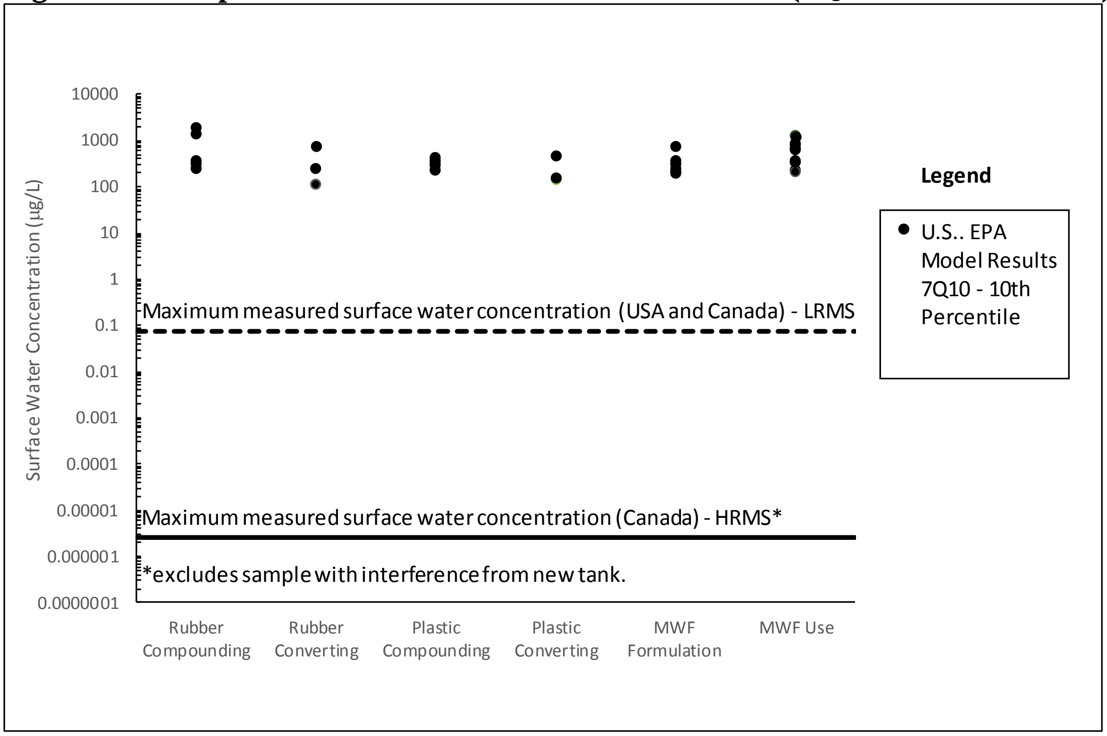


Figure 2b: Comparison of Model Result to Measure Data (Harmonic Mean – 10th Percentile)

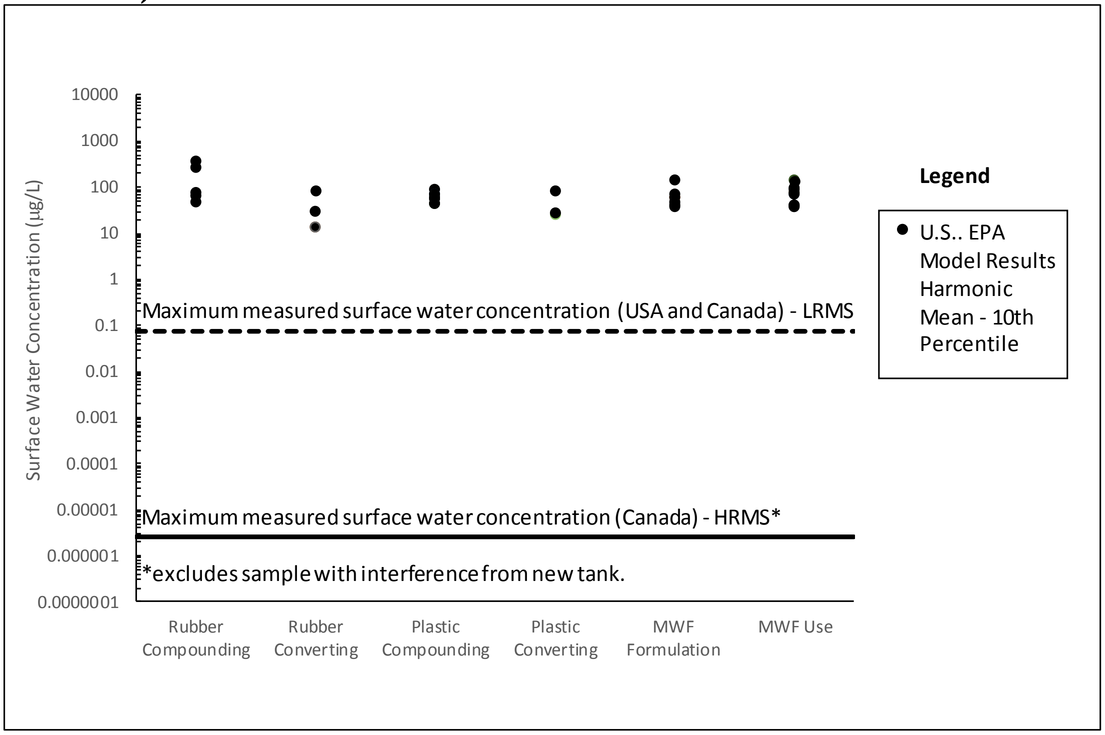
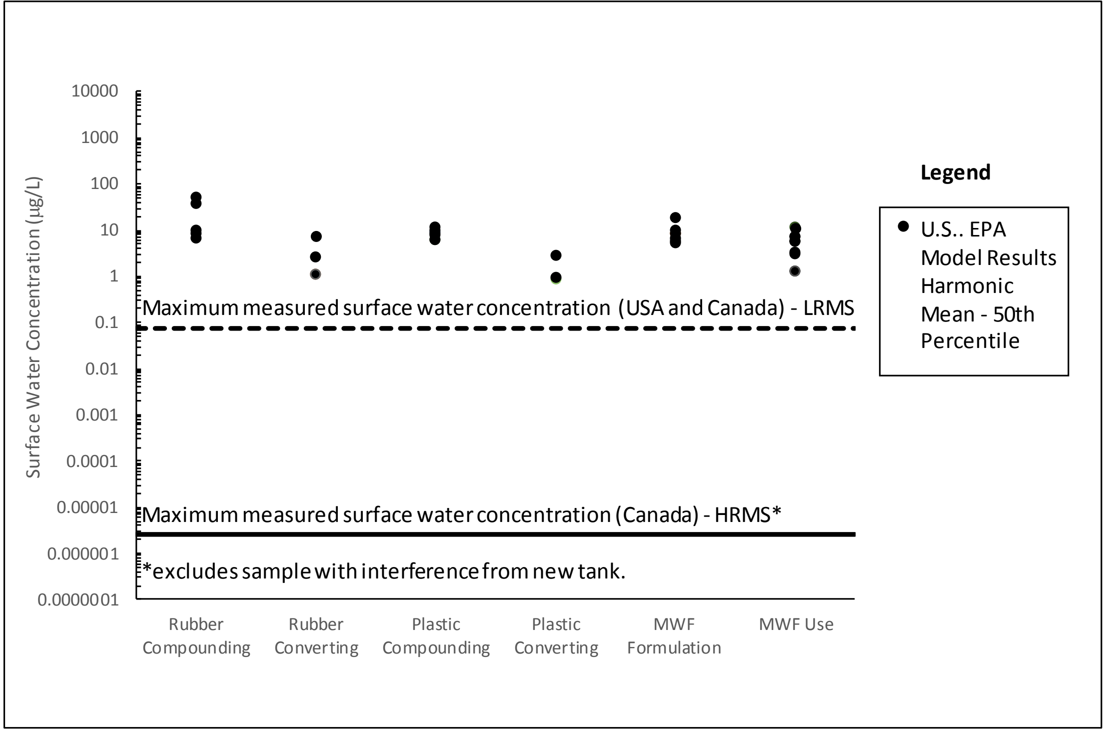


Figure 2c: Comparison of Model Result to Measure Data (Harmonic Mean – 50th Percentile)



Sediment

EPA identified 17 studies with reported MCCP sediment concentrations. A total of 139 concentrations (some of which represent mean values, maximum values or duplicates) were converted to uniform units by EPA and presented in Appendix D of the reports. Of the 139 samples, one result appeared to be an instrument detection limit (from Pribylova et al. (2006), and the same result of 0.068 mg/kg d.w. appears to have been associated with Tomy et al. (2009) and Tomy and Stein (2009). Therefore, 137 converted concentrations from Appendix D of the risk assessments are considered below.

Review of Sediment Data

Of the 17 studies identified by EPA with MCCP data, there were only three studies that reported a sediment concentration greater than the EPA COC of 18.7 mg/kg d.w. Figures 3a and 3b present the frequency of concentrations provided by categorized by marine and non-marine locations. Figures 4a and 4b present the concentrations categorized by method and region. Of the 137 concentrations listed by EPA, approximately 90% were less than the EPA COC, indicating that exceedances of the COC are not common. As explained in more detail below, the three studies with exceedances of the EPA COC are not reflective of current environmental practices in the United States. The locations with concentrations exceeding the COC consisted of pond sediment samples from China at an electronic waste facility where CP release is unregulated (Chen et al., 2011), sediment samples from the United Kingdom at locations with extensive PCA use and discharges to industrial wastewater (Nicholls et al., 2001), and a historical surface impoundment at a U.S. CP manufacturer in the United States (EPA, 1988). The LCCP data reviewed by EPA was limited to marine sediment, with a maximum concentration of 0.431 mg/kg d.w.

Several general trends are apparent in Figures 4a and 4b, including:

- MCCPs are not accumulating in marine sediments at levels exceeding the EPA COC for sediment;
- MCCPs detected above the EPA COC are associated with specific discharges to industrial wastewaters (already restricted in the United States) rather than indirect sources;
- Many of the samples were quantified by low resolution mass spectroscopy methods, which may be impacted by interferences from other PCAs or chlorinated compounds; and
- The sampling results based on HRMS were below the EPA COC. The two HRMS results that were greater than 1 mg/kg d.w. (but less than the EPA COC were collected from "landfill sediment".

In summary, the environmental sediment data summarized by EPA suggests that exceedances of the COC are uncommon, and when they have occurred appear to be associated with facility-related surface impounds or discharges of significant amounts of MCCPs to industrial wastewaters. These releases to surface impoundments or industrial wastewaters are restricted by current discharge regulations and waste management practices in the United States.

Figure 3a: Distribution of Marine Concentrations Summarized by EPA

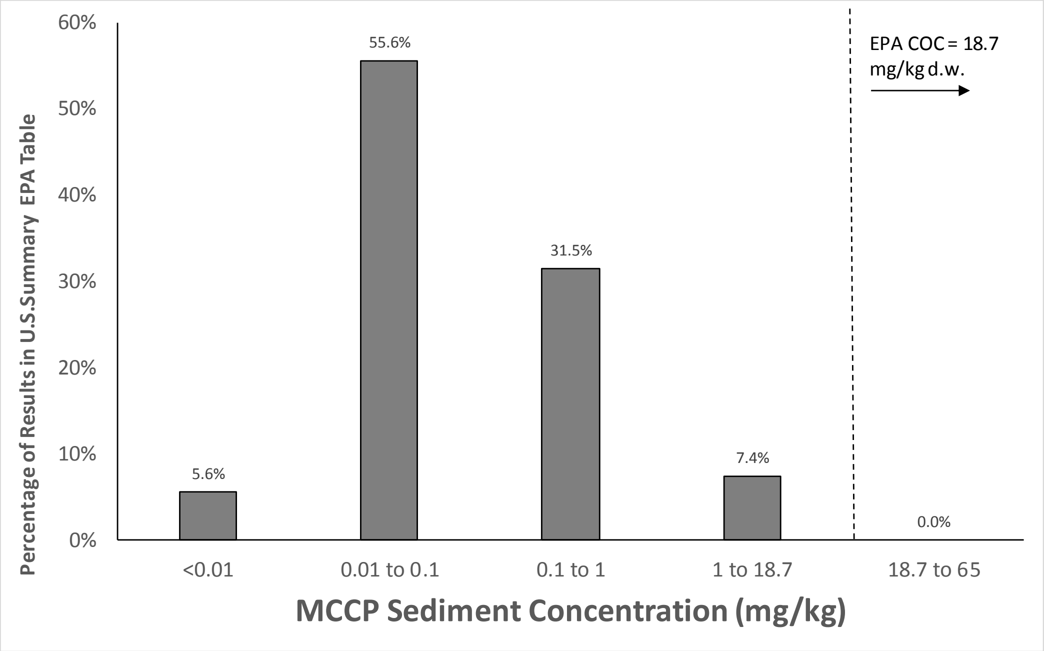


Figure 3b: Distribution of Non-Marine Concentrations Summarized by EPA

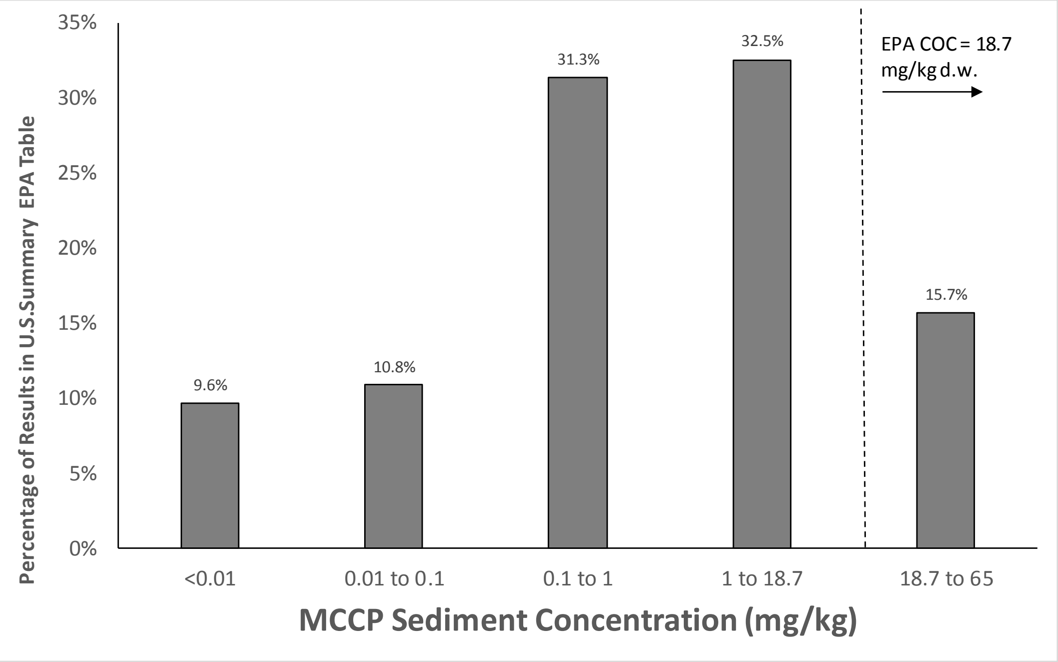


Figure 4a: Summary of Marine Surface Water Data Considered by EPA by Region and Analytical Method

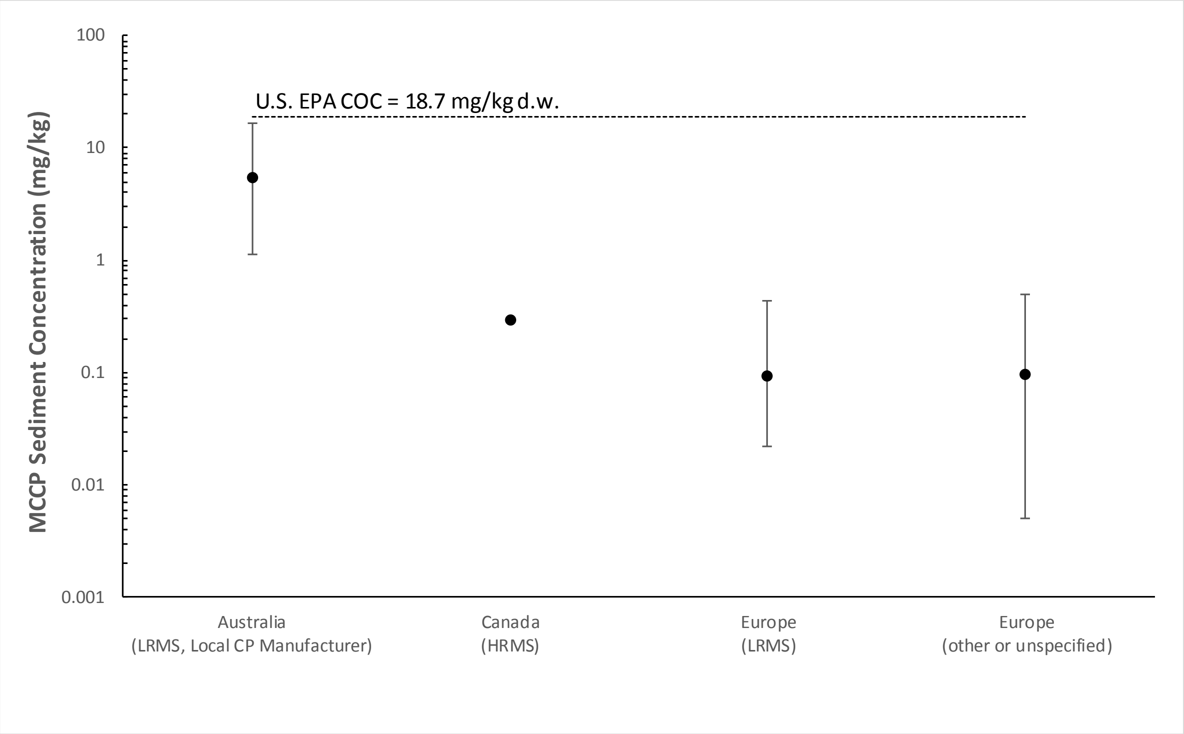
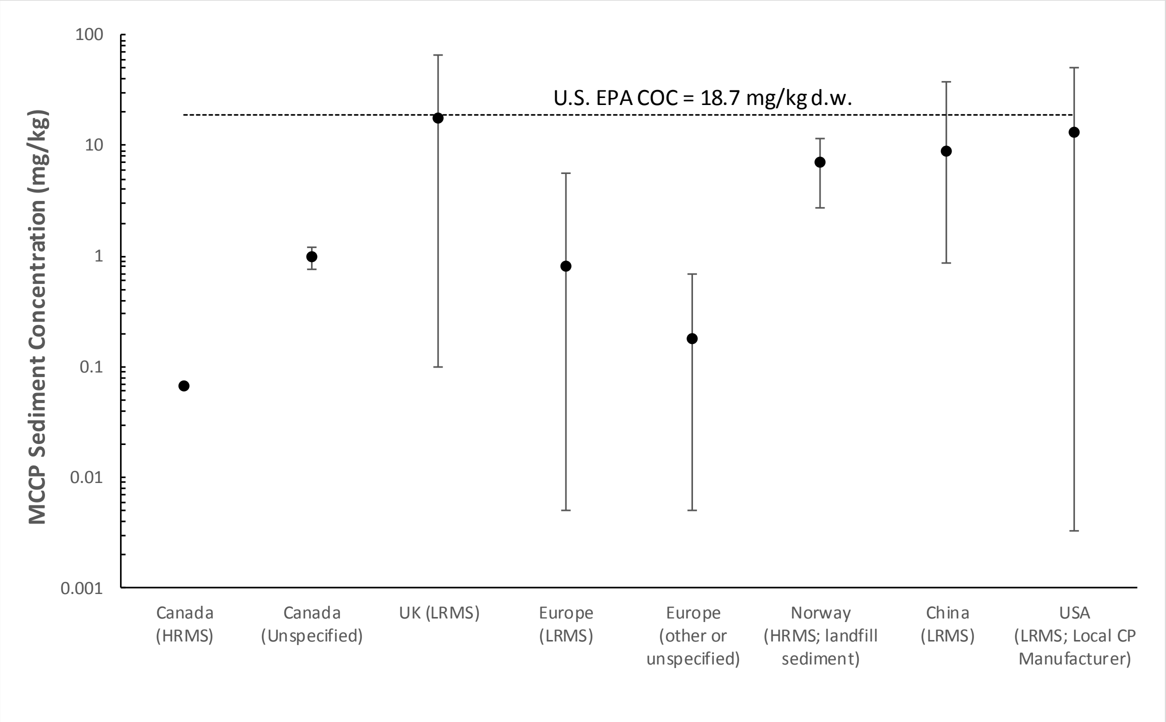


Figure 4b: Summary of Non-Marine Surface Water Data Considered by EPA by Region and Analytical Method



Limitations of Studies Reporting Elevated Concentrations

EPA identified the three studies with reported concentrations exceeding the COC of 18.7 mg/kg d.w. The study conducted in the UK by Nichollis et al. (2001) was considered by EPA to be the most relevant, but EPA generally considered the studies with at least one RQ greater than 1 as supporting the conclusion that MCCP concentrations in sediment may present a chronic risk to aquatic species.   Of the three studies considered by EPA with concentrations greater than the EPA COC:

- One study was performed in South China, where usage of CPs, including SCCPs, is not regulated (Chen et al. 2011). The mean and maximum MCCP concentrations of 21 and 38 m/kg d.w. cited by EPA were observed in the pond sediment of an electronic waste recycling facility. Despite the lack of regulation and controls in China, the mean MCCP concentrations in industrialized areas of 3.9 mg/kg d.w. were less than the EPA COC.

- A second study with reported 8 of 29 concentrations exceeding the EPA sediment COC was performed in the United Kingdom, including sampling sites targeted for "industries known to employ significant quantities of PCAs" in manufacturing or production (Nicholls et al. 2001). Samples were analyzed by a low resolution MS method (GC-NICI-MS). The elevated concentrations in this study appear to reflect down-the-drain disposal of PCAs to industrial effluents, with less restrictive pre-treatment or on-site treatment standards than currently enforced in the United States. Because a low resolution mass spectroscopy method was used, it is unclear whether the pervasive PCA use in the areas sampled may have positively biased the reported MCCP concentrations.

- The third and final study with concentrations exceeding the EPA COC (EPA, 1998) was a field study completed in the United States near a chlorinated paraffin manufacturing facility. Of the 8 sample results summarized by EPA, only three results exceeded the COC. These three samples were not representative of environmental sediment, but rather were collected from the surface impoundment lagoon located at the chlorinated paraffin manufacturing facility.

Conclusion on Measured Data

Based on a review of the environmental measurements summarized by the EPA, the weight of evidence does not suggest that exceedances of the EPA COC for surface water or sediment are likely. While limited in geographical and temporal coverage, a conclusion of frequent or likely exceedances of the EPA COCs does not appear to be supported by the available data.

Information regarding general sample location was not available for the sole surface water result exceeding the EPA COC, though the study appears to have been conducted in Norway. With regard to the sediment data, two of the studies characterized areas with obvious impacts, including a historical surface impoundment at a CP manufacturing location in the United States, and a pond at an electronic waste facility in China. Sediment data collected in the United Kingdom appears to reflect significant discharge of PCA to industrial wastewater, a scenario which is not applicable to the current regulatory framework in the United States. The available data suggest that environmental concentrations of MCCPs and LCCPs may be effectively managed by eliminating discharge pathways to water.

7. Conclusions and Reducing Uncertainties in Risk Assessments

In its Draft Standard Review Risk Assessments and subsequent letters[3] to the PMN submitters, EPA identified concerns with MCCP and LCCP, including the potential for release to water during processing and use, estimated environmental concentrations above the CoCs, and measured environmental concentrations above the CoCs. CPIA believes that this submission establishes that for most uses of MCCP and LCCP there are not releases to water and that for those use applications with releases to water, the total mass is very low and well controlled by existing water discharge practices and regulations. Eliminating the release pathways to water eliminates the estimated environmental concerns above the CoC. Additionally, a detailed review of the monitoring data used by EPA does not a support a conclusion of high levels in the environment. Data most relevant to the PMN assessments, based on location and higher resolution analytical methods, in fact supports the conclusion that releases are low and resulting concentrations in the environment are below EPA's concentrations of concern.

Overall, the conclusions from this assessment are:

- The physiochemical properties of MCCP and LCCP, such as very low ambient vapor pressure, decomposition at elevated temperatures, and very low water solubility, limit the ability to release significant quantities of these substances the environment, particularly via the water or air.

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[3] January 21, 2015 letters from Greg Schweer to each MCCP and LCCP PMN submitter.

- Information from users indicates that there are not the release pathways to water for MCCP and LCCP that EPA assumed in it Draft Standard Review Risk Assessment.

- Exceedances of EPA's COC in environmental surface water or sediment are not expected to occur.

- Finally, that these data support that MCCP and LCCP can be effectively managed by eliminating discharge pathways to water using existing U.S. industry practices and th regulatory framework.

CPIA believes that there is sufficient information for EPA to reconsider its risk conclusions and also to propose alternative actions to those presented in the Agency's January 21, 2015, letters to the PMN submitters. To the extent that EPA still has concerns about uncertainties in the risk assessments for these substances, CPIA believes there are actions short of elimination from the market or extensive additional laboratory studies that could be undertaken reduce these uncertainties.

Perhaps the main follow-up activity that EPA should consider for these substances is new environmental monitoring data in the U.S. along the lines of what was suggested in the 2015 report on chlorinated paraffins by U.S. and Canada Identification Task Team (ITT) on Chemicals of Mutual Concern in the Great Lakes. The ITT 2015 report concluded that there are "insufficient data and/or information available to effectively apply the Binational Considerations" and, therefore it made a designation of "No Determination" for all CPs - SCCPs (C10-C13), MCCPs (C14-C17) and LCCPs (> C18). The ITT specifically recommended "continued targeted monitoring in top predator fish across the Great Lakes, including in the near-shore environment, in order to confirm recent trends continue to show decreases for SCCPs and definitely establish whether downward trend exists for MCCPs." The ITT also recommended "targeted sediment monitoring… in the near shore environment and tributaries, to establish trends and evaluate loadings of these chemicals to the lakes." The ITT noted that "this monitoring work will provide some of the information necessary to evaluate the performance of existing and forthcoming risk management and control activities." It is worth noting that the ITT report had already found that what trend data did exist for CPs in the Great Lakes showed a drop in levels of SCCP and MCCP in the biota based on the work by Ismail et al. (2009). Based on the enhanced review of the monitoring data in this report, CPIA believe that collecting new water and sediment data using high resolution methods could provide a confirmation that these substances are not presenting an unreasonable risk to the environment. Such an approach could also confirm initially identified downward trends and eliminate any concerns that these substances are accumulating in the environment.

CPIA has separately provided EPA information regarding the environmental fate and aquatic toxicity of these substances that CPIA believes supports a conclusion that these substances are not PBTs. These data include analysis of the bioaccumulation potential of MCCP in the environment demonstrating that MCCP is not bioaccumulating in environmental organisms. While CPIA believes these data are sufficient to demonstrate a lack of bioaccumulation, additional sampling could also be done on organism as a part of the monitoring efforts mentioned above.

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